GEF-7 Africa Minigrids Program

Part I: Program Information

GEF ID
10413

Program Type
PFD

Type of Trust Fund
GET

CBIT/NGI
- ☐ CBIT
- ☐ NGI

Program Title
GEF-7 Africa Minigrids Program

Countries
Regional, Angola, Burkina Faso, Comoros, Djibouti, Eswatini, Ethiopia, Madagascar, Malawi, Nigeria, Somalia, Nigeria, Sudan

Agency(ies)
UNDP, AfDB

Other Executing Partner(s)

Executing Partner Type

Other Executing Partner(s)
Rocky Mountain Institute

Executing Partner Type
CSO

GEF Focal Area
Climate Change

Taxonomy
Focal Areas, Climate Change, United Nations Framework Convention on Climate Change, Paris Agreement, Nationally Determined Contribution, Enabling Activities, Climate Change Mitigation, Technology Transfer, Energy Efficiency, Renewable Energy, Financing, Influencing models, Deploy innovative financial instruments, Transform policy and regulatory environments, Strengthen institutional capacity and decision-making, Demonstrate innovative approache, Convene multi-stakeholder alliances, Stakeholders, Local Communities, Private Sector, Financial intermediaries and market facilitators, Individuals/Entrepreneurs, Large corporations, SMEs, Capital providers, Civil Society, Community Based Organization, Communications, Education, Public Campaigns, Behavior change, Strategic Communications, Awareness Raising, Beneficiaries, Type of Engagement, Information Dissemination, Consultation, Participation, Partnership, Gender Equality, Gender Mainstreaming, Women groups, Gender-sensitive indicators, Sex-disaggregated indicators, Gender results areas, Participation and leadership, Capacity Development, Knowledge Generation and Exchange, Access to benefits and services

Rio Markers

Climate Change Mitigation
Climate Change Mitigation 1

Climate Change Adaptation
Climate Change Adaptation 0

Duration
48 In Months

Agency Fee($)
2,181,178

Program Commitment Deadline
6/19/2021

Submission Date

10/11/2019

Impact Program

IP-Food-Land-Restoration **No**

IP-Sustainable Cities **No**

IP-Sustainable Forest Management Amazon **No**

IP-Sustainable Forest Management Congo **No**

IP-Sustainable Forest Management Drylands **No**

Other Program **Yes**

A. Indicative Focal/Non-Focal Area Elements

Programming Directions	Expected Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CCM-1-1	Promote innovation and technology transfer for sustainable energy breakthroughs for de-centralized renewable power with energy storage	GET	23,357,308	324,310,000
CCM-1-3	Promote innovation and technology transfer for sustainable energy breakthroughs for accelerating energy efficiency adoption	GET	878,000	20,000,000
		Total Program Cost ($)	**24,235,308**	**344,310,000**

B. Indicative Project description summary

Program Objective

Support African countries to increase energy access by reducing the cost and increasing commercial viability of renewable energy minigrids (‘minigrids’).

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
Component 1—Policy and Regulation (National child projects)	Technical Assistance	Appropriate policies and regulations are in place that address policy, institutional, regulatory and technical barriers to facilitate investment in renewable energy minigrids (“minigrids”) *National child projects may include a selection of the following outputs:* 1.1 A minigrid regulatory framework, including tariff model, tax regime, and grid expansion risk, is developed in close coordination with other development partners 1.2 Geospatial, techno-economic modeling of least-cost off-grid renewable electricity technologies (minigrids, grid expansion, solar home systems) 1.3 Formulation of rural electrification strategy/plan, incorporating transparent targets and supported by multi-tier data 1.4 Assessment of negative impact of competing fossil-fuel subsidies on competitiveness of minigrids, and recommendations for subsidy reform. 1.5 Minigrid DREI techno-economic analyses carried out to propose most cost-effective basket of policy and financial derisking instruments 1.6 Institutional set-up for rural electrification assessed and	GET	3,064,862	25,083,625

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
Component 2—Business Model Innovation and Private Sector (National child projects)	Investment	Innovative business models based on cost reduction operationalized to support and strengthen private participation in minigrid development *National child projects may include a selection of the following outputs:* 2.1 Pilots developed, including on productive use/innovative appliances and modular hardware/system design, leading to cost-reduction in mini-grids	GET	9,450,279	170,799,625

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
Component 2—Business Model Innovation and Private Sector (National child projects)	Technical Assistance	2.2 National report on opportunities to boost economic activities through electricity access and productive use, with focus on minigrids 2.3 Capacity of potential tender bidders (private sector developers) strengthened to consider innovative business models and cost-reduction levers 2.4 Capacity of winning tender bidders (private sector developers) strengthened to develop and implement innovative business models and cost-reduction levers 2.5 Support to upstream suppliers on hardware standardization/modular approaches, including in tendering processes 2.6 Support provided to establish and grow a national industry association for private sector developers	GET	2,181,421	16,893,500

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
Component 3—Innovative Financing (National child projects)	Technical Assistance	An innovative financing mechanism and accompanying financial instruments in place to incentivize investments in the development of minigrids *National child projects may include a selection of the following outputs:* 3.1 Design support, including development of operational guidance, provided for Minigrid Funding Facility (MFF, or equivalent financial mechanism) under rural electrification agencies/funds 3.2 Innovative financing solutions for minigrid development are identified and implemented through the MFF (or equivalent) with supporting human and institutional strengthening 3.3 General market intelligence study on minigrids prepared and disseminated amongst public officials and finance community 3.4 Feasibility study support provided to minigrid developers, creating a pipeline of investible assets. 3.5 Domestic financial sector capacity-building on business and financing models for minigrids 3.6 Capacity building provided to minigrid developers and	GET	2,965,508	39,805,875

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
Component 4—Convening, dissemination, and tracking progress (Regional child project and national child projects)	Technical Assistance	Child project countries benefit from rapidly-deployable technical expertise on minigrid cost-reduction and associated business models tailored to each country's context, and harmonized knowledge management approaches *Regional child project outputs are the following:* Outputs: 4.1 Knowledge Tools 4.1.1 Various tools (policy packages; financial models; template contracts; template tender documents; template legal documents; guidelines on system design) to support cost reduction in national child projects 4.1.2 Reports, in-depth case studies, and insight briefs that codify and synthesize cost-reduction good practices 4.1.3 Cost-reduction training materials for the community of practice for national child projects, and for a broader set of stakeholders 4.2 Tailored technical assistance to national child project implementation 4.2.1 A roster of leading technical experts (consultants, program partner staff) are selected, and made available to countries on demand, providing rapidly-deployable support	GET	5,269,662	81,328,375

Program Component	Financing Type	Program Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
			Sub Total ($)	**22,931,732**	**333,911,000**
Program Management Cost (PMC)					
			GET	1,303,576	10,399,000
			Sub Total($)	**1,303,576**	**10,399,000**
			Total Program Cost($)	**24,235,308**	**344,310,000**

Please provide justification

Notes: The Angola and Madagascar 'self-financed' national child projects , with AfDB SEFA and UNDP TRAC funding, are represented in the program's finances as 'co-financing'. Angola and Madagascar wished to participate in the program but were facing unavailability of CCM resources. New and additional resources from AfDB and UNDP have been provided to fund child project's national activities, to complement the regional child project's activities funded by the GEF CCM set-aside. Angola and Madagascar child projects will have access to knowledge tools and technical assistance support provided by the regional child project, and benefit from learning and sharing as part of the child project country cohort. They will also share their perspectives and experiences, which can help scale up minigrid development and increase the program's impact. Djibouti's component 4 on energy efficiency as a cost-reduction lever for minigrids has been included under the program's component 2, given that component 4 includes piloting integrated energy efficient housing for minigrids.

C. Co-Financing for the Program by Source, by Name and by Type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
CSO	Dutch Postcode Lottery (via RMI	Grant	Investment mobilized	2,600,000
CSO	Good Energies Foundation (via RMI)	Grant	Recurrent expenditures	500,000
CSO	IKEA Foundation (via RMI)	Grant	Recurrent expenditures	500,000
Private Sector	African Minigrid Developers Association	In-kind	Recurrent expenditures	250,000
GEF Agency	AfDB-Green Mini-grid Market Development Programme (Phase 3	Grant	Investment mobilized	4,000,000
GEF Agency	AfDB-Sustainable Energy Fund for Africa (SEFA) - Technical Assistance	Grant	Investment mobilized	11,000,000
GEF Agency	AfDB-Sustainable Energy Fund for Africa (SEFA) - Results-based Financing	Grant	Investment mobilized	25,000,000
GEF Agency	UNDP	Grant	Investment mobilized	1,000,000
Donor Agency	ESMAP, World Bank	Grant	Recurrent expenditures	7,500,000
Donor Agency	Carbon Trust (DFID)	Grant	Investment mobilized	2,380,000
GEF Agency	Angola fDB-SEFA	Grant	Investment mobilized	1,000,000
GEF Agency	Burkina Faso_UNDP	Grant	Investment mobilized	1,000,000

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Donor Agency	Burkina Faso_World Bank	Loans	Investment mobilized	20,000,000
Donor Agency	Burkina Faso_Green Climate Fund (GCF)	Grant	Investment mobilized	19,646,350
Donor Agency	Burkina Faso_GCF	Loans	Investment mobilized	7,453,650
GEF Agency	Comoros_European Union (EU)	Grant	Investment mobilized	3,300,000
Private Sector	Comoros_VIGOR	Equity	Investment mobilized	10,000,000
Private Sector	Comoros_INOVANT	Equity	Investment mobilized	3,000,000
Donor Agency	Djibouti_World Bank	Loans	Investment mobilized	40,000,000
Government	Eswatini_Ministry of Natural Resources and Energy	Grant	Recurrent expenditures	3,000,000
Private Sector	Eswatini_Eswatini Electricity Company	Grant	Recurrent expenditures	230,000
Government	Eswatini_Eswatini Standards Authority	In-kind	Recurrent expenditures	100,000
Donor Agency	Eswatini_Japan International Cooperation Agency	Grant	Investment mobilized	2,000,000
Donor Agency	Eswatini_ Italian Government / Africa Centre for Climate and Sustainable Development	Grant	Investment mobilized	1,000,000

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Donor Agency	Eswatini_World Bank	Loans	Investment mobilized	4,000,000
Government	Ethiopia_Ethiopia Electric Utility	Grant	Investment mobilized	12,000,000
Donor Agency	Ethiopia_World Bank	Grant	Investment mobilized	15,000,000
Donor Agency	Ethiopia_AfDB	Loans	Investment mobilized	20,000,000
Donor Agency	Ethiopia_EU	Grant	Investment mobilized	10,000,000
GEF Agency	Madagascar_AfDB-SEFA	Grant	Investment mobilized	1,000,000
GEF Agency	Madagascar_UNDP	Grant	Investment mobilized	1,000,000
Government	Malawi_Ministry of Natural Resources, Energy and Environment	Grant	Investment mobilized	5,000,000
GEF Agency	Malawi_UNDP	Grant	Investment mobilized	1,000,000
Donor Agency	Malawi_World Bank	Grant	Investment mobilized	250,000
Donor Agency	Malawi_USAID	Grant	Investment mobilized	300,000
Government	Nigeria_Rural Electrification Agency	Grant	Investment mobilized	1,875,000
Government	Nigeria_Rural Electrification Agency	In-kind	Recurrent expenditures	625,000
Donor Agency	Nigeria_World Bank	Grant	Investment mobilized	80,000,000

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Donor Agency	Nigeria_GIZ	Grant	Investment mobilized	6,000,000
Donor Agency	Nigeria_GIZ	Loans	Investment mobilized	3,600,000
Donor Agency	Nigeria_GIZ	Equity	Investment mobilized	2,400,000
Donor Agency	Nigeria_AllOn	Equity	Investment mobilized	2,000,000
Government	Somalia_ Ministry of Energy and Water Resources	In-kind	Recurrent expenditures	3,500,000
GEF Agency	Somalia_UNDP	Grant	Investment mobilized	750,000
Donor Agency	Somalia_World Bank	Grant	Investment mobilized	500,000
Donor Agency	Somalia_DfID	Grant	Investment mobilized	5,500,000
GEF Agency	Sudan_UNDP	Grant	Investment mobilized	300,000
Government	Sudan_Electricity companies	Equity	Investment mobilized	500,000
Government	Sudan_Ministry of Energy and Mining	In-kind	Recurrent expenditures	250,000
Government	Sudan_ Higher Council for Environment and Natural Resources	In-kind	Recurrent expenditures	250,000

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Government	Sudan_ State Governments	In-kind	Recurrent expenditures	250,000
			Total Program Cost($)	**344,310,000**

Describe how any "Investment Mobilized" was identified

Notes: The Angola and Madagascar ‘self-financed’ national child projects, with AfDB SEFA and UNDP TRAC funding, are represented in the program’s finances as ‘co-financing’. Angola and Madagascar wished to participate in the program but were facing unavailability of CCM resources. New and additional resources from AfDB and UNDP have been provided to fund child project’s national activities, to complement the regional child project’s activities funded by the GEF CCM set-aside. “Investment Mobilized” was identified: At the regional level, investments mobilized were identified through stakeholder engagement with donor partners and foundations active in the minigrid sector in Africa. At the national child project level, the investments mobilized were primarily identified through ongoing discussions with national counterparts facilitated by UNDP Country Offices in child project countries. All of the investments will be confirmed during the PPG phase. At this stage, co-financing sources and amounts are indicative.

D. Indicative Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNDP	GET	Regional	Climate Change	CC Global/Regional Set-Aside	3,000,900	270,081	3,270,981
UNDP	GET	Burkina Faso	Climate Change	CC STAR Allocation	924,566	83,211	1,007,777
UNDP	GET	Comoros	Climate Change	CC STAR Allocation	1,269,863	114,288	1,384,151
UNDP	GET	Djibouti	Climate Change	CC STAR Allocation	3,071,347	276,421	3,347,768
UNDP	GET	Eswatini	Climate Change	CC STAR Allocation	863,242	77,692	940,934
UNDP	GET	Ethiopia	Climate Change	CC STAR Allocation	2,890,826	260,174	3,151,000
UNDP	GET	Malawi	Climate Change	CC STAR Allocation	396,125	35,651	431,776
UNDP	GET	Nigeria	Climate Change	CC STAR Allocation	5,905,046	531,454	6,436,500
UNDP	GET	Somalia	Climate Change	CC STAR Allocation	3,276,147	294,853	3,571,000
UNDP	GET	Sudan	Climate Change	CC STAR Allocation	2,637,246	237,353	2,874,599
				Total GEF Resources($)	**24,235,308**	**2,181,178**	**26,416,486**

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	321495	0	0	0
Expected metric tons of CO_2e (indirect)	21796122	0	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)				
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	321,495			
Expected metric tons of CO_2e (indirect)	21,796,122			
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)				

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)
select	4.50			

Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	368,025			
Male	368,025			
Total	736050	0	0	0

Part II. Programmatic Justification

1a. Program Description

1) Global environmental and/or adaptation problems, root causes and barriers that need to be addressed

840 million people - including over half of Africans - have no access to electricity, and, as a result, no access to the improved income and savings that depend on electricity [1]. Many millions more suffer from poor quality and unreliable grid-connected power, or expensive and polluting diesel generators. SDG7 (energy) is a fundamental enabler of the broader set of SDGs; electricity is an essential ingredient for lifting people out of poverty, improving health, boosting educational levels, reducing gender inequities, and enabling sustainable economic development.

In recent decades, electricity access has typically relied on a model of large, centralized power generation and extending publicly-funded grid connections. In some countries this has proved successful, in other countries the poor financial health of grid-connected power systems has held back progress. Today, innovative off-grid solutions – namely renewable energy minigrids ('minigrids') and solar home systems (often using a Pay-as-you-go (PAYG) model) – offer great potential for electricity access. The particular technology choice for electricity access – grid extension, minigrids or PAYG solar – will be determined on the basis of the least-cost solution for the particular site and scenario. Minigrids will have an important role to play: IEA geospatial analysis has shown that under a universal electricity access scenario by 2030, minigrids would be the cheapest technology for connecting 450 million people, two-thirds of whom live in sub-Saharan Africa.[2][1]

This minigrid opportunity is driven by a number of converging disruptive trends: falling hardware costs (solar modules, batteries, energy efficient appliances, and modular approaches), disruptive digital technologies including mobile money, and innovative, private sector business models (new service offers, lowering customer acquisition costs). Just as mobile phones have eliminated the need to build costly landlines for communication, there is evidence that minigrids – with private sector involvement, could enable Africa to leapfrog traditional power systems that consist of large, polluting, and typically heavily-subsidized fossil-fuel power plants and expensive transmission lines.[3][2]

Unlike other off-grid energy solutions, such as most solar home systems currently on the market, minigrids have the added advantage of supporting both residential and institutional energy needs (e.g., lighting and small appliances) and productive energy uses (e.g., milling, irrigation, and light manufacturing). Minigrids can, therefore, have a positive impact on the local economy and contribute to sustainable community development and, more importantly, they can support future energy demand growth. Minigrids also have the benefit of being able to be deployed fast at relative speed. This realization has meant that there is an increasing emphasis on developing lower cost minigrid business models with the aim of achieving universal electricity access.[4][3]

However, several risks and barriers exist in most countries for minigrid investment. The primary risks are summarized in Table 1. As further illustrated in the next section (2.1), from a private sector perspective, these risks result in a higher financing costs (equity and debt) and reduce the competitiveness of minigrids relative to alternative sources of energy (e.g., diesel generators). All else being equal, the need for higher returns that reflect these risks translates into higher energy prices that, in turn, adversely affect affordability for the end-user, or require larger subsidy requirements for rural electrification programs.

[1] IEA, IRENA, UNSD, WB, WHO (2019), Tracking SDG 7: The Energy Progress Report 2019, Washington DC

[2] World Economic Forum/IEA (2018): 1.1 billion people still lack electricity. This could be the solution.

[3] T. Safdar (2017) Business models for mini-grids, Technical Report 9, Smart Villages;.

[4] IRENA (2016) Innovation Outlook: Renewable minigrids, IRENA, T. Safdar and Brian Heap (2016) Energy and Agriculture for Smart Villages in India, Technical Report 7, Smart Villages

Table 1. Risks and barriers to develop renewable energy minigrids

Risk Category	Underlying Barriers	Description
Energy Market Risk	Market outlook	Lack of political will and/or uncertainty regarding national/state targets for electrification and renewable energy minigrid investment, including lack of electrification plans, rural electrification agencies/institutions, and good data (geospatial) on energy demand and lowest cost technology options.
	Market access, competition and grid expansion	Lack, or limitations (suboptimal design, lack of capacity), in current government policy framework for minigrids including off-grid services areas; well-defined concessions (size, years, targets, bundling); compensation schemes in case of grid expansion.
	Tariffs	Uncertainty or inflexibility in electricity tariff regulations for minigrid developers
	Technical standards	Lack of clarity, uncertainty and/or inconsistent government technical requirements for minigrids regarding (i) quality of service and (ii) grid integration, should it occur.
	Competing subsidies	Competition from subsidized diesel and kerosene (mostly used for lighting); negative perceptions of minigrid tariffs due to subsidized grid-distributed electricity.
Social acceptance risk	Unfamiliarity with minigrids	Risk arises from lack of awareness and resistance to renewable energy and minigrids in communities, also from resistance from incumbent businesses.
Hardware risk	Availability and quality of hardware	Lack of availability of quality hardware and national quality standards for components of minigrids, and/or the lack of institutionalization of a minigrid quality assurance framework. In several countries, hardware costs are also higher than expected because of the lack of a supply chain for spare parts.
	End-of-life waste management	Risks arising from lack of policies and planning regarding disposal of hardware, including batteries, at end-of-life of mini-grids
	Customs	Cumbersome customs/clearing process for importing hardware, leading to delays in delivery; punitively high customs tariffs on minigrid hardware.
Digital risk	Networks and software availability	Lack of cellular coverage in rural area for minigrid remote monitoring and payments
Labor risk	Inadequate capacity	Lack of a competitive labor market of educated, skilled and qualified potential employees to design, construct, operate and maintain minigrids, leading to higher costs, hiring non-local staff and suboptimal performance.
Developer risk	Project development and management capacity	Minigrid business developers may not have the necessary expertise and capabilities to formulate financially viable projects and operate minigrids. Also, there is no 'one-size-fits-all' solution yet, implying that business models need to be contextualized.
	Developers' creditworthiness	Inability of developer to secure low-cost financing from investors due to lack of credit worthiness, or insufficient cash flows to meet investors' return requirements.
End-user credit risk	Lack of customer creditworthiness	Lack of end-user credit data; customers' willingness and ability to pay and methods of payment for electricity.
Financing risk	Capital scarcity	Limited availability of long-term domestic loans, well-capitalized actors and policy incentives.
	Limited experience with minigrids	Investors' lack of familiarity with minigrid projects and appropriate financing structures.
Currency risk	Local currency volatility	Currency mismatch between domestic currency revenues and hard currency financing.
Sovereign risk	Various uncertainties not specific to minigrids	Limitations and uncertainty related to conflict, political instability, economic performance, weather events/natural disaster, legal governance, ease of doing

2) Baseline scenario or any associated baseline programme/projects

This section describes a number of baseline related issues including: minigrid costs, minigrid models, and baseline activities by the private sector and development actors.

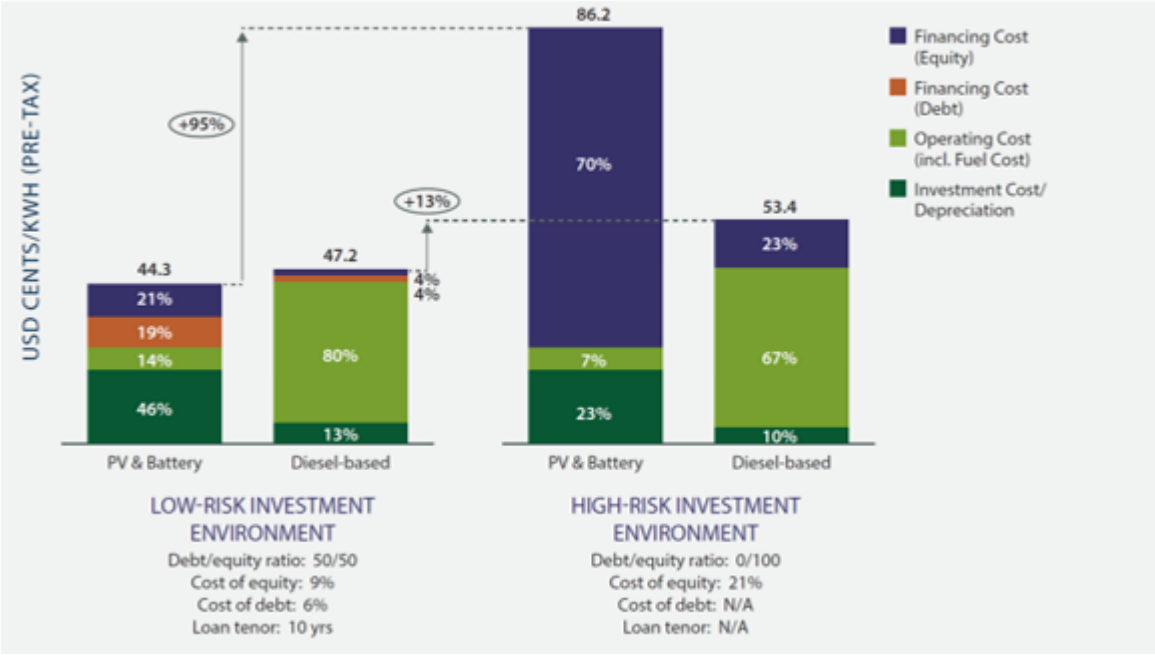
2.1 Baseline minigrid costs

Today, while hardware costs have experience large reductions in recent years, the baseline generation costs of renewable energy minigrids in developing countries, including African countries, remain uncompetitive with conventional, fossil fuel-based alternatives.

Figure 1, below, based on a generic modelling analysis by UNDP, illustrates this, comparing the generation costs of solar PV-battery minigrids and diesel-based minigrids in both a developed country (left hand side, 'low-risk environment') and developing country (right hand side, 'high-risk environment) context. In a typical developed country, generation costs from solar PV-battery and diesel-powered minigrids are at approximate parity, estimated at USD 44.3 cents/kWh and USD 47.2 cents/kWh respectively. However, in a developing country context, solar-PV battery minigrids today typically become uncompetitive, with an illustrative generation cost of USD 86.2 cents/kWh, compared to a diesel-based generation cost of USD 53.4 cents/kWh.

This baseline situation, with higher generation costs for solar PV-battery minigrids, reflects a number of underlying factors. One key factor is that developing countries are characterized by high financing costs, reflecting a variety of underlying investor risks that are present in early-stage markets. Given their high capital intensity, solar PV-battery minigrids are particularly sensitive to these higher financing costs needed to fund their upfront investment, and this penalizes their relative competitiveness with respect to diesel. Another important factor can be elevated hardware costs in developing countries, caused by a variety of issues, including lack of economies of scale and sub-optimal system-design.

Figure 1: Comparison of Solar PV-Battery and Diesel-powered Minigrid Generation costs in Low-risk (Developed Country) and High-risk (Developing country) Investment environments.



Source: UNDP, Derisking Renewable Energy Investment: Off-Grid Electrification (2018)

2.2 Baseline minigrid business models:

Table 2 provides a summary of the four main minigrid business models that are currently being used, including variants underpinning each model, and a summary of their characteristics.

Table 2. Summary of Baseline Minigrid Business Models

Category (and variations)	Brief description	Characteristics
Utility-operated	Typically state-owned national or regional electricity utilities own and operate the minigrid. The government takes on all risks associated with the design, construction, operation and maintenance of the infrastructure.	This model has traditionally been dominant. Typically, minigrid tariffs are highly subsidized and set at parity with grid-connected electricity. This model has not proved to be financially sustainable. The low-level scalability of this model has motivated countries (e.g. Kenya, South Africa) to shift to other models, especially those involving private sector participation.
Community-operated	The minigrid is operated and managed by a group of end-users grouped in a cooperative that is governed by government regulations. Financing is primarily based on grants and, quite often, the local community provides in-kind contributions (e.g., labor, land).	This model provides opportunities for job creation and revenue generation to the local community. However, there is usually a lack of technical expertise within the community, therefore planning, design, and implementation (operation and maintenance) are weak, resulting in a high portion of community-operated minigrids being unsustainable. Whereas the conditions may be conducive for this model to be successful in some communities (e.g. Terrat in northern Tanzania), it is not necessarily applicable to all communities.
Private sector-operated	The private sector is responsible for building, managing, and operating the minigrid. To create economies of scale and diversify risk, there is the potential for private sector developers to aggregate multiple minigrids. Typically, risk transfer or compensation measures in the form of loan guarantees, grants or subsidies are provided by the government or development partners to improve financial returns and sustainability.	In recent years there has been significant innovation in private sector minigrid business models, driven by lower cost hardware, and new opportunities via digitalization/cellular networks. There continues to be a high level of experimentation in business models and financial structuring. Nonetheless, private sector models are currently still not fully financially viable, with limited commercial financing available. Some successful investments are predicated on servicing an anchor (industrial/commercial) load (e.g. servicing tea and coffee plantations in Kenya).
Hybrid (combining aspects of previous three models)	These models combine different aspects of the previous models, where different entities could be involved in investment, ownership, and operation of a minigrid. Division of labor and the clear demarcation of roles and responsibilities of various actors are essential to ensure the effective and efficient design, commissioning and management of minigrids.	Depending on the regulatory framework and property rights regime, different contractual agreements may bind two or more of the three main actors, namely (i) government or public institution, (ii) private company, or (iii) community, in the management of a minigrid. Examples of hybrid models can include public ownership of the asset, and private operations and maintenance (e.g. 160 minigrids in Mali).

Source: Smart Villages, Technical Report 9 (2017) , IRENA, Innovation Outlook: Renewable minigrids (2016) ; M. Franz, N. Peterschmidt, and M.R. Bozhi (2014) Mini-grid policy toolkit: policy and business frameworks for successful mini-grids roll out

There is no gold-standard business model for operating minigrids, and there remains substantial experimentation and exploration of these models. The particular suitability of one model will depend on the specific context; in general, as markets mature, there is the opportunity to graduate to private sector models, with good potential for scalability

2.3 Private sector baseline activities:

In Africa, a small group of pioneering private sector minigrid developers are leading the way, backed by an ecosystem of suppliers, investors, development actors and champions. These developers are mainly backed by patient, impact-oriented equity capital and grants, which enable them to experiment with different business models, ownership modalities, capital structures and technologies. Illustrative, first-mover private sector developers include *PowerGen* in Kenya, and *Nayo Tropical Technology* and *Green Village Energy* in Nigeria. Early lessons extrapolated from these developers' successes demonstrate that private sector investment in minigrids across Africa has the potential to address the electrification challenge. However, most of the private sector minigrid developers in Africa are international, with domestic private sector developers under-represented.

According to Bloomberg New Energy Finance (BNEF), investment in private sector minigrids in Africa and Asia (mainly India) is estimated to total $259 million since 2013,[5][4] far less than the billions needed by 2030.[6] Local commercial investment, either in debt or equity, in the minigrid sector is extremely rare.

2.4 Baseline activities of development partners:

There are a number of existing donor-driven and NGO initiatives and activities promoting minigrids at the regional level in Africa. These are set out below. These initiatives typically involve large international financing institution programs comprised of highly concessional debt packages to key markets such as Ethiopia and Nigeria. These programs can also include support on enabling environments, and pre-feasibility and feasibility studies. Few of these programs have an explicit focus on minigrid costs.

UNDP, RMI and the African Development Bank (AfDB) baseline activities include:

UNDP, RMI and AfDB bring comparative advantages and complementary strengths and competencies to the program.; UNDP brings in-depth investment risk and regulatory experience in the global minigrid sector, along with on-the-ground experience and capacity; RMI brings techno-economic expertise, hands-on experience analyzing African minigrid costs and revenues, and experience working closely with African governments and the private sector on minigrid planning; the African Development Bank brings regional financial expertise and experience with concessional finance for minigrids, and broad programmatic support to the sector.

UNDP: UNDP's baseline activities in minigrids are composed of its *Derisking Renewable Energy Investment* (DREI) framework, as well as its on-the-ground support to developing countries.

- Derisking Renewable Energy Investment (DREI)[7] is an innovative, quantitative framework to support policy makers to cost-efficiently promote private investment in renewable energy. In late 2018, UNDP expanded the DREI framework to include solar PV-battery minigrids, releasing open-source analytic and financial modelling tools to track investment risks, financing costs, and to support the private sector and policymakers in modelling levelized costs, tariffs and subsidies for minigrids.

- National GEF-funded minigrid projects. UNDP, working with its partners, has a large active portfolio of GEF-funded projects supporting renewable energy minigrids (solar-PV battery; mini-hydro; biomass), totaling 12 countries in Africa***[8]***, and 23 countries globally. These projects assist governments with designing and implementing policies and regulations, and with piloting minigrid investment and financing.

Rocky Mountain Institute: Rocky Mountain Institute (RMI) is an impartial not-for-profit organization with a 37-year history of creating market-led energy transformations globally. Its work in minigrids focuses on reducing cost of service and supporting innovative business models. Its approach is based on experience working across seven countries in Africa with governments, utilities, and the private sector to better understand market-driven solutions to the continent's energy needs.

- Minigrid planning support to governments, utilities and the private sector: RMI is currently supporting minigrid policy, strategy, and regulatory framework development in Nigeria and Ethiopia. In Nigeria, RMI is working directly with the Rural Electrification Agency along with several Distribution Companies to support minigrid cost reduction and the testing of innovative business models. This support has included the collection of data, analysis, and recommendations on tariff rate design, subsidy, site selection, and tenders. RMI is working closely with public and private sector partners to understand and pilot the impact of 'productive use loads' (such as grain-milling or ice-making) on minigrid economics, as well as the market potential for interconnected minigrids in peri-urban areas. In both countries, RMI has engaged private sector developers and investors as key stakeholders, ensuring their perspective on minigrid market development is communicated to governments and utilities.

- Thought leadership and research: Over the past three years, RMI has performed research and published several widely-read reports on the minigrid market in sub-Saharan Africa. These reports have included regional analysis and recommendations on minigrid cost reduction through hardware, soft costs, finance and regulations; the impact of

commerical and industrial ‘productive loads’ on the financial viability of minigrids; and the market potential of so-called ‘under-grid’ minigrids that could operate interconnected, using existing distribution infrastructure. These reports have focused on the potential of the private sector minigrid business model. Two of these reports have closely analyzed the impact of minigrid hardware standardization on cost.

- Regional convening events: RMI has participated in and hosted several regional minigrid convening events. In one instance, RMI brought together African governments, minigrid developers, upstream hardware suppliers, financiers, and donor partners in Lagos, Nigeria, for a multi-day facilitated discussion of minigrid cost-reduction activities. RMI has led transitions toward clean energy in China and the US, while advising private sector companies around the globe.

AfDB: AfDB is actively supporting minigrids via the Green Mini Grid Market Development Program, the Sustainable Energy Fund for Africa (SEFA), the Facility for Energy Inclusion (FEI), and GCF projects, amongst others.

- Green Mini Grid Market Development Programme: Funded by SEFA, with a $1 million grant to launch Phase 1 in June 2015, a $3 million grant for Phase 2 in June 2017, and anticipated $4m for Phase 3 from 2020 onwards. The objective of the Programme is to support the scale-up of investments in commercially-viable green minigrid projects through a broad range of interventions to improve the enabling environment in SSA. The Program has been implemented by the SEforALL AfDB, organized in five business lines providing market intelligence, technical assistance to government and developers, regulatory support, quality assurance and access to finance. The programme currently works to provide this support in 12 countries

- Sustainable Energy Fund for Africa (SEFA): Funded by the governments of Denmark, Norway and the United States, as well as the GEF, SEFA provides grants to facilitate the preparation of bankable projects including minigrids, equity investments in the energy sector, and support to public sector institutions to improve the enabling environment for sustainable energy.

- Facility for Energy Inclusion: FEI is a $500 million fund providing senior and mezzanine debt financing to small renewable IPPs, GMGs and off-grid solar companies.

- Desert to Power Initiative: The Desert to Power Initiative is working to develop 10 GW of solar by 2025 across the Sahel, in Senegal, Nigeria, Mauritania, Mali, Burkina Faso, Niger, Chad, Sudan, Ethiopia, Djibouti and Eritrea. $140 million has been committed to the initial project preparation phase.

- GCF: AfDB is the project owner of the $59 million GCF-funded Yeleen Rural Electrification Project in Burkina Faso, providing capital subsidies and an enabled environment to scale-up private sector investement in minigrids.

The primary regional-level development actor baseline activities:

World Bank Energy Sector Management Assistance Program (ESMAP): ESMAP's Global Facility on Mini Grids works to increase World Bank investments in mini grids while generating knowledge on the factors affecting mini grid scale-up. ESMAP has supported the World Bank's work with minigrids in 25 global countries, totaling $445 million in investment in Benin, Ghana, Kenya, and Tanzania, with significant upcoming projects in Nigeria ($150m) and Ethiopia, among other countries. For example, ESMAP has been providing direct support to Nigeria's Rural Electrification Agency with tender design, subsidy design, and site selection. ESMAP has also hosted periodic "Mini Grids Action Learning Events" (most recently in Ghana in June 2019), and recently published *Mini Grids for Half a Billion People (June 2019)*, an extensive state of the market report.

BOAD: The West African Development Bank (BOAD) is supporting renewable energy minigrids across West Africa through several projects.

- BOAD is the project owner and a co-financier of the GCF-supported $138.6 million BOAD climate finance facility to scale up solar energy investments in Francophone West Africa. The facility provides blended finance to solar energy, including minigrids, along with grant funding to support both private sector and public sector capacity building.
- BOAD is the project owner of the $38.9 million GCF-funded Mali solar rural electrification project, which includes $9.4 million in BOAD funding.
- BOAD is the GEF implementing agency in Togo of a $19.4 million GEF-6 renewable energy program that includes minigrid activities.

GCF: The Green Climate Fund is supporting a range of climate mitigation minigrid projects across Africa. Project owners for these minigrid projects include the AfDB and BOAD, as described above. Specific projects in addition to those described above include:

- Through the $300 million Universal Green Energy Access Program, with Deutsche Bank as the project owner, the GCF aims to provide financing for off-grid and minigrid energy companies. The program operates in Nigeria, Namibia, Benin, Kenya and Tanzania, and will operate until 2031.
- As described above, the GCF is also funding minigrid work in the Democratic Republic of Congo, Mali, Benin, Tanzania, Namibia, Kenya, Rwanda. A variety of project owners are implementing this work.

CLUB-ER: The African Association for Rural Electrification or Association Africaine pour l'Electrification Rurale (CLUB-ER) is a Community of Practice including rural electrification agencies and ministries from over 35 member countries. As a Community of Practice, CLUB-ER supports annual meetings, workshops and an online platform. CLUB-ER is supported by ADEME DEME (Agence de l'Environnement et de la Maîtrise de l'Energie - France), and the IFDD (Institut de la Francophonie pour le Développement Durable) – Québec.

Carbon Trust: The Carbon Trust leads the consortium managing the Transforming Energy Access (TEA) Programme. The TEA programme is supporting the development of innovative technologies, business models, partnerships and skills that will accelerate access to affordable, clean energy services for households and enterprises in developing countries.UK aid is providing up to £100 million ($130 million) through the TEA programme until 2024. To date the programme has already helped people and businesses across Africa cut 2 million tonnes of carbon emissions and improve the lives of 3.2 million low-income people. It has also leveraged $359 million worth of investment in clean energy from the public and private sectors. Within the TEA programme, the Mini Grid Cost Reduction (MGCR) Partnership and Powering Opportunities Partnership (POP) focus on minigrid cost-reduction and productive use, respectively. The MGCR Partnership builds upon and links existing initiatives such as CrossBoundary's Mini-Grid Innovation Lab and AMDA, and acts as an R&D budget seeking minigrid capital and operational cost reduction from private sector developer perspective. AMP, in contrast, will take a more holistic approach that includes working with private sector developers, government, communities, and hardware providers by applying, various policy, design, financing, and project derisking instruments to reduce minigrid costs.

Innovation Lab: CrossBoundary and The Rockefeller Foundation launched the Minigrid Innovation Lab in April 2018 in Kenya, the first research and development fund for sub-Saharan Africa that focuses exclusively on testing business model innovations in the minigrid sector aiming to accelerate sustainable rural electrification. Recent focus of the Lab includes how minigrids can integrate with the main grid, household and business energy use on minigrids with tariff change, also examining the commercial returns and social benefits for minigrids for offering appliances to customers on credit.

UNF Mini Grid Partnership: Originally launched at the SEforAll Forum in 2014, the Mini Grid Partnership is a voluntary partnership of leading minigrid stakeholders that seeks to accelerate the development and deployment of minigrids through the exchange of information and ideas, shaping policy and markets to unlock the potential of widespread minigrid electrification. The network includes 250+ donors, companies and public sector stakeholders active in the sector. UNF helps manage the initiative and issues a periodical Newsletter (~4 issues per year) with their Energy Access Practitioner Network initiative.

African Minigrid Developers Association: The African Minigrid Developers Association (AMDA) is a trade association of minigrid developers operating across the continent. AMDA represents EPCs, hardware vendors, software vendors, and integrators. AMDA partners with governments, donors, and utilities to share knowledge and feedback from the private sector with policy-makers, regulators, and investors. AMDA is supported by the Shell Foundation, UK Department for International Development (DFID), and the World Bank.

Global Commission to End Energy Poverty: The Global Commission to End Energy Poverty is a cross-sector group of African energy sector leaders consisting of development banks, utilities, and off-grid firms, along with academics, industry leaders and investors. The Commission operates under the joint chairmanship of The Rockefeller Foundation President Rajiv J. Shah, former U.S. Secretary of Energy Ernest J. Moniz, and the Africa Development Bank President Akinwumi Adesina. Launched in 2019, the Commission intends to forge a consensus that lays out viable pathways for providing electricity services to hundreds of millions of under-served homes and business more quickly and more cost-effectively than the current trajectory. These pathways include off-grid electrification and minigrid technology, and the commission includes leading energy financiers.

Beyond the Grid Fund for Africa: The Beyond the Grid Fund for Africa is a EUR 48 million results-based financing fund focused on Zambia, Burkina Faso, Liberia and Mozambique off-grid sectors, including both solar home systems and minigrids. The Fund is financed by Swedish International Development Cooperation Agency and managed by NEFCO in cooperation with the Renewable Energy and Energy Efficiency Partnership (REEEP). Using a results-based financing and risk-sharing approach called Social Impact Procurement, the Fund aims to reach 5 million beneficiaries by 2025.

3) Proposed alternative scenario, (GEF focal area strategies), with a brief description of expected outcomes and components of the programme

The GEF-7 Africa minigrids program (the 'program') – led by UNDP, RMI and AfDB – **will increase access to energy by improving the financial viability and promoting scaled-up commercial investment in renewable energy minigrids ('minigrids')**[OW1]

The programmatic approach aims to achieve greater impact by creating new minigrid markets across the continent, which, in aggregate, will create scale and momentum, attracting private sector interest and investment. The programmatic approach will also allow for a broader sharing of good practice, and create economies of scale in providing program services.

3.1. Summary of key features

The following text sets out the key features of the program.

Program Focus: The program is **focused on minigrid cost-reduction – across hardware costs, soft costs[9] and financing costs – and innovative business models for minigrids**. With lower costs minigrids will be more financially viable, commercial capital flows will increase, and end-users will benefit from lower tariffs and expanded service.

The program has been designed to specifically address the niche of cost-reduction, and in this way be complementary to existing baseline activities supporting minigrid investment in Africa. Figure 2 sets out how the program can promote more efficient and effective use of development resources. Program partners such as the AfDB and the World Bank can leverage the program's focus on cost reduction in their own distinct activities.

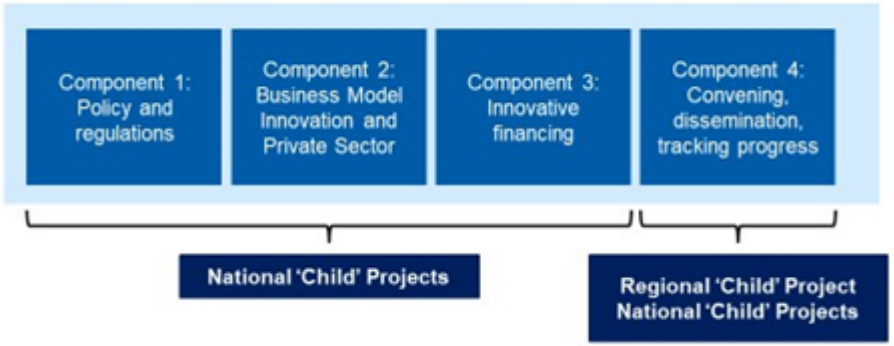
Figure 2. GEF 7 African Minigrid Program's Niche

Program Design: The program has two main elements:

- A cohort of **National 'Child' Projects**, each with a set of tailored activities in line with the program's three thematic areas of (i) policy and regulations, (ii) business model innovation and private sector, and (iii) innovative finance
- A **Regional 'Child' Project**, to support the program's national child projects, and the Africa minigrid market more generally, offering three core sets of activities: (i) knowledge tools for both public and private actors; (ii) tailored technical assistance to countries; and (iii) convening, dissemination, and tracking of progress.

The program is structured as four components, across national child projects and the regional child project, as set out in Figure 3, below. This structure allows for a clear results framework for measuring impact across national child projects, with a commonality in outcomes, outputs and indicators in each component.

Figure 3. Architecture of the GEF-7 Africa Minigrids Program



Country Participation: The primary form of country participation in the program will be as national child projects. The program will initially support a first round of 11 such countries submitted for the GEF December 2019 work programme. These 11 countries are: Angola, Burkina Faso, Comoros, Djibouti, Ethiopia, Eswatini, Madagascar, Malawi, Nigeria, Somalia and Sudan. Funding for national child projects has come from GEF STAR, UNDP TRAC and AFDB SEFA[10], as well as other co-financing sources. The opportunity of a future second round of national child projects, as well as via other modalities such as the GEF non-grant instrument modality, will also be explored.

These initial 11 countries represent a diverse cross-section of African countries: both large as well as smaller markets; Anglophone and Francophone countries; small island developing states; and countries in post-crisis contexts. This can create a rich and diverse mix of contexts, perspectives and experiences in the program.

In addition to participating as national child projects, countries in Africa will be able to participate in the program in three further ways. Under these additional categories, the regional child project will look to create a 'docking station' by which countries can engage with the program. This support will be subject to availability of regional child project resources, and may involve a degree of cost-sharing.

- Should there be no second round of GEF 7 national child projects, interested countries can still benefit from the program as standalone GEF-7 project.
- Existing GEF-funded minigrid projects being implemented in African countries with closure dates planned for between 2021 and 2024 as per Annex E in the PFD – i.e. 11 in total - will be invited to participate in the program with observer status.
- A final category can come from all other interested countries. In this regard, the program can be viewed as a public good that will seek to be inclusive, open and accessible, making its knowledge tools available to all interested parties.

Partnerships: The program will partner widely with other stakeholders and initiatives in minigrids. Key partners include (non-exhaustive):

- Lead partners of UNDP, RMI and AfDB
- Financing partners, who will be key to the program's investment goals, including development banks: AfDB, BOAD, World Bank, and DBSA
- Knowledge partners, including Club ER, Carbon Trust, WB ESMAP, Innovation Lab and Minigrid partnership.

The program will put in place an inclusive governance structure, including an AMP advisory committee, to promote engagement and information flow amongst partners. Similarly, the program will actively seek to reciprocate engagement in partners' governance bodies.

Complementarity: To ensure complementarity with baseline activities, during the design phase detailed 'gap analysis' exercises have been performed at the national child project level. The technical team has travelled to 9 of the countries under consideration. During these fact-finding missions, the technical team met with national counterparts, UNDP Country Offices, donor partners, and private sector developers and investors. Summary findings of these analyses are reflected in Annex D and are reflected in each national child project concept note.

Theory of change: The program's theory of change is summarized in Figure 4 below.

The theory of change is premised on a baseline context where, while good progress is being made, renewable energy minigrids are currently not competitive with fossil-fuel based alternatives. This baseline context is described earlier in the baseline section, and in Figure 1. This program, by focusing on cost-reduction levers and innovative business models, can improve the financial viability of renewable energy minigrids. When renewable energy minigrids are more competitive, private capital will then flow, resulting in various program benefits: investment at scale, GHG emission reductions, and electrification and lower tariffs for end-users.

As set out in Figure 4, a number of internal logical steps need to occur to achieve this change

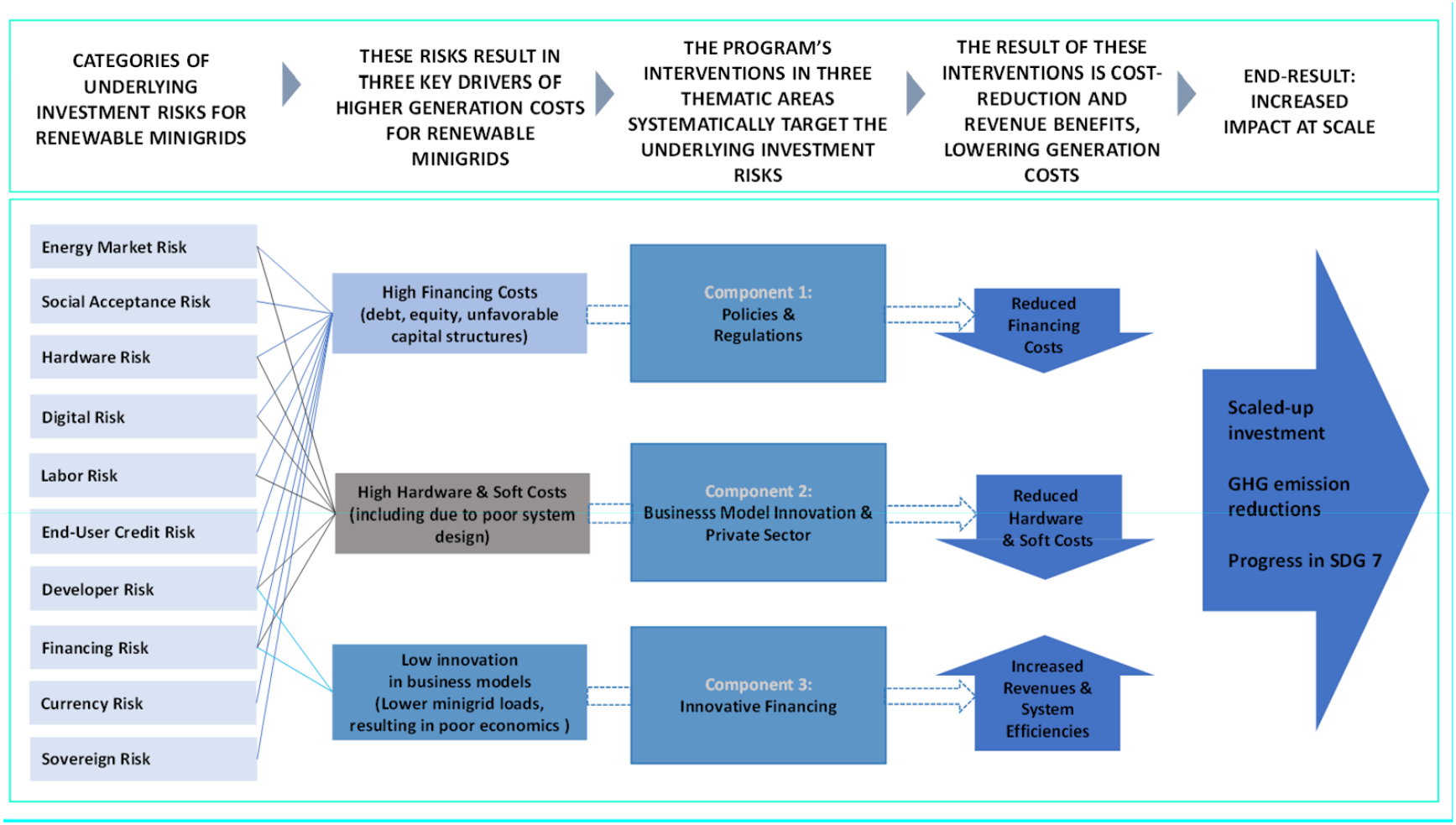
· Renewable energy minigrids face a range of underlying investment risks. These are shown in Figure 4, and described earlier in Table 1.

· These underlying investment risks in turn result in three key negative drivers on renewable energy minigrid's generation costs: high financing costs, with elevated costs of equity, debt and unattractive capital structures; high hardware/soft costs, reflecting market barriers and poor system design; and lack of innovation in business models, holding back revenue growth and new sources of demand.

· In this context, the program itself has interventions organized into three key areas (components): policies and regulations; business model innovation and private sector; and innovative finance. The program's specific outputs under each of these three areas are designed to systematically target the underlying investment risks at the national level for renewable energy minigrids.

· When underlying investment risks are mitigated, this in turn inverses the earlier relationships, resulting in three key beneficial drivers for the competitiveness and fincancial viability of renewable energy minigrids: reduced hardware and soft costs, and increased revenues and economies of scale. Collectively these three beneficial drivers result in a virtious cycle of lower generation costs.

Figure 4. GEF 7 Africa Minigrids Program Theory of Change



This theory of change, and the program's focus on cost-reduction, is well-aligned with both UNDP's and RMI's areas of expertise. This is further explored in Boxes 1 and 2, respectively, below.

Box 1: UNDP's Derisking Renewable Energy Investment Framework for Minigrids

Derisking Renewable Energy Investment (DREI) is an innovative, quantitative framework to support policy makers to cost-efficiently promote private investment in renewable energy. In late 2018, UNDP expanded the DREI framework to include solar PV-battery minigrids, releasing open-source analytic and financial modelling tools to track investment risks, financing costs, and to model levelized costs, tariffs and subsidies for minigrids.

As an illustration of the DREI framework for solar PV-battery minigrids, Figure 5 below shows financing cost waterfalls that have been prepared for an analysis in Kenya. The underlying data was gathered via 12 structured interviews with international and domestic private sector developers and investors.

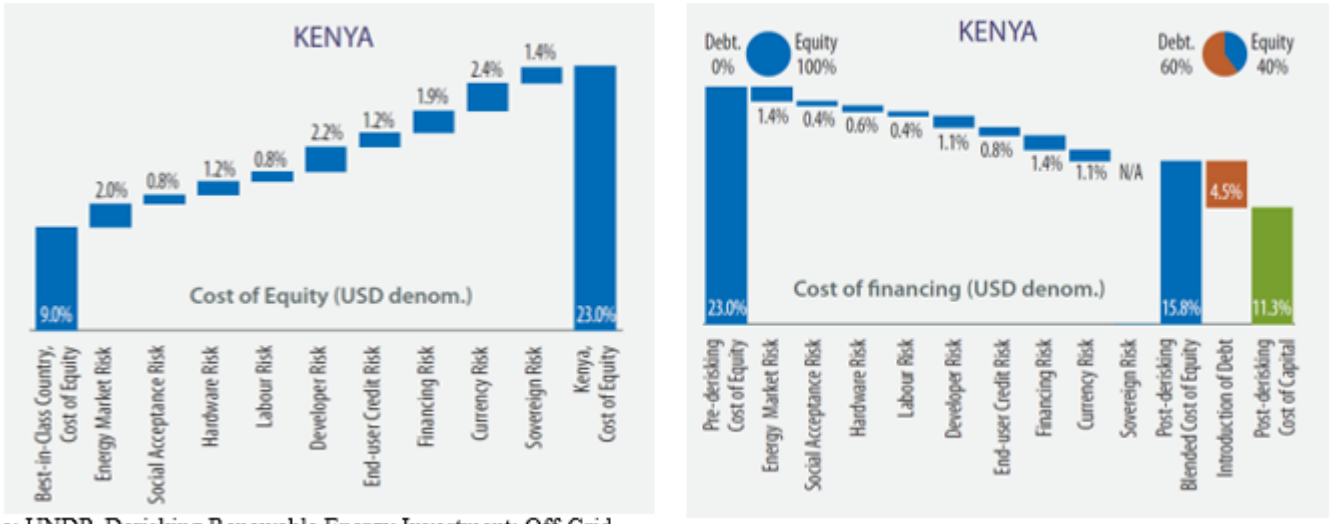
In terms of specifications, this Kenya analysis has been performed for a total 77MW minigrid investment target, serving 3.52 million people, and amounting to 8,000 systems. Each minigrid is sized to 10kWp systems with 40kWh lithium-ion batteries, with each minigrid serving 100 households, to a Tier 1-2 electrification level at 95% reliability. The analysis assumes private sector build-own-operate (BOO) minigrids.

The financing cost waterfall on the left (pre-derisking) quantifies how different investment risks contribute to higher financing costs for solar PV-battery minigrids. The figure shows that the business-as-usual cost of commercial equity for solar-PV battery minigrids in Kenya is 23%, and that currently debt is not available. Four major risk categories, energy market risk, developer risk, financing risk and currency risk, contribute strongly to higher financing costs. This financing cost waterfall can assist in identifying and prioritizing public measures to address these investment risks.

The financing cost waterfall on the right (post-derisking) quantifies how - once a package of public derisking measures is implemented – each of these public measures can mitigate individual risk categories, lowering the overall financing costs for minigrids in Kenya. The package of measures modelled is estimated to reduce the average cost of capital by 11.7%, from 23.0% to 11.3%, including a significant benefit from introducing debt into the capital structure. This reduction in financing costs results in a significant increase in the competitiveness of minigrid investment.

Figure 5: Pre and Post-derisking financing cost waterfalls for solar PV-battery minigrids (Kenya)

Figure 5: Pre and Post-derisking financing cost waterfalls for solar PV-battery minigrids (Kenya)

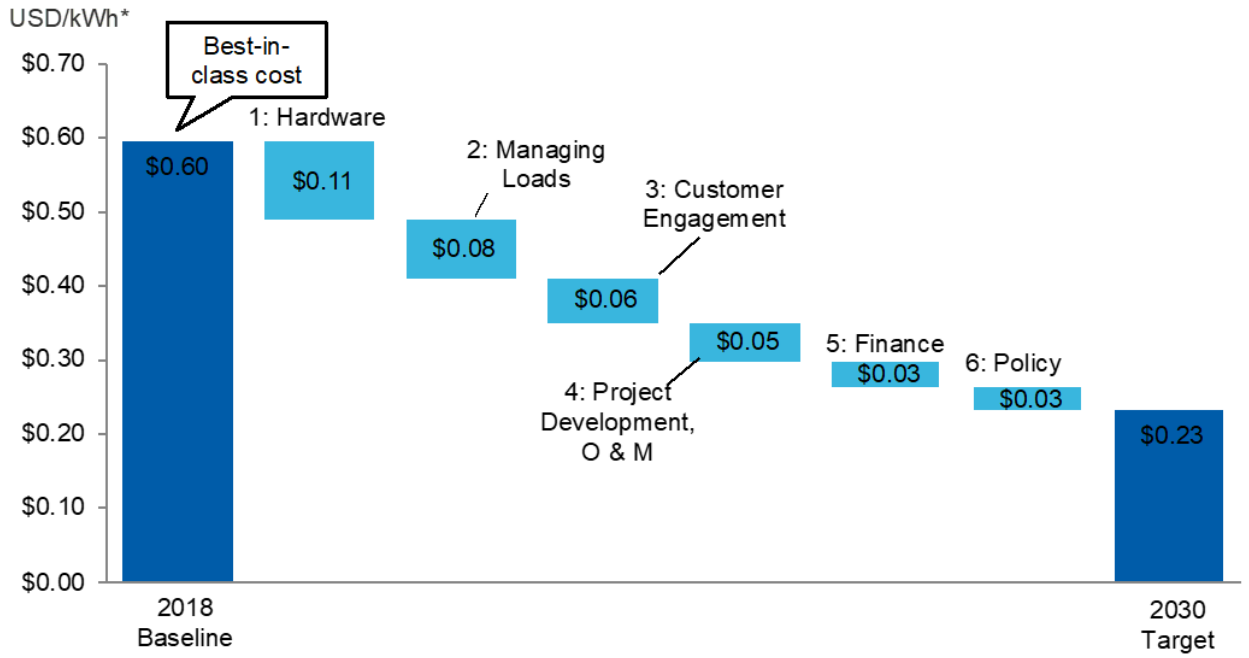


Source: UNDP, Derisking Renewable Energy Investment: Off-Grid Electrification (2018)

Box 2: RMI's Approach to Mini-Grid Cost Reduction

RMI has engaged public and private sector stakeholders in several countries across Africa on minigrid cost reduction. The work to date has revealed six cost-reduction opportunities to reduce minigrid levelized cost of electricity from $0.60/kWh today to near $0.20/kWh by 2030 (see Figure 6: 1) reduce costs of minigrid hardware, 2) ensure electricity generated is fully utilized through demand stimulation and optimized load management, 3) focus on customer acquisition and relationship management, 4) reduce costs of building and operating minigrids, 5) enable low-cost financing, and 6) reduce regulatory barriers, costs and risks.

Figure 6 Levelized Cost Of Electricity Reduction Opportunities In Six Categories



Source: RMI analysis (2018)

RMI's broader cost-reduction work includes data collection, data analysis, developing recommendations to inform tariff design and subsidy, site selection and tender development to encourage cost reduction in partnership with utilities, government, and private sector developers. RMI has also conducted research and provided thought leadership regarding the impact of productive use loads on minigrid economics, the market potential for undergrid minigrids, and new business models to enable cost reduction. RMI has a particular focus on leveraging the private sector to pursue cost reductions and regularly consults with local and international minigrid developers across Africa.

3.2 Program Design and Components

The following four **Program Components** will collectively seek to achieve the outcome of the program.

- Components 1 to 3 will apply at the national child project level
- Component 4 at both the regional child project and national child project level.

Component 1: Policy and regulations (*national child projects)*

Outcome: Appropriate policies and regulations are in place that address policy, institutional, regulatory and technical barriers to facilitate investment in minigrids.

For the private sector to invest, they require clear, transparent and long-term domestic policies and regulations, which are well-designed, implemented and enforced. Under these conditions, low-cost, commercial capital can start to flow. Private sector actors in African countries often express indifference with current regulations, and point to burdensome or poorly-formulated public measures. The policy and regulatory activities undertaken in this component will address a variety of barriers to investment, from energy market risk, to digital risk, to labor risk, amongst others (see earlier Table 1). Typically activities under this component are targeted towards public officials and institutions.

List of generic outputs (to be tailored to country context):

- A minigrid regulatory framework, including tariff model, tax regime, and grid expansion risk, is developed in close coordination with other development partners
- Geospatial, techno-economic modeling of least-cost off-grid renewable electricity technologies (minigrids, grid expansion, solar home systems)
- Formulation of rural electrification strategy/plan, incorporating transparent targets and supported by multi-tier data
- Assessment of negative impact of competing fossil-fuel subsidies on competitiveness of minigrids, and recommendations for subsidy reform.
- Minigrid DREI techno-economic analyses carried out to propose most cost-effective basket of policy and financial derisking instruments

- Institutional set-up for rural electrification assessed and supported, and institutional capacity building provided on technical, managerial, and regulatory issues.
- Capacity building provided to public officials (regulator, ministries) specifically to design procurement/tender processes that incorporate cost-reduction levers and innovative business models
- Domestication of quality standards for solar minigrid components, and institutional capacity of national standards organizations/bureau strengthened
- Customs procedures and import requirements harmonized, and capacities of public officials to implement and enforce simplified import process strengthened
- Support provided to establish waste management policies and plans to ensure minigrid hardware and batteries are properly handled at end-of-life
- Support provided to improve policies around digital infrastructure for smart minigrids, including improving cellular coverage in rural areas and mobile money
- Public programmes (apprenticeships, certificates, university programs) to develop competitive, skilled labor market in minigrids

Component 2: Business model innovation and private sector ***(national child projects)***

-

Outcome: Innovative business models based on cost reduction operationalized to support and strengthen private participation in minigrid development.

Private sector (developers, supply chain, investors, financial intermediaries, etc.) involvement in minigrid cost-reduction will be central to the program's approach. A range of activities will be offered to engage and support the private sector. The centerpiece of these activities will be support on pilot minigrids, with a focus on productive use and innovative business models. A range of complementary activities will build the capacity of private sector actors. This component will place an emphasis on support to domestic private sector developers, and advancing gender considerations.

List of generic outputs (to be tailored to country context):

- Pilots developed, including on productive use/innovative appliances and modular hardware/system design, leading to cost-reduction in mini-grids
- National report on opportunities to boost economic activities through electricity access and productive use, with focus on minigrids
- Capacity of potential tender bidders (private sector developers) strengthened to consider innovative business models and cost-reduction levers
- Capacity of winning tender bidders (private sector developers) strengthened to develop and implement innovative business models and cost-reduction levers

- Support provided to upstream suppliers on hardware standardization/modular approaches, including in tendering processes
- Support provided to establish and grow a national industry association for private sector developers

Outputs in this component may involve capital investments funded by GEF. Specific GEF-funded capital investments will be defined during the PPG stage when national child project documents are developed. However, in general, GEF-funded capital investment, alongside other co-financing, will be used in a targeted fashion to maximize cost reduction impact. For example, GEF-funded investment could be used for minigrid cost-reduction activities such as piloting hardware standardization and modularization, and productive-use and innovative appliances business models, addressing hardware costs. In all cases, GEF-funded capital investment will only address incremental costs, and not business-as-usual investment which would have occurred in the baseline.

Where applicable, principles of competitive selection according to transparent criteria, and in line with public procurement principles, will be used to select private sector developers to participate in this component's activities/outputs. In addition, to maximize relevant participation, selection of private sector developers will be aligned as relevant with existing criteria and selection of private sector developers in national tenders.

Component 3: Innovative financing *(national child projects)*

Outcome: An innovative financing mechanism and accompanying financial instruments are in place to incentivize investments in the development of minigrids.

Access to low-cost, commercial capital (equity and debt), ideally in local-currency, is key to reducing the cost of minigrids, and the long-term commercial sustainability of minigrid markets. In markets which are being supported by donor partners, concessional finance and/or capital subsidies and results based financing can provide additional cost-reduction. The program will establish partnerships with development banks and financial actors, and will support innovation in cost-efficient financial mechanisms to enable innovation that leads to minigrid cost-reduction and bring minigrid markets to maturity.

List of generic outputs (to be tailored to country context):

- Design support, including development of operational guidance, provided for Minigrid Funding Facility (MFF, or equivalent financial mechanism) under rural electrification agencies/funds
- Innovative financing solutions for minigrid development are identified and implemented through the MFF (or equivalent) with supporting human and institutional strengthening
- General market intelligence study on minigrids prepared and disseminated amongst public officials and finance community
- Feasibility study support provided to minigrid developers, creating a pipeline of investible assets.
- Domestic financial sector capacity-building on business and financing models for minigrids
- Capacity building provided to minigrid developers and investors on measuring and reporting on impact indicators, building credibility in impact investment as an asset class

Component 4: Convening, dissemination, and tracking progress *(national child projects, regional child project)*

Outcome: Child project countries benefit from rapidly-deployable technical expertise on minigrid cost-reduction and associated business models tailored to each country's context, and harmonized knowledge management approaches.

This component will be facilitated by the regional child project, with activities organized around three key areas:

Knowledge Tools

These activities will **develop and share knowledge products** that provide guidance and share good practice regarding minigrid cost-reduction. Development of tools will be demand-driven, based on surveys of stakeholder needs. Emphasis will be placed on accessible, user-friendly tools that can be applicable in a wide-range of contexts. Activities may include collecting and analyzing good practices around minigrid cost-reduction in a variety of regulatory environments, research and develop tools (e.g., policy packages, template tender documents, and guidelines) on productive use program designs to reduce cost. These tools will be made widely available and used in multiple markets. This will draw from and build on RMI and UNDP's innovative research and experience in minigrids. These toolkits will support both the public sector (e.g. rural electrification agencies)

and the private sector (e.g. minigrid developers) in national child projects and the overall minigrid market. An emphasis will be placed on market-oriented outputs, reflecting the needs of developers and investors to accelerate market growth and ensuring additionality relative to other minigrid knowledge tools.

Tailored Technical Assistance to National Child Project Implementation

The regional child project will also **provide tailored, hands-on, technical assistance** to support activities in the national child projects, both at the design and implementation stages. At times national child projects can benefit from support and facilitation to identify high-quality experts, or for immediate trouble shooting and guidance. A roster of technical minigrid experts will be made available to participating countries. The regional project will guide national child projects in the scoping of appropriate technical assistance to match their objectives, and ensure linkages to the roster of technical minigrid experts. The regional child project will also support participating countries during key decisions and technical reviews at national child project milestones and provide actionable, strategic recommendations to increase adoption of minigrid cost-reduction opportunities and innovative business models.

The modalities of the coordination between regional and national projects, including the modalities to request additional support (especially considering the limited nature of regional level TA funding for these activities) by national projects, will be further developed and defined before CEO Endorsement Request submission.

Convening, Dissemination, and Tracking

The program will **support and facilitate knowledge management and information sharing** between the regional child project and national child projects, within the program's community of practice, as well as broader information sharing amongst the larger minigrid community. This component will also develop a monitoring and evaluation framework against which GHG emission reductions, and broader impact on the SDGs, can be measured, and will work closely with national child projects to ensure operationalization and harmonization. A common M&E framework with SMART indicators will ensure that the program is able to track progress toward its overarching objective. Several working groups organized around the program's three thematic areas (policies, private sector and financing) will be established and will convene regularly, with an emphasis on south-south cooperation, and minigrid cost reduction. Particular attention will be given to private sector engagement, encouraging their active participation in working groups, in order to collect inputs for project implementation and to inform government action. The program will also support national child projects to carry out lessons learned studies that will be used to develop replication plans for scaling up minigrid investments in each participating country.

List of outputs:

Knowledge Tools

- Various tools (policy packages; financial models; template contracts; template tender documents; template legal documents; guidelines on system design) to support cost reduction in National Child Projects
- Reports, in-depth case studies, and insight briefs that codify and synthesize cost-reduction good practices
- Cost-reduction training materials for the community of practice for National Child Projects, and for a broader set of stakeholders

Tailored technical assistance to national child project implementation

- A roster of leading technical experts (consultants, program partner staff) are selected, and made available to countries on demand, providing rapidly-deployable support
- Regular tailored assessments and support (either via desk-review, video conference or travel) to countries to include operational and technical support, TOR reviews and trouble-shooting

Convening, dissemination, tracking

- A cost-reduction community of practice is established, with working groups addressing the programs three thematic areas (policies, private sector and financing), and including members from national child project countries and global experts; learnings from the program are shared regularly with an emphasis on South-South cooperation and private sector engagement
- Cost-reduction community of practice web-platform established, webinars, conferences, blogs, media release (interviews etc.) arranged for knowledge management and communication
- A common monitoring and indicator framework (including MRV for GHGs, SDG impact, and quality assurance) is established for national child projects, support provided, and data tracked
- Annual monitoring and evaluation reports, including mid-term and terminal program evaluations for enhanced learning and tracking program impacts
- End-of-project replication / scaling-up plans, including investment plans, based on lessons learned reports supported for national child projects to ensure sustainability, and to help countries integrate off-grid energy access in NDCs

National Child Project Budget Allocations for Program Activities:

With the aim of contributing to collective ownership of the program, it is anticipated that each national child project will set aside between USD 50,000 to USD 100,000 for specific national-level activities which can contribute to the program and link up with the regional child project's activities. To be clear this will not involve any transfer to the regional child project, but will simply cover national child project costs. For example, this national child project budget can cover costs related to: (i) M&E to feed into program framework indicators, (ii) travel to participate in the regional child project's workshops/events; (iii) sharing of research and lessons learned to the regional child project; and (iv), contributions towards the regional child projects knowledge products.

4) ALIGNMENT WITH GEF FOCAL AREA

The program is aligned with Objective 1 of the Climate Change Focal Area to "Promote innovation and technology transfer for sustainable energy breakthroughs", and through CCM1-1 - Promote innovation and technology transfer for sustainable energy breakthroughs for de-centralized renewable power with energy storage. Under one national child project, the program also has linkages to CCM-1-3 - "Promote innovation and technology transfer for sustainable energy breakthroughs for accelerating energy efficiency adoption."

It also contributes to points 113, 118, and 119 of the GEF-7 Programming Directions to accelerate "the speed and scale of sustainable energy investment in developing countries", to develop "innovative business models that go beyond business as usual" and to foster innovation. The overall contribution towards supporting "transformational shifts towards low emission and climate-resilient development pathways" is particularly important given access to affordable renewable energy is unavoidable for sustainable development, particularly in a context where countries are struggling to extend national grids to secure energy access to off-grid communities.

Since many of the national child projects under the program will develop low-carbon minigrids supported by innovative business models that can be scaled-up, the programme also aligns with the objective to focus "on the demonstration and early deployment of innovative technologies to deliver sustainable energy solutions that control, reduce or prevent GHG emissions" (117).

In addition, the program follows GEF's advice to deliver focused interventions "through programmatic approaches or regional projects" (118).

5) INCREMENTAL COST REASONING

The program has a clear incremental cost reasoning, building on the baseline analysis and program's area of focus and niche.

· The baseline analysis, as set out in earlier section, has identified that generation costs for renewable energy minigrids in developing countries are not competitive with fossil-based alternatives. The key drivers behind this are identified. It is the case that generation costs are falling, based on a number of baseline trends, but there is a need to further accelerate this

· The program has a focus on minigrid cost-reduction – across hardware costs, soft costs and financing costs – and innovative business models for minigrids. With this clear focus, the program has a specific niche, being complementary to existing activities. In this way, the program has the aim of promoting more efficient and effective use of existing development resources and programs.

In short, the program's alternative scenario will result in additional falls in generation costs, making renewable energy minigrids more competitive, and spurring more investment, GHG emission reductions, and electrification. At the PPG stage, a numeric analysis will be modelled to quantify the benefits of the GEF's alternative scenario on generation costs, as opposed to a business-as-usual reference.

6) GLOBAL ENVIRONMENT BENEFITS

The program is expected to mitigate significant amounts of CO_2 emissions and will be accompanied by co-benefits. Direct and consequential (indirect) emission reductions are expected to occur at the national child projects and regional child project. The table below provides an overview, and the methodology is further elaborated in this section.

Table 3. Overview of GHG Emission Reductions Expected from the AMP's child projects

Countries	Emissions mitigation (million tons of CO2e)		
	Direct	Consequential	Total
Regional	-	2.18	2.18
Ethiopia	0.01	4.97	4.98
Nigeria	0.18	4.94	5.11
Somalia	0.05	0.97	1.01
Eswatini	0.01	0.05	0.06
Malawi	0.002	2.00	2.01
Comoros	0.01	0.01	0.02
Burkina Faso	0.004	0.73	0.73
Madagascar	0.01	2.47	2.48
Djibouti	0.02	0.04	0.05
Sudan	0.03	1.90	1.92
Angola	0.01	1.55	1.56
Total	0.32	21.80	22.12

The emissions calculations are attributed to each national child project in the following categories: 1) direct emission mitigation from pilot investments (corresponding typically to output 2.1 in the PFD); 2) consequential emission mitigation, from creating a general enabled investment environment, and subsequent investment flows. The methodology for the contributions is calculated as follows:

- **Direct emission mitigation** from country projects are the cumulative CO2 emissions saved from the baseline, which is assumed to be standalone deisel generators in all countries (i.e. an emission factor of 0.786 tCO2/MWh[11]). The minigrid capacity, capacity factor and availability are based on RMI's fieldwork in Africa. The size of the pilot investments are taken from national child project concept notes. The number of minigrids is calculated assuming the use of GEF investments as a portion of grant financing towards minigrid capital expenditures. The direct emissions reduction assumes a 20-year technology lifetime.

- **Consequential emission mitigation** is calculated using a top-down approach, on the basis that the project contributes to an enabled environment which subsequently attracts minigrid investment. A time frame of a 4 year national child project, with a further 10 year post-project period is assumed. The methodology further assumes that minigrids will electrify either 33%, 20% or 15% (depending on country context) of the current unelectrified population in the particular country, with a 20 year technology lifetime for minigrids. The selection of these three tiers is based on several criteria, including (1) current levels of grid coverage; (2) recent and ongoing initiatives for grid extension; (3) geographical size of countries; and (4) spread of off-grid communities in terms of population density. Thereafter the methodolgy applies a causality factor varying between 20% and 80%, chosen based on the state of the minigrid market development and ongoing baseline initiatives in each country.

At the regional child project, 10% of the consequential/indirect GHG impacts calculated at the national child project level as per the above methodology are allocated to the regional child project, in line with the apportioning of the overall program budget. This reflects the benefits of national child projects accessing the regional child project's support. To avoid double counting, this 10% is removed from the consequential/indirect totals for each of the national child projects.

In addition to GHG emission reductions, it is estimated that a total of more than 4.5 MW in direct installed renewable energy capacity will be established as a result of the program. When taking into account indirect impacts as a result of the enabled environment that the program will contribute to, it is estimated that a total of nearly 1.2 GW of installed renewable energy capacity will be established during the influence period following program completion.

Further, the program will contribute to significant energy cost-reductions as a result of the displacement of diesel and petrol generators by the child project countries through the increased utilization of renewables and storage. Therefore, the program is also expected to improve energy security within the child project countries, since the share of local energy resources used in the energy sector will grow and dependency on imported fuels will decrease.

The above methodology will be further developed, and calculations refined, before CEO endorsement.

7) INNOVATION, SUSTAINABILITY, AND SCALING-UP

Innovation

The Program's primary innovation is its extensive focus on cost-reduction and business model innovation to reduce minigrid cost, with the overall aim to increase the affordability of renewable electricity to off-grid markets. Since off-grid market development cannot be met solely through public investments and development aid, a more sustainable approach is to involve private sector participation in off-grid electrification using PV minigrids. Reductions in financing costs is underlined by the theory of change that proposes to reduce, eliminate or transfer the investor's risks using appropriate derisking instruments, thereby reducing the investor's cost of capital (equity and debt). In addition to reducing financing costs, emphasis will be given to hardware and soft cost reductions, all of which will act in synergy to decrease the cost of renewable electricity in rural settings. In addition, the Program will operationalize innovative business models centered on productive energy uses, providing economic opportunities in the form of income-generating activities for local communities. The combined effects of decreasing electricity costs and improved economic conditions will be the increased affordability and capacity to pay for renewable electricity by end users. In a derisked investment environment, the increasing demand driven by low cost of electricity will catalyze further investments in renewable minigrids thereby creating a virtuous circle for scaling up investments and contributing to higher levels of rural electrification. All of this will be done using a programmatic approach without compromising each Child Country's specific needs.

Sustainability

(a) Technical viability: From a technical point of view, the viability of low-carbon minigrids for rural electrification has been demonstrated in several developing countries particularly in Africa (e.g. Mali and Nigeria). By supporting the adoption of technical standards and a QAF for minigrids in participating countries, the barriers to technology transfer and diffusion will be reduced or eliminated. By further addressing non-technical barriers to the development of low-carbon minigrids, the Program will help create a sustainable niche by strengthening the political, institutional, legal, regulatory and operational capacities of key national institutions. It will also support technology development through a market-based approach - developing national capabilities and disseminating information. These efforts should ensure the long-term technical viability of minigrids for rural electrification in participating African countries.

(b) Financial viability: One of the innovative elements of the Program is its focus on cost reduction (hardware, non-hardware, and financing costs) in order to increase the affordability of renewable electricity to rural communities. To achieve this objective, National Child Projects will implement policy and financial de-risking measures designed to reduce the costs of hardware, non-hardware (site-selection, system design, customer acquisition, operations and maintenance, etc.) and finance (debt and equity). Secondly, the Program will operationalize the most optimum business model for the design, implementation, operation, maintenance and management of the Child Projects using the business template discussed above - taking into account local conditions to minimize both transaction and operational costs in minigrid development and management. For instance, the Program will promote a value chain approach to technology transfer that will integrate local labor and local industries / service providers in the development of solar PV-battery minigrids. A third element of the Program design is to promote the use of renewable electricity for productive uses in order to support the socio-economic development of targeted communities. A by-product of this development will be the increased capacity of local communities to pay for electricity, which will ensure the financial viability of proposed

minigrids. This will be achieved by providing targeted support to rural households and/or associations willing to engage in income-generating activities using electricity simultaneously building the capacity of technical staff.

With regard to the financial support given to project promoters, the key to sustainability is to ensure that low-carbon minigrids are viable investments. As discussed earlier, the Program will support National Child Projects to identify and implement financial instruments based on stage of market development in order to ensure the financial viability of investments. The range of financial instruments will be outlined in National Child Project concepts and detailed during program formulation. In addition to integrating financial instruments in project designs, it is important to involve the private sector by making promoters aware of investment opportunities in minigrids and low-carbon technologies, educating financial institutions about the particularities of investments in the off-grid sector, as well as strengthening the role of government and development partners as facilitators. The activities proposed under Component 4 of the Program will serve this purpose.

(c) Socio-economic sustainability: The Program will fully support the human rights-based approach and will not have any negative impact on the enjoyment of human rights (civil, political, economic, environmental, social or cultural) of key potential stakeholders, targeted communities or the population as a whole. In particular, a gender-transformative approach will be used (as described in the Section in Gender Mainstreaming), and it will avoid any community relocation as far as practicable. If relocation is unavoidable, appropriate relocation action plans and grievance mechanisms will be developed within a robust Environmental and Social Management Framework (ESMF).

The Program will focus on providing modern and sustainable decentralized energy services to the rural population and, in the process, demonstrate the benefits that sustainable technology can bring to improved livelihoods in rural areas. These relate to the social and economic benefits accruing to local communities in terms of a healthier environment for the rural population, opportunities for income-generating activities and improved management of natural resources related to productive energy uses. Particular attention will be given to strengthening the role of women as actors in the energy sector rather than mere beneficiaries. Women entrepreneurs will be encouraged to manage facilities. Those engaged in the processing and packaging of agricultural products will be at the core of promoting renewable electricity for productive purposes. In addition, on-the-job capacity building - especially for installation and maintenance of minigrids, will be gender-sensitive. These combined activities will help reduce the gender gaps that traditionally exist in the energy sector.

(d) Environmental sustainability: The Program, accompanied by investments in solar PV-battery minigrids in National Child Projects, will result in an estimated direct GHG emission reduction of 0.32 $MtCO_{2e}$ and 21.80 $MtCO_{2e}$ in consequential emission reductions. Consequently, the Program will support all participating countries in either implementing their NDCs through deployment of low-carbon minigrids or in updating NDCs to cover off-grid electrification using sustainable delivery models for low-carbon

minigrids. This will facilitate decision-making on energy infrastructure and service delivery options to account for the uncertainty associated with climate change predictions and to assess the climate resilience of different options. For example, decisions to invest in minigrids should take into account current and future climate changes and variability. The project will ensure that the country's climate change portfolio agencies are actively involved in the project coordination mechanism to promote an integrated approach. The program will also promote the uptake of energy efficient appliances for residential and commercial purposes, thereby further supporting environmental sustainability.

(e) Scaling-up: The replication and scaling of the Program's impact is embedded within the program design. Each Child Project will develop a replication plan - including investment plans, for scaling-up investments in minigrids. These replication plans will be based on lessons learned across all country projects and from GEF-funded minigrid projects worldwide. Preliminary estimates, on the high replication factor potential, ranges from 3 to 5 for GHG emission reductions. In some participating countries, the scaling-up potential will be much higher - as the baseline electrification rates in rural areas (e. g. Angola, Ethiopia) are very low and the Program is the first of its kind. More detailed market surveys will be carried in each participating country during program formulation to assess scaling-up and replication impact. The Program's comprehensive approach to reduce financing, hardware and soft costs will create the enabling environment to attract public and private investments. This coupled with sound knowledge management underpinned by a robust theory of change is expected to catalyze markets.

[5] ESMAP. 2019. Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers. Executive Summary. Energy Sector Management Assistance Program (ESMAP) Technical Report 014/19. Washington, DC: World Bank.

[6] Accelerating SDG Achievement: SDG Policy Briefs in support of the High-Level Political Forum. United Nations. 2019.

[7] More information at www.undp.org/DREI

[8] GEF funded active UNDP mini-grid projects in Africa are in the following 12 countries: Benin, Central African Republic, Congo, Dem. Rep. of the Congo, Djibouti, Equatorial Guinea, Guinea-Bissau, Lesotho, Malawi, Mali, Mauritania, Sao Tome & Principe

[9] Typical soft costs include site-selection, customer acquisition, project development, ongoing operations and maintenance, and other non-hardware costs.

[10] New and additional UNDP TRAC (USD 3.0m) and AfDB SEFA (USD 2.0m) funding is as follows. Two 'self-financed' projects in Angola (AfDB SEFA USD 1.0m) and Madagascar (AfDB SEFA (USD 1.0m), UNDP TRAC (USD 1.0m)). Co-financing to two GEF STAR projects in Malawi (UNDP TRAC (USD 1.0m) and Burkina Faso (UNDP TRAC (USD 1.0m)). Please also see Annex A.

[11] UNDP (2019) Project Document for UNDP-GEF project entitled “Promoting a better access to modern energy services through sustainable mini-grids and hybrid technologies in Djibouti” (PIMS 6202)

1b. Program Map and Coordinates

Please provide geo-referenced information and map where the program interventions will take place.

Please provide geo-referenced information and map[12] where the programme interventions will take place.

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[12] CIF & ESMAP (n.d.) Standardized Process for Productive uses & Gender Integration - https://esmap.org/sites/default/files/Myanmar_Standardized%20Process%20for%20Productive%20uses%20Gender%20Integration_Web.pdf – accessed 16 July 2019.

2. Stakeholders

Select the stakeholders that have participated in consultations during the program identification phase:

Civil Society Organizations Yes

Indigenous Peoples and Local Communities

Private Sector Entities Yes

If none,please explain why:

In addition, provide indicative information on how stakeholders, including civil society and indigenous peoples, will be engaged in the program preparation, and their respective roles and means of engagement.

Key stakeholder engagement activities included:

- Inception workshop in New York with UNDP, GEF in person and AfDB, WB ESMAP, DBSA via video conference (Nov. 2018)
- Minigrid Summit in Abidjan with over 40 stakeholders present, including government counterpart from 5 countries, donor partners and knowledge partners (March 2019)
- In-person and conference meetings with child project country counterparts, discussing the minigrid sector and the program (Sept. 2018 mission to Ghana, Eswatini, Uganda, Cote d’Ivoire, Zambia; July 2019 mission to Burkina Faso; Aug. 2019 mission to Djibouti, Gambia, Madagascar; ongoing remote communication)

· Bilateral meetings with donor partners exploring co-financing opportunities, and conducting DREI analysis interviews as part of the gap analysis. (Feb. 2019 mission to Cote d'Ivoire; Jun. 2019 mission to UK; Sept. 2019 mission to Cote d'Ivoire and Togo; ongoing remote communication)

· Regular bimonthly missions to Ethiopia and Nigeria, coinciding with other RMI work in those countries (2018-2019)

Table 4: Stakeholder Engagement

Stakeholder		Contributions
Angola	Minigrid developers (Private Sector)	UNDP Angola Country Office led in-depth interviews with private sector minigrid developers in Angola, as part of the DREI analysis. They've provided valuable input in the state of the minigrids sector and key barriers in Angola.
Burkina Faso	Ministry of Energy (Government)	The core technical team engaged and consulted with the Ministry in program design and prioritized child project activities. The Ministry will be main national implementing counterpart for the UNDP-GEF project, and will contribute to identification and promotion of minigrids, communicating and advertising minigrids with stakeholders.
	Swedish Embassy Burkina Faso team (Development Partner)	The core technical team interviewed Swedish Embassy's Burkina Faso team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Burkina Faso. The Embassy also presents co-financing opportunity. UNDP CO is exploring collaboration with the Embassy, under its renewable project funding window.

	World Bank Burkina Faso team (Development Partner)	The core technical team interviewed World Bank's Burkina Faso team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Burkina Faso.
Comoros	SONELEC (national utility) (Government)	The core technical team interviewed SONELEC, with facilitation from UNDP Comoros Country Office as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Comoros. The national utility company also presents co-financing opportunity, and team is coordinating with existing support and funding SONELEC receives on similar initiatives to create synergy.
	ENGIE (Private Sector)	The core technical team interviewed ENGIE's Comoros team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Comoros, also their ongoing minigrid project in the country.
Djibouti	Ministry of Housing, Urban Planning and Environment (MHUEAT) (Government)	MHUEAT is the political and operational focal point of GEF. The Ministry is in charge of the environmental policy of Djibouti.
	Ministry of Energy and Natural Resources (MERN) (Government)	MERN is responsible for designing, defining and developing government policy on energy and natural resources. It defines rules, regulations, statutory instruments and legislation for the energy sector including electricity, petroleum products and renewable energy.
	Electricité de Djibouti (EdD) (Government)	EdD is the national power utility of Djibouti and has the mandate for the provision electricity throughout the country. A new law adopted in 2015 enabled the participation of IPP under a PPA contract with EdD.

	Agence Djiboutienne de Maîtrise de l'Energie (ADME) (Government)	ADME is a public institution whose mission is to promote energy efficiency and renewable energy in all economic sectors, including knowledge sharing, research, developing solutions and ensuring compliance.
Eswatini	Ministry of Natural Resources & Energy (MNRE) (Government)	The core technical team engaged and consulted with MNRE in program design and prioritized child project activities. MNRE will be main national implementing counterpart for the UNDP-GEF project, and will contribute to identification and promotion of minigrids, communicating and advertising minigrids with stakeholders.
	EU Eswatini team (Development Partner)	The core technical team interviewed EU's Eswatini team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Eswatini.
	Tifiso Energy (Private Sector)	The core technical team interviewed Tifiso Energy as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Eswatini.
Ethiopia	Ministry of Water, Irrigation and Energy (MoWIE) (Government)	The core technical team has worked closely with MoWIE on off-grid energy planning and minigrids in particular over the past year, with several visits to country.
	Ethiopian Energy Agency (EEA) (Government)	The core technical team has interviewed EEA, the Ethiopia regulator, to better understand the existing minigrid regulatory framework and the target minigrid regulatory framework.
	Ethiopian Electric Utility (EEU)	The core technical team has interviewed EEU, the Ethiopian distribution utility, to understand operational and technical issues around permitting, licensing, and overseeing minigrids.
	European Union delegation (Development Partner)	The core technical team has interviewed the EU to understand their technical assistance and financial support to the National Electrification Plan, regarding minigrids.

	USAID/Power Africa (Development Partner)	The core technical team has interviewed the USAID/Power Africa team to understand their technical assistance and financial support to the National Electrification Plan, regarding minigrids.
Madagascar	Agence de Développement de l'Électrification Rurale (ADER) (Government)	The core technical team engaged and consulted with ADER in program design and prioritized child project activities. ADER will be key national implementing counterpart for the UNDP-GEF project.
	World Bank Madagascar team (Development Partner)	The core technical team interviewed World Bank's Madagascar team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Madagascar.
	GIZ Madagascar team (Development Partner)	The core technical team interviewed GIZ's Madagascar team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Madagascar.
	KfW (Development Partner)	The core technical team interviewed KfW's Madagascar team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Madagascar.
	EOSOL Madagascar (Private Sector)	The core technical team interviewed EOSOL Madagascar as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Madagascar, also their ongoing minigrid project in the country.
Malawi	Ministry of Natural Resources Energy, and Mining (MNREM) (Government)	The core technical team engaged and consulted with MNREM in program design and prioritized child project activities. MNREM will be main national implementing counterpart for the UNDP-GEF project, and will contribute to identification and promotion of minigrids, communicating and advertising minigrids with stakeholders.

	Ministry of Agriculture, Irrigation and Water Development (MAIWD) (Government)	The core technical team engaged with MAIWD to explore electrification in an integrated way that plans for electricity access with productive use and agriculture development.
	World Bank Malawi team (Development Partner)	The core technical team interviewed World Bank's Malawi team and they've provided valuable input in their activities, the state of the off-grid energy sector and ongoing donor partner support in Malawi.
	Japan International Cooperation Agency (JICA) (Development Partner)	The core technical team interviewed JICA's Malawi team and they've provided valuable input in their activities in the energy sector and ongoing donor partner support in Malawi.
	Economic Consulting Associates (ECA) (Private Sector)	The core technical team interviewed ECA's Malawi team and they've provided valuable input in their activities, the state of the off-grid energy sector and ongoing donor partner support in Malawi.
Nigeria	Rural Electrification Agency (REA) (Government)	The core technical team has interviewed Nigeria's REA on several occasions regarding minigrid planning and strategy, with frequent visits in country.
	AllOn (Private Sector)	The core technical team has interviewed Shell-supported energy access-focused impact investor AllOn regarding the minigrid sector in Nigeria.
	GIZ Nigeria team (Development Partner)	The core technical team has interviewed GIZ's local Nigeria office, which is involved in the NPSP minigrid program
	Nayo Tropical Technologies (Private Sector)	The core technical team interviewed private sector minigrid developer Nayo Tropical Technologies and visited one of Nayo's operational minigrid sites.
	Green Village Electricity (Private Sector)	The core technical team interviewed private sector minigrid developer Green Village Electricity (GVE) and visited one of GVE's operational minigrid sites.

Somalia	Ministry of Energy and Water Resource (MoE&WR) (Government)	The core technical team engaged and consulted with MoE&WR in program design and prioritized child project activities. MoE&WR will be main national implementing counterpart for the UNDP-GEF project, and will contribute to identification and promotion of minigrids, communicating and advertising minigrids with stakeholders.
	World Bank Somalia team (Development Partner)	The core technical team interviewed World Bank's Somalia team as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Somalia.
	GEEL (USAID) (Development Partner)	The core technical team interviewed GEEL as part of the gap analysis. They've provided valuable input in the state of the minigrids sector and ongoing donor partner support in Somalia.
Sudan	Ministry of Energy and Mining (Government)	The Ministry is responsible for electric power in Sudan under the new government, managing generation, transmission and distribution of electricity.
	Higher Council for Environment and Natural Resources (HCENR) (Government)	HCENR oversees the application of environmental laws and regulations to all development projects in Sudan, and has particular responsibilities in the climate change area. It serves as GEF focal point for Sudan.
	National Energy Research Centre (NERC) (Government)	NERC has a special department for solar energy and has already participated in the installation of solar pumps around Sudan and is one of the most experienced entities in this regard in the country. NERC is tasked with the development of Sudan's future energy resources and securing the energy needed for sustainable growth.
NGOs and Associations	Africa Minigrid Developers Association (AMDA)	The core technical team engaged and consulted with NGOs and associations active in minigrid development space in program design and prioritized activities under the GEF minigrid program. They provide valuable input and will serve as knowledge partners.
	Club-ER	
	ECREEE	

Development Partners	AfDB	AfDB will be the implementation agency for some child projects (Angola, Madagascar). AfDB expressed interest in co-financing the program.
	BOAD	BOAD expressed interest in co-financing the program and lead implementation of participating countries (possibly in 2nd round). The technical core team regularly consulted BOAD and brief them on program progress.
	Carbon Trust/DFID	Carbon Trust helps administrate DFID's Transforming Energy Access program and expressed interest in co-financing the program, collaborating mainly with initiatives around cost reduction and productive use at country level.
	World Bank ESMAP	The World Bank ESMAP group is a valuable knowledge partner of the program, providing insights on the state of minigrid market and development in SSA and helped connect the technical core team to World Bank's country team to conduct gap analysis. The technical core team regularly consulted ESMAP group and brief them on program progress.
	UN Foundation	UN Foundation is a key knowledge partner of the program, its Mini-Grids Partnership initiative provides report and updates of the state of minigrid market. The technical core team regularly consulted UN Foundation and brief them on program progress.
	UNIDO	The technical core team regularly consulted UNDO and brief them on program progress. They shared helpful experience designing and implementing regional projects of similar size or focus areas.

	UNEP	The technical core team regularly consulted UNEP and brief them on program progress. They shared helpful experience designing and implementing regional projects of similar size or focus areas.
	DBSA	The core technical team engaged and consulted with DBSA in program design and they might be interested in co-financing some child projects.
	Shell Foundation	The core technical team engaged and consulted with Shell Foundation in program design
UNDP Country Offices	UNDP Country Offices in Angola, Burkina Faso, Comoros, Djibouti, Cote d'Ivoire, Eswatini, Ethiopia, Gambia, Madagascar, Malawi, Mozambique, Nigeria, Somalia, South Sudan, Sudan.	The UNDP Country Office (CO) has been the liaison for the core technical team to engage with government counterparts in respective countries, facilitating securing Letters of Endorsement from GEF OFP and providing technical input upon requests (e.g. DREI analysis). In most cases, UNDP CO will be the implementation agency for child project, with support from the regional child project, and will work in close cooperation and consultation with government to develop detailed project documents for child projects, implement and monitor project delivery. Some UNDP also has provided co-financing for the program with their own TRAC resources.

3. Gender Equality and Women's Empowerment

Are gender dimensions relevant to the success of program. Yes

If yes, please provide indicative information on these dimensions and how these will be addressed in the program. If no, please explain why

Clean energy access through minigrids has the potential to bring multiple benefits to off-grid communities as shown in Table 5. First, the benefits may not accrue equally to men, women, and youth. Second, the burden of work that disproportionately affects women and youth may be exacerbated by access to electricity when additional work is generated after dark. Since men, women, and youth are affected differently by electricity access, the market development of minigrids for enhanced rural electrification needs to be supported by gender-responsive policies, strategies and action plans. The Program will identify and implement measures to integrate gender issues in minigrid development across all three thematic areas. In particular, it will ensure that gender considerations are included in all child country projects.

It is expected that opportunities for gender transformation can be achieved through the integration of women and youth in productive energy uses.

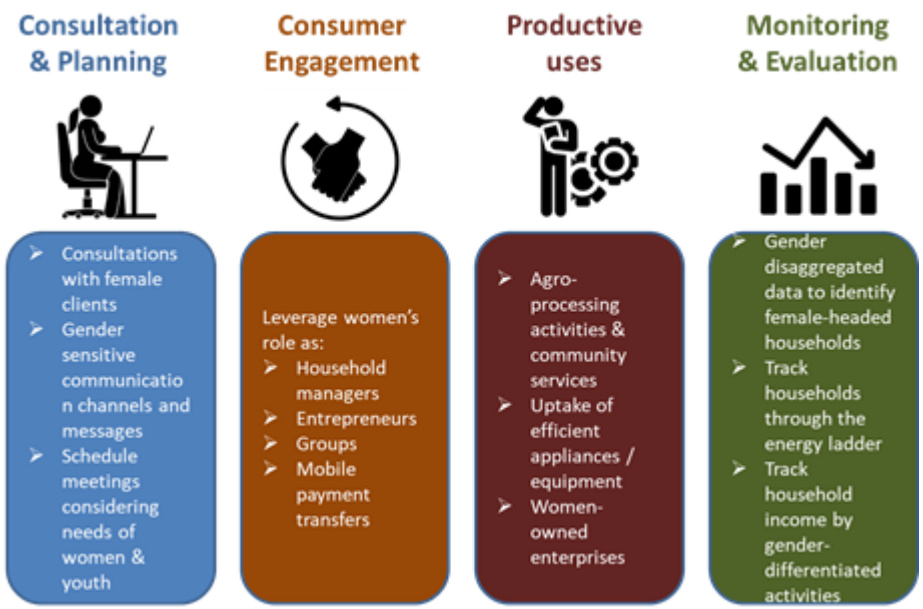
Table 5. Summary of minigrid benefits

	Minigrid benefits
Household	Food preparation; Study after sunset; Information and communication technologies; Increased comfort; Leisure and learning; Food conservation; Better nutrition
Productive use	Reduced physical effort; Faster processing; Cheaper price; Greater range of services; Business after dark; Trade without travelling; Market information; Cool and frozen products
Community	Medical & Education services at night; Safe communities; Clean, reliable water supply; Less time spent, less distance traveled; Local new services; Digital government services

Source: Adapted from Practical Action Total Energy Access

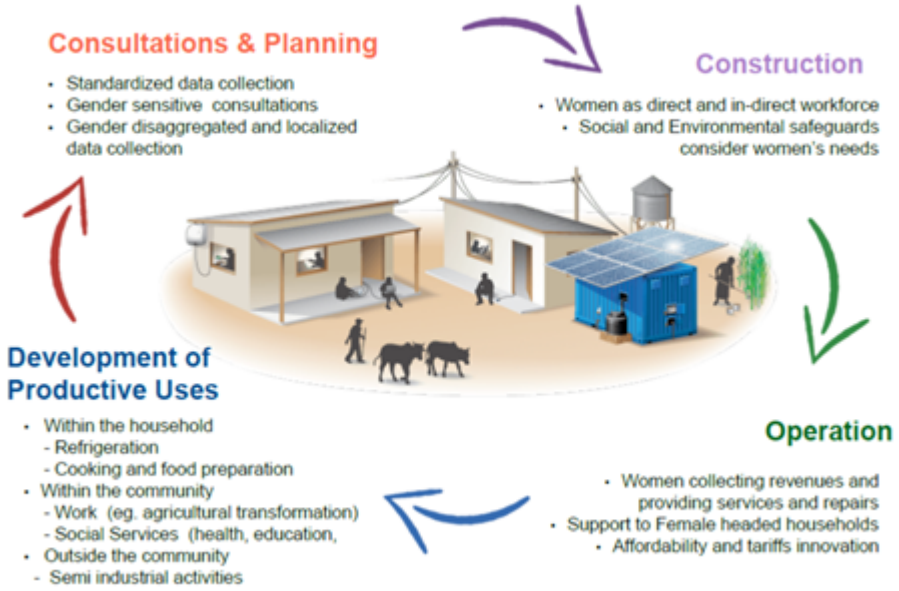
National Child Projects will include a specific gender component. Gender Action Plans (GAPs) will be developed as part of the National Child Projects, to ensure that the development of minigrids in each participating country considers the energy and income-generation needs and characteristics of men and women, as well as boys and girls (i.e. youth). GAPs will be developed based on in-depth gender analyses predicated on two hypotheses, namely: (1) gender gaps prevent women to reap full benefits of electrification; and (2) poor and vulnerable households are overly represented by women. The role, needs and expectations of women and youth in minigrid development will be carried out as using the gender analysis framework shown in Figure 8, and informed by the roles that women may play at different stages of a minigrid project cycle (Figure 9) that will be relevant to the investment component in National Child Projects.

Figure 8. Framework for gender analysis



Source: adapted from World Bank (2017) Mini-grid and Gender Toolkit

Figure 9. Gender through the minigrid project cycle



Source: CIF & ESMAP (n.d.) Standardized Process for Productive uses & Gender Integration

Gender mainstreaming in the regional child project will be carried out in the following ways:

· As mentioned earlier in the PFD, working groups organized around the program's three thematic areas (policies, private sector and financing) will be established and will convene regularly, with an emphasis on south-south cooperation, and minigrid cost reduction. Gender issues will be integrated in these working groups and support and investment platforms. The working groups will assess and collate gender-relevant policies and identify best practices and ensure that this is disseminated to the policy makers;

· In particular, knowledge tools and lessons learned reports (Component 4) will highlight the use of minigrids for women and youth empowerment, and training materials will be customized to be gender-responsive. Also, tools (Component 4) and technical expertise (Component 2) to assist private sector developers will ensure that the respective roles, and needs and interests are taken into consideration at different stages of the minigrid project cycle (Figure 9);

· GAPs discussed above will ensure that gender is mainstreamed in each country work plan, especially regarding empowerment of women and youth in productive uses of minigrid electricity and access to finance; and

· Awareness raising (Component 4) is also one of the main components of the programme, which can include targeted campaigns aimed specifically at women and youth. Finally, the programme will ensure that gender considerations are fully taken into account during workshops, trainings and meetings and that all capacity building related activities consider gender specific issues and track gender participation.

In order to ensure the above, the regional child project will integrate gender issues across its different work streams. Further, gender as a cross-cutting issue will be addressed in the project team and stakeholder meetings, to help identify other areas where gender goals could be established. During the project development phase, a baseline will be established based on the participation of women in key stakeholder meetings, gender disaggregated data and indicators will be defined and a gender action plan will be developed. This will be carried out as part of the in-country gender analyses that will be carried out to inform GAPs discussed earlier.

In addition, please also indicate whether the program the program will include gender sensitive indicators in its result framework

Yes

4. Private sector engagement

Will there be private sector engagement in the program?

Yes

Please briefly explain the rationale behind your answer.

The Program will support minigrid business models that involve private sector collaboration through a hybrid model. It is already acknowledged that the degree of minigrid coordination between governments and utilities and the private sector varies widely across Africa, but in every case, the engagement of the private sector is in early stages. Whether as firms providing engineering, procurement and construction (EPCs), only operation, only maintenance or as full owner-operators, the transition toward a competitive, high-capacity private sector will reduce minigrid costs.

As discussed in section 2, several private companies have been engaged during the formulation of the PFD and national child project concept notes. The specifics around private sector engagement will be expanded in the Stakeholder Engagement Plans during the detailed preparation stage. However, in short, when developing the national and regional child projects, particular attention will be given to active consultation using mechanisms such as workshops with country-specific stakeholders such as minigrid developers and minigrid industry associations. UNDP's DREI analysis, which actively sources quantitative data on investment risks from the private sector, may also be used. Building off this, during project implementation, private sector engagement will be central to the project, whether with industry groups, financiers, or specific minigrid developers, in order to solicit

ongoing feedback and inputs, and ultimately to catalyze private sector investment. These stakeholders will also be invited to participate in the program's community of practice and working groups.

5. Risks

Indicate risks, including climate change, potential social and environmental risks that might prevent the Program objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the Program design (table format acceptable)

The main risks of the Program are summarized in Table 6. Each risk will be country-specific and will be contextualized in the National Child Projects. The overall risk is rated as moderate.

Table 6. Main risks associated with the Program

Risk	Level of Risk	Mitigation Action
Political (and security) risk Some countries are experiencing internal political issues (e.g. Sudan, Somalia and Nigeria) or are geographically located in regions that are experiencing instability (e.g. northern parts of Nigeria). However, if a sudden political instability occurs, it will certainly negatively impact on the overall investment climate and cause delays in project implementation.	Moderate P=2 I=4	The project will work as much as possible with decentralized authorities in provinces and rural areas where there is strong political will for socioeconomic development of off-grid communities through electrification and supporting income-generating activities. Also, the area of countries that face political and security risks are large enough to be able to identify areas that are sufficiently safe for project implementation. The project will also build a wide coalition of partners and stakeholders whose interest in rural development will likely sustain off-grid electrification beyond project lifetime. Importantly, the use of solar-battery minigrids to sustain productive energy uses will without doubt improve standards of living of local communities, and, thereby, be a means of decrease political tensions. Stakeholders include local businesses and communities, NGOs and international development agencies. Further, the Program has a diversified portfolio of country political risks, which together with the above, will ensure its overall success.

Risk	Level of Risk	Mitigation Action
Technology risk Insufficient quality of locally-produced equipment, leading to early break-down of PV or minigrid systems and dwindling consumer confidence in the technology.	Low P=2 I=2	Given the low literacy rate and the lack of technical capacity among rural communities in participating countries, maintenance issues represent a significant risk for minigrid system operation and maintenance. Minor repairs have to be done by locally-trained staff to prevent equipment from being idled for long periods. Spare parts have to be standard among sites, locally manufactured if possible, readily available for transport and installed at minimal cost. The building of technical and operational capacities among rural communities will be critical to mitigate these technical risks. The Program will: (1) adopt a technology supply chain approach to put in place effective technology transfer mechanisms; (2) provide accredited technical training to technicians in rural areas; and (3) sponsor local institutions that take on maintenance tasks. The minigrid business model that will be developed in participating countries will cater for technology risks. Further, the Program will deploy technical standards and a Quality Assurance Framework (QAF) for solar-battery minigrids in order to ensure that technologies deployed meet minimum quality standards, and serviced with warranty on parts and components.
Financial risk Widespread poverty and lack of sustainable sources of income, resulting in low capacity to pay for modern energy services.	Moderate P=2 I=3	The project will conduct assessments of the capacity and willingness to pay of end-users. Importantly, hybrid business models, which will see participation of public, private and community actors, will be tailored to the specific country contexts in order to enhance the affordability of renewable electricity to end users. There are several ways in which the Program intends to minimize this risk, namely: (1) using electricity to support income generating activities that will have the dual role of increasing socioeconomic development of communities, and serving as a positive measure for increasing the capacity to pay for electricity; (2) where necessary financial incentive schemes will be provided (this is linked to the stage of market development discussed earlier); and (3) where practicable, alternative PAYG models will be employed to enable access to the maximum of populations at a reduced cost.

Risk	Level of Risk	Mitigation Action
Market risk Solar-battery minigrid systems will have to compete with an incumbent technology, which is mainly expected to be locally available diesel alternatives. It is possible that without additional incentives, solar-battery minigrids may remain uncompetitive.	Moderate P=3 I=3	Introduction of financially- and socially-viable tariffs for solar-battery minigrids will be a cornerstone instrument of the proposed policy package, aimed specifically at addressing this market risk by leveling the playing field for solar PV against local alternatives.
Social Acceptability risk Solar-battery minigrid systems will have to compete with an incumbent technology, and the lack of knowledge and perceived benefits and uses of the new technology may result in a low-level adoption rate.	Moderate P=3 I=3	The Program will invest in awareness raising and capacity building of target communities on the uses and benefits of low-carbon minigrids. Notwithstanding the development of productive energy uses, a main benefit is the creation of green jobs in the technology supply chain. As far as practicable, the affordability of the new technology will be demonstrated from avoided energy costs on prevailing baseline technology options. Affordability can be a trigger for new technology acceptability, and the financing measures discussed above will help reduce social acceptability risks. Finally, the hybrid business model will involve the close participation of local communities in the design, installation, commissioning and operation of minigrids in one or more of the following: (1) participation in the capital structure of minigrids; (2) in-kind contribution through provision of land and/or labor; and (3) involvement in the setting up electricity tariffs.
Climate risk Climate change and climate variability are expected to increase in the future, resulting in sub-optimal use of minigrids or operation of PV-based minigrids.	Moderate P=2 I=3	Results of climate models for country / target areas will be incorporated in the design and selection of pilot sites. The existing and projected climatic data will be used to ensure that the chosen sites are not highly affected by irregular rain trends and are least vulnerable to projected changes in temperature or wind regimes. This is particularly important when the minigrids are associated with productive uses in agriculture.

6. Coordination

Outline the institutional structure of the program including monitoring and evaluation coordination at the program level. Describe possible coordination with other relevant GEF-financed programs and other initiatives.

Figure 10 below sets out the proposed institutional arrangement for the program.

The program will be set up as follows:

· UNDP will be the lead implementing agency

o The UNDP will provide implementing agency financial, technical oversight to ensure successful program execution.

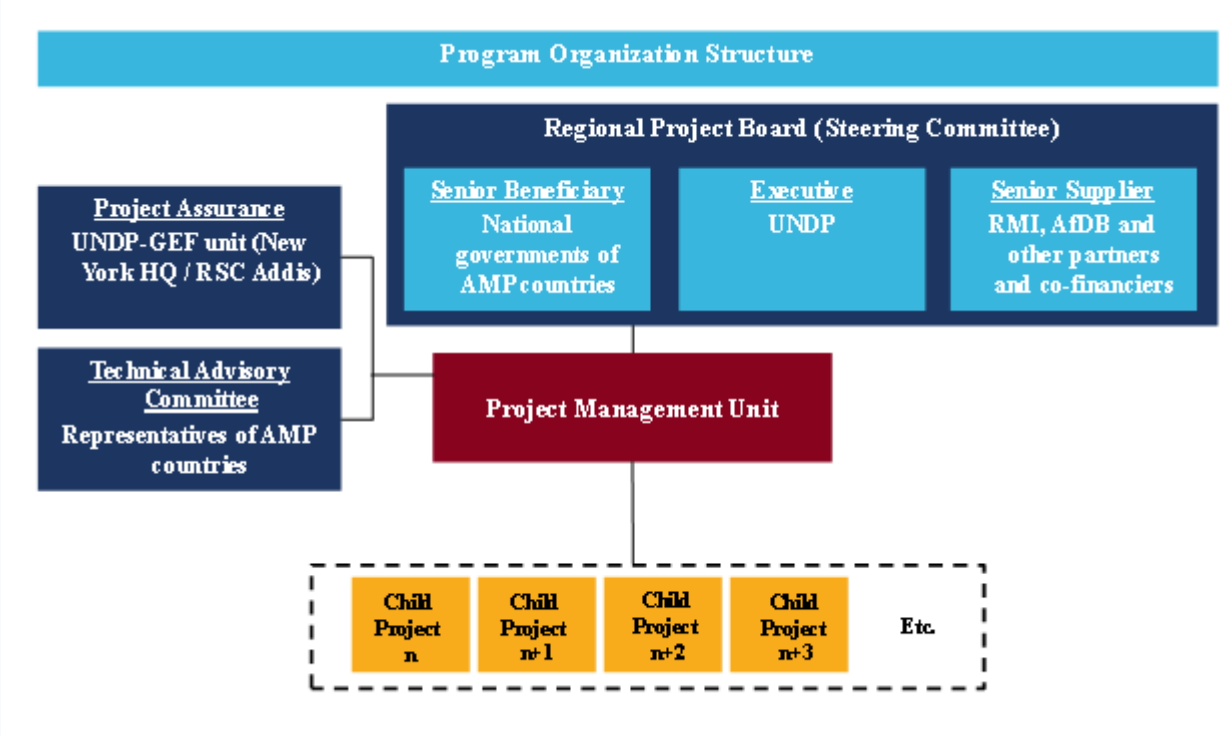
o UNDP will act as implementation agency for most national child projects, with the exception of joint implementation agency status with AfDB in Angola and Madagascar.

o Local government agencies will be executing agencies for the national projects.

o The regional child project will be executed by UNDP (DIM modality) and RMI (responsible party), with roles in accordance with their comparative advantages.

· The regional project Steering Committee (PSC) will be composed of representatives from UNDP and other key partners (Senior Suppliers, including RMI and GEF Implementing Agencies), national governments of child project countries (Senior Beneficiaries).

Figure 10. Institutional structure of the African Minigrid Program



UNDP, in coordination with RMI, will develop a measurement, reporting and verification (MRV) framework based on the SMART indicators used to assess project implementation and progress for the GEF. The MRV indicators will be developed jointly with the Steering Committee members. National child projects will report at the mid-term and at the end of the project against these indicators, and UNDP will consolidate these reports.

A terminal evaluation by an independent consultant will be carried out at the end of both the regional child project as well as the national child projects. The terminal evaluation of the regional child project will be commissioned by the UNDP-GEF unit in NY The terminal evaluations of the national child projects will be commissioned by the relevant GEF agencies. Terminal evaluation reports will be sent to the GEF Evaluation office at the latest 6 months after the completion of the evaluation.

In terms of cost coverage, national child projects will be requested to each set aside between USD 50,000 to USD 100,000 of their budget to cover costs associated with participating in the program. These costs may address expenses related to (i) knowledge management/lessons learnt, (ii) national market studies/assessments, which can in turn feed global knowledge products, (iii) travel associated with the regional child project, including participating in workshops, and (iv) monitoring and evaluation activities.

For fragile states and SIDS, and in cases where the implementing partner is assessed to have high risk in terms of financial management, it is expected that support services will be required. During detailed project formulation at the national level, further analyses will be performed to determine who is the best entity to provide these services.

GEF:

The GEF has invested in the development of minigrids[13] globally through different GEF implementing agencies. The proposed Program will capitalise on lessons learned from past projects and will develop complementarities with ongoing minigrid projects. This will be especially important in participating countries, such as Angola, Malawi and Djibouti that are already benefiting from GEF6 and/or GEF7 resources. Representatives from these projects and countries will be invited to the program's community of practice and working groups and relevant communities of practice.

Lessons learned from GEF microgrid / minigrid projects

-

A lesson learned report was developed by the GEF based on case studies on investments in renewable microgrids[14] around the world. The main conclusions of the report are:[15]

· With the demonstrated evidence of the importance of new technologies for renewable energy-based microgrids, it is necessary to improve enabling environments for creating markets conducive to the new technologies;

· Project investment is a necessary first step, but for success to be fully realized, catalyzing follow-on investments should also be set as an important goal; and

· Investments need to include effective technology transfer components for renewable energy-based microgrid technologies.

Summary of UNDP-GEF minigrid projects in Africa

The GEF has invested in 13 minigrid projects in sub-Saharan Africa with the UNDP as implementing agency. All but two projects (projects in Lesotho and Malawi) are still active. These projects and the lessons learned (from the completed projects in Lesotho and Malawi) are set out in **Annex E** and will be used to inform the design of the Child Projects in the Program. Except for projects in Djibouti, which was approved by the GEF CEO in July 2019, and Guinea-Bissau, which is at an advanced stage of development, all of the GEF-funded projects have focused mainly on either small hydro power (SHP)-based or biomass-based minigrids thereby complementing very well the low-carbon minigrids that will be supported by the Program. These projects also propose the demonstration of business models, mainly hybrid, for attracting private sector investments with accompanying policy and financial derisking measures. The National Child Project in Malawi will seek complementarities and synergies with the ongoing GEF6 project on mini hydro-based minigrid development. The measures proposed for the development of PV-battery minigrids in Djibouti and Guinea-Bissau will be used to inform National Child Projects.

In addition to the minigrid projects mentioned above, there are several ongoing GEF-funded broader energy access projects in Africa, such as new solar PAYG projects in Nigeria and Angola. These projects are in general promoting alternative technology choices, namely PAYG solar, to off-grid electrification, and in this manner will complement the program well. Areas of complementarity may for example include tecno-economic geo-spatial analyses to identify the lowest costs technology solution for any particular location. More ambitiously, and in the longer term, there may also be the opportunity to integrate PAYG solar into minigrids, increasing generation capacity and enabling peer-to-peer markets for power (including potential distributed block-chain solutions).

[13]This category also covers isolated grids grouped under the microgrid nomenclature

[14] *A renewable energy-based microgrid in this GEF paper is defined as a very small power grid system with a range of 20-500 kW that uses localized new renewable energy resources such as solar, wind, and biomass as primary energy input to provide electricity to local communities.*

[15] *GEF Secretariat (2017) Rural Electrification: GEF Experience in Renewables-based Microgrids.*

7. Consistency with National Priorities

Yes

Is the Program consistent with the National strategies and plans or reports and assesments under relevant conventions

- National Action Plan for Adaptation (NAPA) under LDCF/UNFCCC

- National Action Program (NAP) under UNCCD

- ASGM NAP (Artisanal and Small-scale Gold Mining) under Mercury

- Minamata Initial Assessment (MIA) under Minamata Convention

- National Biodiversity Strategies and Action Plan (NBSAP) under UNCBD

- National Communications (NC) under UNFCCC

- Technology Needs Assessment (TNA) under UNFCCC

- National Capacity Self-Assessment (NCSA) under UNCBD, UNFCCC, UNCCD

- National Implementation Plan (NIP) under POPs

- Poverty Reduction Strategy Paper (PRSP)

- National Portfolio Formulation Exercise (NPFE) under GEFSEC

- Biennial Update Report (BUR) under UNFCCC

- Others

The Program is supportive of the objectives of the UNFCCC, and with the commitments that all participating countries have made for national GHG reductions. Most participating countries have submitted at least their Second National Communication (SNC) to the UNFCCC, and have made significant pledges to reduce GHG emissions in their Nationally Determined Contributions (NDC). Specific information on consistency with national priorities are presented in the individual National Child Projects.

Most participating countries have identified the energy sector, including off-grid electrification, as one of their key priorities for achieving their emissions reduction targets set in their NDCs, as presented in Table 7 . Selected mitigation actions are those that are most relevant to the Program.

Table 7. Country commitments to energy sector emission reductions in NDCs

<table>
<tr><th>Country</th><th>Mitigation Commitments in NDC</th></tr>
<tr><td>Angola</td><td>Angola plans to reduce GHG emissions up to 35% unconditionally by 2030 as compared to the Business as Usual (BAU) scenario (base year 2005). In addition, it is expected that through a conditional mitigation scenario, the country could reduce an additional 15% below BAU emission levels by 2030. In achieving its unconditional and conditional targets Angola expects to reduce its emissions trajectory by nearly 50% below the BAU scenario by 2030 at overall cost of over 14.7billion USD.

Unconditional Reduction: The level of reduction planned unconditionally is expected to be up to 35% by 2030 as compared to the Business as Usual (BAU) scenario, taking 2005 as the reference year.

Conditional Reduction: In a conditional mitigation scenario, Angola plans to reduce further its emissions. Therefore, the mitigation options identified in this scenario are expected to reduce an additional 15% below BAU emission levels by 2030. In total, in achieving its unconditional and conditional targets, Angola expects to reduce its emissions trajectory by nearly 50% below the BAU scenario across sectors by 2030.</td></tr>
<tr><td>Burkina Faso

(11/11/2016)</td><td>Reduction of emissions
<table><tr><th></th><th>BaU</th><th>Unconditional</th><th>Conditional</th></tr><tr><td>In numbers (GgCO2 eq.)</td><td>118,323</td><td>7,808.3</td><td>13,766.3</td></tr><tr><td>In % of reduction</td><td>-</td><td>6.6%</td><td>11.6%</td></tr></table>
Mitigation Actions
<table><tr><th></th><th>Unconditional scenario</th><th>Conditional scenario</th></tr><tr><td>Electricity production</td><td>Small hydroelectric plants in public-private partnership, Installation of 20 MW of PV solar connected to the network every 10 years, Gasifiers (cotton stalks) for electricity production (20 X 250 KW), Photovoltaic solar (EDF), Renewable and hybrid energy based mini-networks, PV, pico-hydro and small wind systems, Reduction of losses from the electric network</td><td>Small hydroelectric plants (Bontioli, 5.1 MW; Gongouro, 5 MW; and Folonzo, 10,8 MW) in public-private partnership, Renewable and hybrid energy based mini-networks, PV, pico-hydro and small wind systems</td></tr></table></td></tr>
</table>

Comoros (23/11/2016)	Conditional Contribution: Comoros intends to reduce its net greenhouse gas (GHG) emissions in 2030 by 84% relative to the business-as-usual (BAU) scenario. This will represent a reduction of emissions from 523.1 $ktCO_{2e}$ to 81.4 $ktCO_{2e}$ in 2030. Mitigation Actions: · Renewable energy (solar, hydro and geothermal) in the energy industries (total emission reductions of 29.5 $ktCO_{2e}$ in 2020 and 41.2 $ktCO_{2e}$ in 2030, with share of solar being 7.8 $ktCO_{2e}$ and 9.4$ktCO_{2e}$, respectively)
Djibouti (11/11/2017)	Unconditional Contribution: 40% compared to the business-as-usual `scenario. Conditional Contribution: 20% relative to business-as-usual scenario. Under a business-as-usual growth scenario, consistent with average economic growth of 5% per year, Djibouti's emissions are expected to double in 2030, which translates to around 4475 ktCO2e. The key measures below could potentially reduce emissions by around 60% compared to business-as-usual – i.e. 1790 ktCO2e in 2030. Mitigation Actions: • Electrical line with Ethiopia: Unconditional contribution - Construction of a very high voltage line with a 50 MW capacity to import electricity from Ethiopia to Djibouti. 90% of Ethiopian electricity is generated from renewable energy sources. (150 kt of CO2e/year) • Onshore wind farms: Installation of 60 MW onshore wind turbines in Goubet. Those power plants are scheduled to be commissioned in 2025. (100 kt of CO2e/year)
Ethiopia (09/03/2017)	NDC does not differentiate between Unconditional and Conditional Contributions. Ethiopia intends to limit its net GHG emissions in 2030 to 145 MtCO2e or lower. This would constitute a 255$MtCO_{2e}$ reduction from the projected BAU emissions in 2030 or a 64% reduction from the BAU scenario in 2030. Mitigation Action: · Renewable energy: Expanding electric power generation from renewable energy (5 $MtCO_{2e}$ emission reduction by 2030)

eSwatini (21/09/2016)	Conditional Contribution: Not quantified because of lack of MRV / GHG inventory system, but contains relevant energy sector mitigation actions Mitigation Actions: Ø Swaziland's contribution is to double the share of renewable energy in the national energy mix by 2030, relative to 2010 levels. The contribution covers grid and off-grid applications: Ø Implement small scale, decentralized renewable energy technologies to improve energy access in rural areas (0.94 $MtCO_{2e}$ emission reduction by 2030) Ø Increasing the use of grid-connected renewable technologies with fuel sources such as waste, solar, bagasse (from the sugar industry) and wood chips.
Madagascar (21/09/2016)	Unconditional Mitigation Contribution: not stated. Conditional Mitigation Contribution: In 2030, Madagascar aims to reduce approximately 30 $MtCO_2$ of its emissions of GHG, representing 14% of national emissions, compared to the BAU scenario, with projections based of GHG inventory from year 2000 to 2010. Mitigation Actions: · In the Energy sector, Madagascar has identified several actions to contribute to the reduction of GHG emissions, among which: · Facilitate access to energy by strengthening existing systems and by promoting renewable and alternative energies · Reinforce renewable energy (hydraulic and solar) from the current level of 35% to 79%

<table>
<tr>
<td>Malawi

(29/06/2017)</td>
<td>Combined Unconditional and Conditional Contributions: Estimates suggest that between 14,000 and 16,000 Gg of CO_{2e} will be saved per year by 2030 if a robust low emission development path is adopted. Implementing all unconditional and conditional mitigation activities is expected to reduce the per capita emissions of Malawi from 1.4 t CO_{2e} per capita in 2010 to around 0.7 to 0.8 t CO_{2e} per capita in 2030 compared to expected business as usual emissions of around 1.5 t CO_{2e} per capita in 2030.

Between 2015 and 2040, total annual GHG emissions are expected to increase from the current level of approximately 29,000 Gg CO_{2e} to in the range of 42,000 Gg CO_{2e} – i.e. an approximately 38% rise. The energy sector contribution to total emissions is expected to increase from 4% in 2015 to 17% in 2040.

Mitigation Actions:
<table>
<tr><th>Unconditional</th><th>Conditional</th></tr>
<tr><td>· Install 20,000 solar PV systems</td><td>· Increase Solar PV from 20,000 to 50,000 by 2030</td></tr>
</table>
</td>
</tr>
<tr>
<td>Nigeria

(16/05/2017)</td>
<td>Unconditional Contribution: 20% relative to business-as-usual scenario

Conditional Contribution: 45% relative to business-as-usual scenario (included 20% UC)

Under a business-as-usual growth scenario, consistent with strong economic growth of 5% per year, Nigeria’s emissions are expected to grow to around 900 million tonnes per year in 2030, which translates to around 3.4 tonnes per person. The key measures below could potentially reduce emissions by around 45**%** compared to business-as-usual – i.e. per capita emission of around 2 tonnes per person in 2030.

Mitigation Actions:

· Renewable energy: Unconditional contribution - Work towards Off-grid solar PV of 13GW (13,000MW) [31 MtCO2e emission reduction per year in 2030)

· Energy efficiency: Unconditional contribution - 20% gain in energy efficiency by 2030; Conditional contribution: additional 10% gain in energy efficiency by 2030 [combined 179 $MtCO_{2e}$ emission reduction per year in 2030]</td>
</tr>
</table>

Somalia (22/04/2016)	Unconditional Contribution: Not stated Conditional Contribution: Not stated Mitigation Actions · Solar power is seen as the energy source of choice for the rehabilitation of many municipal buildings in the country, particularly health centers. Existing power generation in Mogadishu is predominantly by diesel generators. Therefore, the introduction of 15 MW of solar power would avoid the emission of greenhouse gasses by 75,000 tCO_2. · Rehabilitation of the Fanoole Dam with a power generating capacity of 4.6 MW
Sudan (02/08/2017)	Sudan has neither an overall baseline emission scenario for all sources of emissions and removals in the three sectors covered in this contribution, nor sectoral baselines that can be used to define quantitative mitigation actions and assess their overall effects. Conditional contribution: Forestry: Afforestation/reforestation through official planting, community planting and planting in irrigated agricultural areas. To meet the main goal of 25% forest coverage from the total area of the Sudan by 2030 an area of 790,795 hectares needs to be planted annually if international financial support is provided. Mitigation Actions: Renewable energy (solar, wind, biomass) Integration of renewable energy in the power system of the Sudan, target of 20% by 2030

Source: NDC Registry; https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx

8. Knowledge Management

Outline the Knowledge management approach for the Program, including, if any, plans for the Program to learn from other relevant Programs and initiatives, to assess and document in a user-friendly form, and share these experiences and expertise with relevant stakeholders.

The Program will apply a multi-pronged approach to knowledge management, as follows:

· A focus on collating lessons across the Program. This will involve capturing lessons across the portfolio through formal knowledge management platforms that will occur annually and will include representatives from each national child project, and producing knowledge management products that will be disseminated through formal (e.g. Program website) and informal (e.g. at international events) channels.

· A focus on collaborative learning-by-doing, with National Child Project teams coming together in field missions for hands-on learning of implementation of project activities.

· A focus on testing approaches against clear impact criteria and a well-defined and agreed theory of change. This will involve building infrastructure upstream during project design to capture lessons across the portfolio and ensure take up. The best initiatives will be evaluated for scaling up.

· A focus on learning lessons from outside the Program. This will involve working with external partners to capture their lessons, creating the infrastructure to feed these lessons into project design and implementation, and

· incentivizing National Child Projects to replicate and scale up best practices.

9. Child Program Selection Criteria

Outline the criteria used or to be used for child program selection and the contribution of each child program to program impact.

Strategic country selection criteria have been identified to achieve the overall objective of the program, and in particular to demonstrate the viability of minigrid business models that are specific to country context and stage of minigrid market development. The overarching strategic selection criteria are:

· A combination of low- and middle-income countries;

· Countries that cover a wide population spectrum, which, in combination with the preceding criterion, offers different market potential for rural electrification, and hence minigrid development opportunities;

· Countries that exhibit different stages of minigrid market development, and that have different levels of private sector involvement in the economy / energy sector. This will allow demonstration of country-specific minigrid business models and cost reduction solutions; and

· A mix of GEF implementing agencies, including development banks, which have in-country presence and/or ongoing initiatives in the selected countries, and bring complementary expertise to the program.

Criteria for individual countries to join the programme (***not exhaustive***):

Country commitment to minigrid development

· Demonstration of country priorities on off-grid electrification using solar PV minigrids for socio-economic development of off-grid communities;

· Ambition in reducing GHGs (such as NDC or national energy / rural electrification policy);

· Existing solar PV minigrid strategies and action plans in place or under development;

· Willingness to attract private investments in off-grid / minigrid electrification;

· Early moves by the market in the country with evidence of technology and infrastructure investments;

Emissions reduction potential

· High share of energy related emissions from electricity generation, in general, and high propensity for the uptake of carbon-intensive electricity generation technologies (e.g. diesel or gasoline-powered standalone generators) in off-grid areas;

· High rural population growth rates;

· Relatively low share of renewables in the national electricity mix

· High potential for renewable energies, especially solar energy

Cost effectiveness

· Off-grid electrification using solar PV minigrids is cost efficient;

· High fossil fuel prices and high vulnerability to price volatility (especially when fuel is imported);

Business opportunities in the minigrid market with evidence of strong interests from main stakeholders – i.e. public, private and communities

Part III: Approval/Endorsement By GEF Operational Focal Point(S) And Gef Agency(ies)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the Operational Focal Point endorsement letter with this template).

Name	Position	Ministry	Date
Justin Goungounga	Secretaire Permanent	Ministere de l'Environnement de l'Economie Verte et du Changement Climatique	9/23/2019
Youssouf Elamine Youssouf Mbechezi	Director General for Environment and Forests	Ministry of Agriculture, Fishing, Environment and City Planning	6/15/2019
Dini Abdallah Omar	Secretary General	Ministry of Habitat and Environment	9/11/2019
Hlobsile Sikhosana-Shongwe	Chief Environmental Coordinator	Ministry of Foreign Affairs	6/10/2019
Shamiso Najira	Deputy Director for Environmental Affairs	Ministry of Natural Resources	7/12/2019
Noureldin Ahmed Abdalla	Secretary General	Higher Council of Environment and Natural Resources	9/19/2019
Julio Ingles Ferreira	Advisor to the Minister	Ministry of Environment	10/17/2019
Christine Edmee Ralalaharisoa	Directeur General de l'Environnement	Ministry of Environment and Sustainable Development	10/14/2019
Wordy Hashim Abdullahi	Director General	Environment, Forest and Climate Change Commission	10/31/2019
Princess Bolatito Obisesan	Director, Planning, Research and Statistics	Federal Ministry of Environment	10/8/2019
H.E. Mahdi Mohammed Gulaid	Deputy Prime Minister	Office of the Prime Minister	11/4/2019

ANNEX A: LIST OF CHILD PROJECTS UNDER THE PROGRAM

a/ Total amount of child project concepts should equal the GEF programme financing requested and consistent with Tables A and D.

Country	Project Title	GEF Agency	Type of Trust Fund	GEF project financing ($)	Agency self-financing ($)	Agency fee ($)	Total ($)
Full-sized projects							
Regional	GEF-7 Africa Minigrids Program	UNDP	GEF TF	3,000,900	-	270,081	2,270,981
Djibouti	GEF-7 Africa Minigrids Program	UNDP	GEF TF	3,071,347	-	276,421	3,347,768
Ethiopia	GEF-7 Africa Minigrids Program	UNDP	GEF TF	2,890,826	-	260,174	3,151,000
Nigeria	GEF-7 Africa Minigrids Program	UNDP	GEF TF	5,905,046	-	531,454	6,436,500
Somalia	GEF-7 Africa Minigrids Program	UNDP	GEF TF	3,276,147	-	294,853	3,571,000
Sudan	GEF-7 Africa Minigrids Program	UNDP	GEF TF	2,637,246	-	237,352	2,874,598
	Subtotal			**20,781,512**	-	**1,870, 336**	**22 651 848**
Medium-sized projects							
Angola	GEF-7 Africa Minigrids Program	AfDB	AfDB - SEFA	-	1,000,000	-	1,000,000
Burkina Faso	GEF-7 Africa Minigrids Program	UNDP	GEF TF	924,566		83,211	1,007,777
Burkina Faso	GEF-7 Africa Minigrids Program	UNDP	UNDP TRAC	-	1,000,000	-	1,000,000
Comoros	GEF-7 Africa Minigrids Program	UNDP	GEF TF	1,269,863		114,288	1,384,151
Eswatini	GEF-7 Africa Minigrids Program	UNDP	GEF TF	863,242		77,692	940,934
Madagascar	GEF-7 Africa Minigrids Program	UNDP	UNDP TRAC	-	1,000,000	-	1,000,000
Madagascar	GEF-7 Africa Minigrids Program	AfDB	AfDB - SEFA	-	1,000,000	-	1,000,000
Malawi	GEF-7 Africa Minigrids Program	UNDP	GEF TF	396,125		35,651	431,776
	GEF-7 Africa						

ANNEX A1: Project Map and Geographic Coordinates

Please provide geo-referenced information and map where the project intervention takes place