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Report No: PAD 1466

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT FROM THE CLEAN TECHNOLOGY FUND

IN THE AMOUNT OF US$15.65 MILLION

TO THE

REPUBLIC OF HAITI

FOR A

# HAITI MODERN ENERGY SERVICES FOR ALL PROJECT

July 19, 2017

Energy and Extractives Global Practice
Latin America and the Caribbean Region

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CURRENCY EQUIVALENTS
(Exchange Rate Effective June 5, 2017)

| Currency Unit | = | Haitian Gourde (HTG) |
|---|---|---|
| HTG 62.75 | = | US$ 1 |
| US$ 0.016 | - | HTG 1 |

FISCAL YEAR
October 1 – September 31

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BRH | *Banque de la République d'Haïti* (Bank of the Republic of Haiti) |
| Capex | Capital Expenditure |
| CBA | Cost-Benefit Analysis |
| CPF | Country Partnership Framework |
| CTF | Clean Technology Fund |
| DA | Designated Account |
| DESCO | Distributed Energy Services Company |
| E&S | Environment and Social |
| EA | Environmental Assessment |
| ECVMAS | *Enquête sur les Conditions de Vie des Ménages après le Séisme* (Survey of Households for Living Conditions after the Earthquake) |
| EDH | *Electricité d'Haïti* (Electricity of Haiti) |
| EE | Energy Efficiency |
| EIA | Environmental Impact Assessment |
| EIRR | Economic Internal Rate of Return |
| ENREP | Electricity Network Reinforcement and Expansion Project |
| ESMF | Environmental and Social Management Framework |
| FCS | Fragile and Conflict-affected State |
| FDI | *Fonds de Développement Industriel* (Industrial Development Fund) |
| FI | Financial Intermediary |
| FIRR | Financial Internal Rate of Return |
| FM | Financial Management |
| FY | Fiscal Year |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GOGLA | Global Off-Grid Lighting Association |
| GOH | Government of Haiti |
| GRS | Grievance Redress Service |
| GTF | Global Tracking Framework |
| GWh | Gigawatt Hour |
| HH | Household |
| HTG | Haitian Gourde |
| IBRD | International Bank for Reconstruction and Development |
| ICT | Information and Communications Technology |

| | |
|---|---|
| IDA | International Development Agency |
| IDB | Inter-American Development Bank |
| IFC | International Finance Corporation |
| IFM | International Fund Manager |
| IFR | Interim Financial Reports |
| IMF | International Monetary Fund |
| INDC | Intended Nationally Determined Contribution |
| IP | Investment Plan |
| IPF | Investment Project Financing |
| IPSAS | International Public Accounting Standards |
| IS | Implementation Support |
| KPI | Key Performance Indicator |
| kW | Kilowatt |
| kWh | Kilowatt Hour |
| kWp | Kilowatt Peak |
| LCR | Latin America and Caribbean Region |
| LCOE | Levelized Cost of Energy |
| LED | Light Emitting Diode |
| Li-ion | Lithium-Ion |
| M&E | Monitoring and Evaluation |
| MEF | *Ministère de l'Economie et des Finances* (Ministry of Economy and Finance) |
| MFI | Micro-Finance Institute |
| MTF | Multi-Tier Framework |
| MTPTC | *Ministère des Travaux Publics, Transports et Communications* (f Public Works, Transport and Communications) |
| MTR | Mid-Term Review |
| MW | Megawatt |
| MWh | Megawatt Hour |
| MWp | Megawatt Peak |
| NGO | Non-Governmental Organization |
| NPV | Net Present Value |
| O&M | Operations and Maintenance |
| OGEF | Off-Grid Electricity Fund |
| OM | Operations Manual |
| OP | Operational Policy |
| Opex | Operating expenditure |
| PAD | Project Appraisal Document |
| PAYG | Pay As You Go |
| PDNA | Post Disaster Needs Assessment |
| PDO | Project Development Objective |
| PIU | Project Implementation Unit |
| PPP | Public-Private Partnership |
| PRELEN | *Projet de reconstruction de l'infrastructure électrique et d'expansion de l'accès à l'énergie* (Rebuilding Energy Infrastructure and Access Project) |
| PSE | Private Sector Enterprises |
| PV | Photovoltaic |

| | |
|---|---|
| RAP | Resettlement Action Plan |
| RBF | Result-Based Financing |
| RE | Renewable Energy |
| RISE | Regulatory Indicators for Sustainable Energy |
| RPF | Resettlement Policy Framework |
| SEforALL | Sustainable Energy for All |
| SHS | Solar Home System |
| SME | Small-Medium Enterprises |
| SOE | Statements of Expenditures |
| SPDH | Strategic Plan for Haiti |
| SREP | Scaling Up Renewable Energy Program |
| TA | Technical Assistance |
| $tCO_2$ | Ton of Carbon Dioxide |
| TOR | Terms of Reference |
| UNEP | United National Environmental Program |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USD | United States Dollar |
| USTDA | U.S. Trade and Development Agency |
| US$ | United States Dollar |
| VAT | Value Added Tax |
| WACC | Weighted Average Capital Cost |
| WB | World Bank |
| WBG | World Bank Group |
| Wp | Watt Peak |
| WTP | Willingness to Pay |

| | |
|---|---|
| Regional Vice President: | Jorge Familiar |
| Country Director: | Mary A. Barton Dock |
| Senior Global Practice Director: | Riccardo Puliti |
| Practice Manager: | Antonio Barbalho |
| Task Team Leader: | Frederic Verdol, Dana Rysankova |

**HAITI**
**Haiti Modern Energy Services for All**

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**PAD DATA SHEET**

*Haiti*

*Haiti Modern Energy Services for All Project (P154351)*

**PROJECT APPRAISAL DOCUMENT**

*LATIN AMERICA AND CARIBBEAN*

Report No.: PAD1466

| **Basic Information** | | |
|---|---|---|
| Project ID<br>P154351 | EA Category<br>F - Financial Intermediary Assessment | Team Leader(s)<br>Frederic Verdol, Dana Rysankova |
| Financing Instrument<br>Investment Project Financing | Fragile and/or Capacity Constraints [ ]<br>Financial Intermediaries [ X ]<br>Series of Projects [ ] | |
| Project Implementation Start Date<br>23-Jan-2018 | Project Implementation End Date<br>29-Sep-2023 | |
| Expected Effectiveness Date<br>23-Jan-2018 | Expected Closing Date<br>31-Mar-2024 | |
| Joint IFC<br>No | | |

| Practice Manager/Manager | Senior Global Practice Director | Country Director | Regional Vice President |
|---|---|---|---|
| Antonio Alexandre Rodrigues Barbalho | Riccardo Puliti | Mary A. Barton-Dock | Jorge Familiar |

| **Approval Authority** |
|---|
| Approval Authority |
| AOB Decision |
| please explain |
| The proposed Project is financed through a Grant from the Clean Technology Fund (CTF). |

| Responsible Agency: MTPTC - Ministry of Public Works, Transport and Communications | | | |
|---|---|---|---|
| Contact: | Nicolas Allien | Title: | Coordinator CTF |
| Telephone No.: | 50928119587 | Email: | cenergiemtptec@gmail.com |

| Project Financing Data(in USD Million) | | | |
|---|---|---|---|
| [ ] Loan | [ ] IDA Grant | [ ] Guarantee | |
| [ ] Credit | [ X ] Grant | [ ] Other | |

| | | | |
|---|---|---|---|
| Total Project Cost: | 15.93 | Total Bank Financing: | 0.00 |
| Financing Gap: | 0.00 | | |

| Financing Source | Amount |
|---|---|
| Borrower | 0.00 |
| Clean Technology Fund | 15.65 |
| Total | 15.65 |

**Expected Disbursements (in USD Million)**

| Fiscal Year | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Annual | 1.00 | 3.00 | 4.00 | 3.00 | 2.00 | 2.00 | 0.65 |
| Cumulative | 1.00 | 4.00 | 8.00 | 11.00 | 13.00 | 15.00 | 15.65 |

**Institutional Data**

**Practice Area (Lead)**

Energy & Extractives

**Contributing Practice Areas**

Climate Change

**Proposed Development Objective(s)**

The Project Development Objective is to accelerate private sector-driven, renewable energy-based off-grid electrification in rural and peri-urban areas of Haiti.

**Components**

| Component Name | Cost (USD Millions) |
|---|---|
| Enabling Environment and OGEF Oversight | 1.43 |
| Off-Grid Electrification Sub-Projects | 12.00 |
| OGEF Management, Operations Pipeline Development, and Project Implementation Support | 2.22 |

**Systematic Operations Risk- Rating Tool (SORT)**

| Risk Category | Rating |
|---|---|
| 1. Political and Governance | High |
| 2. Macroeconomic | Substantial |
| 3. Sector Strategies and Policies | High |
| 4. Technical Design of Project or Program | Moderate |
| 5. Institutional Capacity for Implementation and Sustainability | High |

| | |
|---|---|
| 6. Fiduciary | Substantial |
| 7. Environment and Social | Moderate |
| 8. Stakeholders | Low |
| **OVERALL** | High |

## Compliance

**Policy**

| | |
|---|---|
| Does the project depart from the CAS in content or in other significant respects? | Yes [ ] No [ X ] |
| Does the project require any waivers of Bank policies? | Yes [ ] No [ X ] |
| Have these been approved by Bank management? | Yes [ ] No [ ] |
| Is approval for any policy waiver sought from the Board? | Yes [ ] No [ X ] |
| Does the project meet the Regional criteria for readiness for implementation? | Yes [ X ] No [ ] |

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

**Legal Covenants**

| **Name** | **Recurrent** | **Due Date** | **Frequency** |
|---|---|---|---|
| **Energy Cell** | **X** | | **CONTINUOUS** |

**Description of Covenant**

The Borrower shall maintain the Energy Cell within MTPTC, at all times during the implementation of the Project, with competent personnel, in adequate numbers, including, but not limited to, a procurement specialist, a financial management specialist, and a disbursement specialist, all with qualifications, experience and terms of reference acceptable to the World Bank.

| **Name** | **Recurrent** | **Due Date** | **Frequency** |
|---|---|---|---|
| Off-Grid Electricity Fund (OGEF) Fund Manager | **X** | | CONTINUOUS |

**Description of Covenant**

No later than 30 days from the Effective Date of this Agreement, the Borrower, through MTPTC, shall hire in accordance with the provisions set forth in Section III of this Schedule, and thereafter maintain at all times during the implementation of the Project, the International Fund Manager with qualifications, experience and terms of reference acceptable to the World Bank, as further detailed in the Operating Guidelines, and pursuant to the terms of the OGEF Partnership Agreement.

| Name | Recurrent | Due Date | Frequency |
|---|---|---|---|
| Advisory Committee | X | | CONTINUOUS |

**Description of Covenant**

Not later than 45 days after the Effective Date, the Borrower shall cause the FDI to establish, and thereafter operate and maintain, throughout the implementation of the Project, an Advisory Committee, with a composition, functions, responsibilities and resources acceptable to the World Bank, (including, *inter alia*, the responsibility to carry out the general oversight of the OGEF operations, as set out in the Operating Guidelines).

| Name | Recurrent | Due Date | Frequency |
|---|---|---|---|
| Operating Guidelines | X | | CONTINUOUS |

**Description of Covenant**

The Borrower shall cause FDI to carry out the Parts 2 and 3b of the Project in accordance with the provisions and requirements of the Operating Guidelines.

**Conditions**

| Source Of Fund | Name | Type |
|---|---|---|
| CCTF | Project's Operations Manual | Effectiveness |

**Description of Condition**

The Project Operations Manual has been adopted by the Borrower in a manner satisfactory to the World Bank

| Source Of Fund | Name | Type |
|---|---|---|
| CCTF | OGEF | Effectiveness |

**Description of Condition**

OGEF has been established under the FDI in a form and manner acceptable to the World Bank.

| Source Of Fund | Name | Type |
|---|---|---|
| CCTF | FDI Subsidiary Agreement | Effectiveness |

**Description of Condition**

The Subsidiary Agreement has been executed on behalf of the Borrower and the FDI.

| Source Of Fund | Name | Type |
|---|---|---|
| CCTF | International Fund Manager | Effectiveness |

**Description of Condition**

The International Fund Manager has been selected, in a form and manner acceptable to the World Bank.

| Source Of Fund | Name | Type |
|---|---|---|
| CCTF | Grant Cross-Effectiveness. | Effectiveness |

| Description of Condition | | |
|---|---|---|
| The CTF Grant Agreement has been executed and delivered and all conditions precedent to its effectiveness have been fulfilled | | |
| **Source Of Fund** | **Name** | **Type** |
| CCTF | Authorization/ratification of the Agreement | Effectiveness |
| **Description of Condition** | | |
| The execution and delivery of the Grant Agreement on behalf of the Recipient has been duly authorized or ratified by all necessary action of the Recipient | | |
| **Source Of Fund** | **Name** | **Type** |
| CCTF | Component 2 OGEF | Disbursement |
| **Description of Condition** | | |
| (a) OGEF Partnership Agreement has been signed by the parties thereto and is effective; and (b) Borrower has adopted, and has caused the FDI to adopt, the Operating Guidelines in a manner and substance satisfactory to the World Bank. | | |

## Team Composition

**Bank Staff**

| Name | Role | Title | Specialization | Unit |
|---|---|---|---|---|
| Frederic Verdol | Team Leader (ADM Responsible) | Senior Power Engineer | Energy | GEE04 |
| Dana Rysankova | Team Leader | Senior Energy Specialist | Energy | GEEES |
| Rose Caline Desruisseaux-Cadet | Procurement Specialist (ADM Responsible) | Procurement Specialist | Procurement | GGO04 |
| Fabienne Mroczka | Financial Management Specialist | Sr Financial Management Specialist | Financial Management | GGO22 |
| Asli Gurkan | Safeguards Specialist | Senior Social Development Specialist | Social | GSU04 |
| Elizabeth Sanchez | Team Member | Program Assistant | Administrative | LCC2C |
| Juan Buchenau Hoth | Team Member | Senior Financial Sector Specialist | Finance | GFM3A |
| Karan Capoor | Team Member | Senior Energy Specialist | Climate funds | GEESO |
| Lucine Flor Lominy | Team Member | Energy Specialist | Energy | GEE04 |
| Nicolas Kotschoubey | Safeguards Specialist | Consultant | Environment | GEN04 |
| Rhonda Lenai Jordan | Team Member | Young Professional | Energy | GEESO |

| | | | | |
|---|---|---|---|---|
| Antoine | | | | |
| Stephanie Nsom | Team Member | Consultant | Energy | GEE04 |

**Locations**

| Country | First Administrative Division | Location | Planned | Actual | Comments |
|---|---|---|---|---|---|
| Haiti | | | | | Nationwide |

**Consultants (Will be disclosed in the Monthly Operational Summary)**

Consultants Required? Consultants will be required

# I. STRATEGIC CONTEXT

## A. Country context

**Haiti's geography, people, and history provide many opportunities**. Haiti is the third largest Caribbean nation by area and population. The Republic of Haiti and its 10.4 million people are close to major markets — a two-hour flight to Miami, Florida — and benefit from a young labor force, a large and dynamic diaspora, and substantial geographic, historical, and cultural assets.

**However, Haiti has considerable development challenges**. Income inequality is the highest in the region and one of the highest the world, with a 2012 Gini co-efficient of 0.61. Nearly 60 percent of the population, or 6.3 million people, remain poor, and 24 percent (2.5 million) are extremely poor[1], with poverty highest in rural areas. The poorest regions, which are also the furthest from the capital, show extremely poverty rates exceeding 40 percent and have very limited access to basic services. Gross domestic product (GDP) per capita was US$829 in 2015 — less than 10 percent of the regional average.

**Gender inequality is also persistent.** Despite progress in education opportunities, adult women are still less educated, more likely to be illiterate, and disadvantaged in monetizing their economic assets. Gender-based violence remains widespread.

**Haiti's economic performance has been repeatedly compromised by political shocks and natural disasters.** The 2010 earthquake was one of the world's deadliest natural disasters ever, resulting in damages and losses of US$8 billion (120 percent of GDP)[2]. While the post-earthquake period has seen generally positive economic growth, the last two years have been marked by political and economic uncertainties. Contested elections and the impact of natural hazards have slowed economic growth, accelerated inflation, and led to the depreciation of the national currency. This was exacerbated by deadly Hurricane Matthew, which hit Haiti in October 2016, causing an estimated US$1.89 billion (22 percent of GDP)[3] in damages and US$2.2 billion[4] (25 percent of GDP) in reconstruction needs. The 2016 election of President Jovenel Moïse is expected to end this period of uncertainty and re-initiate economic growth.

**The World Bank's 2015 Systematic Country Diagnostic (SCD)[5] for Haiti** recommends a significant acceleration of growth rates to reduce poverty, but that growth must also become more inclusive. This calls for more attention to the development of economic opportunities in secondary cities and rural areas, including better access to basic infrastructure services.

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[1] Under the Haitian poverty line of US$1.98 per day based on consumption

2 IDA, IFC, MIGA: Country Partnership Framework for the Republic of Haiti, FY16-19

3 Rapid Damage and Loss Assessment of Hurricane Matthew, the Government of the Republic of Haiti with joint support from the World Bank and the Inter-American Development Bank (October 24, 2016); Note: the subsequent PDNA published by Government in February 2017 raises the estimate of damages and losses to 32 percent of GDP equivalent.

4 October 24, 2016: Rapid Damage and Loss Assessment of Hurricane Matthew, the Government of the Republic of Haiti with joint support from the World Bank and the Inter-American Development Bank

5 Haiti - Toward a New Narrative: Systematic Country Diagnostic (2015)

## B. Sectoral and institutional context

The Ministry of Public Works, Transportation and Communication (MTPTC) oversees the energy sector in Haiti, including the national electricity utility *Electricité d'Haïti* (EDH), which until recently[6] had a monopoly over transmission and distribution of electricity.

**The Haitian electricity sector's reliance on petroleum products is increasing and is costly.** Eighty-one percent of EDH's total generation is oil-based, mostly provided by Independent Power Producers. The rest is EDH's own hydro generation. In addition, while EDH's available generation capacity has been stagnant in the past decade (today still at 176 MW), the aggregated capacity of stand-alone diesel engines, used for self-generation and back-up power, has been growing steadily, currently reaching an estimated 500MW.[7] EDH's average cost of thermal generation is around US$0.30/kWh, and even higher on its smaller isolated grids that run on diesel. The average cost of generation from individual diesel generators ranges from US$0.40 to almost US$2 per kWh. Such price conditions make renewable energy (RE), like solar PV, highly competitive.

**Haiti has excellent but untapped RE resources.** Studies of RE potential in Haiti confirm that significant economic potential exists for hydropower, solar PV, wind and biomass generation.[8] So far, however, only hydropower has been exploited, and only partially. Haiti is falling behind other countries, including its Caribbean neighbors, which are all investing in energy supply diversification. Latest statistics (as of 2016) from the Sustainable Energy for All (SEforALL) Knowledge Hub show that Haiti is an outlier in its failure to enact a supportive policy and regulatory framework for clean energy and access.[9]

**Only a third of the Haitian population has access to electricity,** and even that is sporadic and unreliable. The access rate has remained virtually unchanged for 40 years. About 53 percent of urban households and 17 percent of rural households have electricity access. Electricity access is also highly skewed towards higher income quintiles, and is increasingly provided through informal and illegal connections.

**EDH faces considerable technical, managerial, and financial challenges.** EDH has a total of about 270,000 "active" (i.e. legally connected, metered and billed) customers, and likely twice as many informal connections.[10] Technical and nontechnical losses are 62 percent, in part due to electricity fraud and theft. Further, the collection rate is only about two–thirds, hence EDH ultimately recovers only less than a quarter of the value of the electricity purchased and generated[11]. In addition, fuel and power purchases are made in US dollars while revenues are collected in Haitian gourdes, which have depreciated significantly in recent years. Consequently, EDH has difficulty paying operating costs, and

---

[6] Presidential decrees dated February 03, 2016 ended EDH monopoly on electricity transmission and distribution, and provided framework for the creation of an energy regulatory body.
[7] EDH and MTPTC Energy Cell estimates
[8] See GOH: Haiti SREP Investment Plan, 2015 for summary of the available studies and resulting estimates of economic potential
[9] See Regulatory Indicators for Sustainable Energy (RISE); rise.esmap.org, Haiti ranked second from bottom in RISE 2017 out of 111 countries.
[10] Haiti Poverty and Equity Note # 2: Electricity in Haiti: Who gets it and how?
[11] World Bank staff calculation based on EDH data

relies on government subsidies to bridge the gap, which according to the International Monetary Fund (IMF), contributes to an annual financial deficit of US$200 million (2015), equivalent to 4 percent of the national budget. These subsidies have been identified by the IMF as the major threat to Haiti's fiscal stability.

**EDH's immediate priority is to reduce technical and commercial losses and to improve quality of service** to its existing customers. The Government of Haiti (GOH) is considering measures to reduce EDH losses,[12] including outsourcing EDH commercialization functions. It will, however, be many years before EDH is able to expand into rural areas.

**Beyond EDH, electricity supply is scarce.** Apart from EDH-owned grids, over 30 smaller diesel-powered municipal grids (also sometimes referred to as village grids, mostly 100-500kW, serving 1,000 to 5,000 customers) operate informally or under the Decentralization Law of 2006[13]. Their diesel units are typically oversized, expensive to run, with sporadic service (if any at all), and with tariffs typically set below operating costs. RE municipal mini-grids have recently emerged as a viable solution for non-electrified rural towns. Currently, there are two private RE municipal grid operators (see Annex 2) in Haiti with a nation-wide scale-up ambition. Both operate mini-grids in agreement with the municipalities, charging cost-reflective tariffs collected through smart pre-paid meters – demonstrating that municipal grids can be run sustainably as a commercial enterprise.

**Self-generation**, primarily through individual diesel engines, is currently the most widespread method to acquire electricity access. The combined capacity of individual diesel generator sets is estimated to be 500MW (far more than all EDH grids, municipal and private mini-grids combined). Most of these are run by industries and businesses that require a reliable power supply that EDH is unable to provide. While diesel gen-sets are also present in rural areas (e.g. used by larger enterprises and agribusinesses), their operation is expensive, and they are therefore rare compared to the rural setting. Most rural households and micro-enterprises have no electricity access, and pay US$10-20 a month for inferior and harmful alternatives, such as kerosene, dry cell batteries and cell phone charging.[14] Significant opportunities exist for converting these expenditures to installment payments to purchase quality solar off-grid products.

**Private sector-driven, solar off-grid electrification solutions are spreading fast globally,** and innovative business models are emerging**,** such as the "pay-as-you-go" (PAYG), which allows households to pay for electricity in installments over a period of time. More recently, three Haiti-based companies started to test PAYG solutions (see Annex 2), complementing an already active market for solar lanterns.

**Haiti off-grid energy has great potential**. It is estimated that over one million households (5 million people) can be reached through solar PV off-grid solutions and mini-grids. See Table 1.

---

[12] See MTPTC's 2017-2022 Roadmap for the Electricity sector, dated April 04, 2017

[13] The Decentralization Law of 2006 allows municipalities to operate their own electricity systems, serving customers on the territory of the municipality. Under this Law, some municipalities also signed concession agreements with the private mini-grid service providers.

[14] Data based both a large household survey - ECVMAS (2012) - and a more recent (2014) telephone survey carried out by Digicel/iiDevelopment for the preparation of the Haiti Investment Plan

Table 1. Distributed RE access expansion options – electrification potential

| Distributed RE segment | Max. population to be reached | Addressable market by 2023 |
|---|---|---|
| Small and medium municipal grids (retrofit and green-field) | 300,000 | 100,000 |
| Stand-alone distributed systems (households, social users, SMEs) | >5,000,000 | 700,000 |

Source: WB team calculations, based on *GOH: Haiti SREP Investment Plan*, 2015

**The pace of off-grid electrification, however, is currently constrained.** Haiti's relative isolation from the main markets in Africa and Asia, as well as domestic barriers (high import duties and VAT, a high level of market spoilage by low quality products, difficulty to access financing) have all been constraining market growth. The key barriers include:

- *Consumer risk premium*. Consumers lack confidence in RE due to the plethora of low quality RE products in the market. Experience from East Africa shows that risk perception changes with a rise in market share of quality products, and as consumers recognize and trust high quality products and brands.
- *High upfront payment, especially for larger systems*. Higher quality products, while cost-effective in the long run, often require consumers to pay more upfront. Despite higher monthly expenditures for fossil fuel, consumers can rarely afford to pay upfront, especially for higher- quality solar kits and home systems, creating a demand-supply mismatch. PAYG models are trying to overcome this barrier.
- *Uneven playing field with fossil fuels*. In Haiti, solar photovoltaic (PV) products are subject to high import duties and taxes, reducing their competitiveness against fossil fuels alternatives, such as kerosene and diesel, which have historically benefitted from implicit and explicit subsidization.
- *Lack of financing for business growth.* There are very limited financing sources for the Haitian off-grid businesses. In the past, several donors and NGOs have provided "innovation grants" for off-grid electrification start-ups in Haiti, but no funding is available for the growth of these enterprises, nor to spur development of the second generation of off-grid businesses. Domestically, the Haitian financial markets are underdeveloped, with limited, expensive financing for SMEs and startups. In addition, local banks perceive the off-grid energy sector as unproven and risky. International investors, on the other hand, are prioritizing investments in their core markets, such as East Africa and South Asia.
- *Capacity/skill constraints*, such as underdeveloped supply chains and a lack of trained local technicians are also constraining the pace of expansion of off-grid businesses.
- *Regulatory barriers (for mini-grids)*. The 2016 presidential decree has ended the monopoly of EDH, allowing the private sector to operate in all segments of the supply chain (generation, transmission, and distribution). This decree, however, still needs to be operationalized, and detailed regulatory rules developed (e.g. requirements for licensing, tariff regulation and what happens when the grid reaches the micro-grid).

**GOH is committed to achieving universal access to electricity.** The Government's vision for Haiti to become an emerging economy by 2030 includes the objective of achieving universal electricity access. This objective, as identified in the Haiti Scaling up Renewable Energy Program (SREP)

Investment Plan, follows two parallel tracks: (i) improving EDH performance and supporting on-grid generation capacity with the objective of enabling EDH to provide reliable and affordable electricity services in urban and surrounding areas; and (ii) supporting decentralized private sector-led solutions for off-grid electrification for households, businesses, and institutions not served by EDH.[15] This vision is re-confirmed in the recently released Roadmap of President Jovenel's Government, which for the first time commits to the acceleration of off-grid electrification, including solar PV solutions and smart mini-grids.[16] The proposed Project is an essential part of this universal access drive. It is a part of a broader SREP Program, identified in the SREP Investment Plan in 2015, consisting primarily of the SREP-funded Renewable Energy for All Project (P156719), the present CTF-funded Project and IDA Rebuilding Energy Infrastructure and Access (PRELEN), P127203 parallel financing. These three sources of funding form a comprehensive investment and technical assistance (TA) package described in Box 1.

**Box 1: SREP Haiti Program**

The SREP Haiti Program sets Haiti on a path to transform its energy sector from underdeveloped, unreliable, and expensive fossil fuel-based power generation mix to a modern and sustainable energy system relying on diverse sources of power. The Program is financed primarily through three funding sources: SREP and the Clean Technology Fund (CTF) – both part of the Climate Investment Funds – and through the ongoing IDA-funded Rebuilding Energy Infrastructure and Access (PRELEN) operation.

- CTF: Modern Energy Services for All Project, P154351 (US$15.65 million). The Project will accelerate private sector-driven, RE-based off-grid electrification in rural and peri-urban areas of Haiti. The Project establishes the Off-Grid Energy Fund (OGEF), which will invest equity and provide loans to commercially viable off-grid energy businesses.
- SREP: Renewable Energy for All Project, P156719 (US$19.62 million). The Project will scale-up renewable energy investments in Haiti in order to expand and improve access to electricity for households, businesses and community services. This will include demonstrating the viability of integrating solar PV generation into the national utility grids, and complementing OGEF funding with grant funding for mini-grids and off-grid electrification to accelerate the market, increase affordability and support rural development.
- The on-going IDA PRELEN P127203 (US$90 million) in line with its objectives and description, will (i) provide additional technical assistance for scaling up renewable energy and energy access, (ii) support selected grid improvements to facilitate integration of solar energy to the national electricity grids, (iii) support off-grid access for community services, such as schools, and (iv) pilot innovative business models, such as those for productive uses or mini-grids. (US$21 million of the grant proceeds in on-going or planned activities for RE and energy access).

The three sources form a comprehensive package, each contributing to the above-referenced outcomes. Namely, CTF funding will be used to establish the Off-Grid Energy Fund (OGEF), which will be professionally managed by an experienced fund manager to invest in commercially viable off-grid energy businesses, while SREP and IDA grants will be used to complement such investments in non-commercial areas to maximize the number of beneficiaries and to ensure that the off-grid electricity services are affordable for poorer population segments. All together, the SREP Program financing package is designed to significantly leverage additional private sector investments (US$64 million).

| | Component 1 (EDH grids) | Component 2 (municipal grids and off-grid) |
|---|---|---|
| IDA | TA/capacity building and minor investments in EDH isolated grids to facilitate vRE integration | TA/capacity building and piloting of new approaches |

[15] Government of Haiti: SREP Investment Plan, 2015

[16] See MTPTC's 2017-2022 Roadmap for the Electricity sector, dated April 04, 2017

| | | |
|---|---|---|
| SREP | Investments in the solar PV plants and limited associated TA | Grants to the private off-grid energy service provider and associated TA/capacity building |
| CTF | - | Equity investments and loans to the private off-grid energy service providers |

### C. Higher-level objectives to which the Project contributes

**The Project supports the World Bank Group (WBG) objectives** of ending extreme poverty and promoting shared prosperity by targeting investments in rural areas, where the highest poverty levels are found, supporting the SCD's call for making Haiti's growth more equitable. The proposed Project will have important climate change co-benefits by displacing fossil fuels with RE generation.

**The proposed Project is fully aligned with the World Bank Group's Country Partnership Framework (CPF)** for FY16-19 (Report No. 98132-HT), discussed by the World Bank Board of Executive Directors on September 29, 2015. The proposed Project will contribute to the CPF focus area of inclusive growth by supporting the development of greater economic opportunities beyond Port-au-Prince, increasing energy access, and supporting RE development. It will support Haiti's competitiveness by promoting private-sector growth through energy investments.

**The Project also supports GOH's vision for the energy sector,** included in the Strategic Plan for the Development of Haiti (SPDH), which sets a path for Haiti to become an emerging economy by 2030, including the ambitious goal of universal electricity access. Furthermore, the Project supports GOH's newly released National Roadmap, which highlights the need for investing in RE and off-grid energy access.[17] The Project also supports Haiti's INDC commitment to expand RE generation to 47 percent of the generation mix by 2030.

## II. PROJECT DEVELOPMENT OBJECTIVE

### A. Project development objective

The Project Development Objective (PDO) is to accelerate private-sector-driven, renewable energy-based off-grid electrification in rural and peri-urban areas of Haiti. This objective will be achieved primarily through (i) supporting the strengthening of an enabling regulatory framework and (ii) by providing financing and market development support to commercially viable off-grid investments with the potential for replication and scale-up. "Off-grid electrification" is understood as electrification of households, businesses and/or institutions with decentralized solutions not connected to the EDH grid, such as solar lanterns, lighting kits, solar home systems and micro-grids.

### B. Project beneficiaries

The **Project's primary beneficiaries are rural Haitians.** Over 500,000 people in rural and unserved peri-urban areas (of which at least 50 percent are women) are expected to receive reliable electricity services within the Project timeframe. Other beneficiaries include private entrepreneurs and their employees, as the proposed Project is expected to contribute to creating new jobs in rural areas, with the potential for local value creation. The Project will have important climate change co-benefits (75%

[17] The Road Map calls for (i) improving EDH performance and for dual efforts to build the national grid while supporting mini-grid and off-grid solutions for electrification (ii) a diversification of Haiti's generation mix with indigenous renewable energy sources and (iii) MTPTC to implement the present CTF Project, as well as the related SREP-funded Renewable Energy for All Project.

of total investment), estimated at about 60,000 $tCO_2$ equivalent a year, and over 1 million $tCO_2$ equivalent over the lifetime of investments.

**The Project's gender-differentiated benefits** will be tracked during Project implementation. Providing household and community electricity access can promote gender equality and women's empowerment, provide new employment opportunities for women, increase the efficiency of productive activities, and improve health and education for women and girls. The Project is therefore integrating specific actions to support positive impacts of electrification on women as both consumers and suppliers of energy[18]..

### C. PDO level results indicators

The PDO will be measured against the following indicators:

- Number of people provided with new or improved electricity service (Bank core), with a gender disaggregation;
- Number of enterprises that started and/or scaled up their off-grid electrification activities with assistance of the Project;
- Private investment and commercial lending leveraged and;
- Tons of GHG emissions reduced or avoided over lifetime of the CTF financed Project ($tCO_2eq$).

The Project will establish a baseline using the Multi-Tier Framework (MTF)[19] methodology, and will measure Project progress and impacts against this baseline.

## III. PROJECT DESCRIPTION

The Project objectives will be achieved through improving the enabling environment for off-grid electrification and establishing an Off-Grid Electricity Fund (OGEF), which will provide equity, loans, grants and Technical Assistance (TA) to businesses engaged in the provision of off-grid electricity services in Haiti. The Project is designed to accelerate off-grid market development and to jump-start the scale-up of diverse off-grid electrification solutions in Haiti. Through leveraging local renewable energy sources and local entrepreneurs, the Project aspires to create sustainable markets for off-grid electricity services that will reduce the country's dependency on imported fossil fuels, such as diesel and kerosene, create jobs, improve productivity, alleviate poverty and improve gender inequality. See Annex 2 for more details about this "market acceleration" approach.

### A. Project components

**Component 1: Enabling Environment and OGEF Oversight (CTF grant US$1.43 million).** This component will be implemented by MTPTC. The main purpose of Component 1 is to help build a more business-friendly policy and regulatory environment. The Project will provide support to MTPTC to (i) strengthen the regulatory and policy framework governing off-grid electrification; (ii) provide capacity building and technical support to key stakeholders, including building awareness about the renewable energy solutions among communities and users to build local ownership and support for the

[18] See Section VI. D and Annex 6 for the Project's specific gender actions, and Annex 1 for gender-related indicators
[19] See World Bank/SEforALL: Beyond Connections, Energy Access Redefined, 2015

Project; and (iii) promote inter-institutional coordination and support the Advisory Committee (consisting of Government, private sector and civil society representatives) to conduct general oversight of the OGEF operations. Other activities include setting quality standards, promoting energy efficient (EE) solutions, improving consumer awareness of RE technologies, energy efficiency and productive uses of electricity, promoting gender-sensitive approaches, strengthening capacities, and monitoring and evaluation.

**Component 2: Off-Grid Electrification Sub-Projects (CTF US$12 million, SREP US$3 million).** This component will support OGEF's provision of financing to the off-grid energy enterprises ("eligible beneficiaries") to carry out "off-grid electrification sub-projects". An off-grid electrification sub-project is an investment or series of investments in off-grid electrification activities, including generation, distribution, and commercialization of off-grid electricity, as well as manufacturing or assembly of off-grid electricity products and parts.

OGEF is designed to provide flexible financing in the form of equity, loans, and limited grant financing modalities[20] to meet the investment needs of off-grid energy enterprises serving different consumer segments in the off-grid electricity market. OGEF will be structured as a technology-neutral investment vehicle, supporting off-grid businesses offering a variety of off-grid solutions - solar lanterns, solar PV kits/home system, larger PV systems and/or renewable energy/hybrid micro-grids. As the market grows, OGEF support may also extend to financing local assembly/manufacturing of off-grid electrification products/parts to serve the growing Haitian off-grid market. OGEF will be housed in the Industrial Development Fund (*Fonds de Développement Industriel* – FDI), which will enter into a contractual relation with a competitively hired International Fund Manager (IFM) for OGEF management (OGEF Partnership Agreement between MTPTC, FDI, and IFM — see Section IV Implementation and Annex 3 for details). OGEF will provide the following types of support:

- *Equity and limited grant financing for Distributed Energy Service Companies (DESCOs) and mini-grids*[21]. This business line will be used for financing equity, startup, and results-based grants[22] for DESCOs and mini-grids.
- *Medium-term loans for DESCOs and mini-grids.* Business expansion will require debt financing to allow companies to grow. The loans will be granted on commercial terms to start building a proof of viability for local commercial banks expected to enter in this market post-CTF Project.
- *Working capital and results-based grants for premium pico-PV products*.[23] Local distributors will receive access to short-term working capital, which would allow them to (i) import quality products at scale, and (ii) provide better financing terms to retailers and/or end-users.

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[20] The grants would be funded through the parallel SREP-funded Renewable Energy for All Project up to a total amount of US$ 3 million.

[21] The Distributed Energy Service Companies (DESCOs) are understood here broadly as companies providing services with individual off-grid systems. These are primarily (but not only) companies deploying PAYG business models. Mini-grids are understood here in the Haitian context as pico-, micro- and mini-grid solutions, typically of 10-500kWp capacity, serving a few dozen to tens of thousands of customers. They are also sometimes referred to as village grids or municipal grids.

[22] The funding for results based grants will be provided from the parallel SREP-funded Renewable Energy for All Project.

[23] Pico-PV products are generally understood as small solar PV products, such as solar lanterns and small solar kits up to 10-20Wp capacity. The funding for grants will be provided from the parallel SREP-funded Renewable Energy for All Project.

The CTF funds will be used for equity and/or loans. The parallel SREP Project will add US$3 million grant funding for OGEF for off-grid energy businesses. These will include: (i) grants for quality-verified solar products to support penetration of higher quality products on the Haitian market; (ii) grants for piloting viable, scalable and sustainable business models; and (iii) grants for growth of early stage off-grid businesses with viable business plans.

The Operating Guidelines will include detailed provisions on how investment and lending decisions will be made by the Fund Manager, and how grants will be awarded under OGEF. The grants will be disbursed against pre-defined results or performance benchmarks, and a monitoring mechanism will be established to ensure that the Project funds are used for the agreed purposes. OGEF will also actively seek co-financing from other potential financiers.

**Component 3: OGEF Management, OGEF's Operations Pipeline Development, and Project Implementation Support** (CTF US$2.22 million). Resources allocated under this component will cover: (3a) payment of the Fund Manager Fee, and (3b) support to FDI for: (i) the development of a pipeline for off-grid electrification sub-projects, (ii) due diligence in financing and off-grid electrification sub-projects such as environmental and social safeguards screening, (iii) monitoring and evaluation of off-grid electrification sub-projects and Project activities – including citizen engagement activities as described in Section IV.B below (household phone and in-house surveys and a customer hot line), and (iv) related operating costs. Sub-Component 3a will be implemented by MTPTC.

**B. Project financing**

**Financing instrument**. This is an Investment Project Financing (IPF) Project, using a Financial Intermediary (FI). The project is financed from the Clean Technology Fund (CTF) as a Grant. The CTF funding is US$16 million, of which US$1.43 million will be extended in the form of a grant for Component 1, US$14.22 million will be extended in the form of contingent recovery grant for Components 2 and 3, and US$0.35 million is an administrative fee.

The contingent recovery grant is a grant that will be provided to GOH for creating and financing OGEF. The Grant Agreement, signed with GOH, will include a clause, allowing World Bank (as CTF trustee) to recover proceeds from CTF-funded OGEF investments the time of OGEF closure. Under this arrangement, any proceeds including financial returns from OGEF investments and lending (net of all approved fees and expenses and up to a maximum of the amount disbursed for OGEF investments and lending), available in OGEF CTF segregated account at its closure in Year 11, will be returned back to the World Bank, in its role as CTF Trustee. See Section IV.A for more details.

**Project cost and financing**. Total Project financing requirements are estimated at US$15.65 million. US$0.35 million are allocated as administrative fees.

Table 2: Project financing

| Component | Source | Amount, US$ M |
|---|---|---|
| Enabling environment and OGEF oversight | CTF Grant | 1.43 |
| Off-grid electrification sub-projects | CTF Contingent recovery grant | 12.0 |
| OGEF management, pipeline development, and implementation support | CTF Contingent recovery grant | 2.22 |

| | | |
|---|---|---|
| Administrative Fees | CTF Grant / CTF Contingent recovery grant | 0.35 |

1. CTF funding is expected to leverage at least US$48 million from the private sector, mostly in the form of additional equity and lending to the off-grid energy businesses supported by OGEF.[24] A parallel, SREP-funded Renewable Energy for All will provide additional US$8.62 million for off-grid electrification, of which US$3 million will be used to finance grants to the off-grid energy companies through OGEF, under Component 2.

### C. Lessons learned and reflected in Project design

The last decade has seen tremendous developments in off-grid electrification that have changed some of the past paradigms. A combination of parallel technology advancements has allowed dramatic improvements in (i) costs, (ii) energy efficiency, (iii) variety and (iv) usability of off-grid electrification products, which in turn has paved the way for (v) the emergence of new private sector business models and (vi) an expanded menu of options for national off-grid electrification:

- There is an opportunity to support a much wider range of technology options, system sizes and business models to satisfy diverse needs of varied population segments. This, in turn, may allow leveraging transaction costs over larger volumes, and scaling-up off-grid Projects ambitions.
- Given the continued stream of technology and business model innovations, national electrification programs need to be designed with enough flexibility to allow users to benefit from the best available options at any given time. The emerging service-oriented approaches and payment schemes provide an opportunity to link incentives more closely to the level of services provided rather than the traditional "input-focused" approach, maximizing user benefits and incentivizing further innovation.
- There is also an opportunity to leverage increasing volumes of private sector investments. Even though public support remains essential for now, Project design should maximize this opportunity (as opposed to crowding out existing private sector efforts), and create conditions for gradual phasing out of public support in favor of private investments, as the market gains more confidence in the new off-grid electricity solutions.

## IV. IMPLEMENTATION

### A. Institutional and implementation arrangements

**The Project has two implementing agencies.** The Ministry of Public Works, Transportation and Communications (MTPTC), through its Energy Cell, will implement Component 1 and 3a. FDI, in a partnership with a competitively selected International Fund Manager (IFM), will manage OGEF and associated activities related to Components 2 and 3b. Ministry of Energy and Finance (MEF) will be

[24] The amount of private sector investment is estimated based on experience of similar funds/impact investors in more advanced off-grid electricity markets, such as East Africa. The overall capital leveraged by the larger SREP Program (including both CTF and SREP financing) is estimated at US$64-72 million.

involved in the Project oversight through its participation in OGEF's Advisory Committee. MEF will also support inter-institutional coordination.

**Components 1 and 3a:** MTPTC is already implementing the IDA-financed PRELEN Project and the same arrangement and team (which would be further strengthened – see Annex 3 for details) will be used for the implementation of Components 1 and 3a. MTPTC's Energy Cell will provide technical oversight for all activities, and use the Project Implementation Unit (PIU), which is currently implementing IDA-financed PRELEN Project for procurement and financial management. The Energy Cell will carry out its activities in accordance with the Project Operations Manual, which is a condition of effectiveness.

**Components 2 and 3b***:* OGEF will be established by FDI as a separate financing window, with its own financing, management, and governance structure. It will be initially financed with CTF funds, but it will allow entry of future financiers. MEF will sign a Subsidiary Agreement with FDI under terms and conditions approved by the World Bank; MEF will transfer funds to FDI free of charge.

OGEF will be established for 11 years, which will include 10 years of active operation and one year for closing. The Subsidiary Agreement will require FDI to establish a segregated account for all proceeds from CTF-funded OGEF investments (liquidated equity holdings and repaid loans). These proceeds could be reinvested during the OGEF life (10 years), but all would need to be liquidated by Year 11. At Year 11, all funds in the CTF segregated account, up to a maximum of the disbursed amount of CTF financing for OGEF, and after the payment of OGEF Fund Managers fees and any other closing expenses, would be returned to the World Bank, acting as a trustee for CTF.

FDI and MTPTC will enter into an agreement with the International Fund Manager (IFM) for the management of OGEF (OGEF Partnership Agreement), which will specify the roles of FDI and IFM in the management of OGEF. Together, they will therefore act as the "OGEF Fund Manager". FDI, with an investment track record in local start-up/SMEs, will provide knowledge of the local financial and SME landscape. A competitively contracted IFM, with a proven track record in investing in off-grid businesses in Africa, South Asia and/or other major off-grid electricity markets, will provide expertise in financing off-grid energy businesses. It is expected that FDI and IFM will jointly evaluate investments, but IFM will have discretion over investment decisions while building capacity at FDI. IFM will build FDI capacity to manage OGEF on its own after the expiration of the OGEF Partnership Agreement. While OGEF will be established for 11 years, FDI could open a successor fund at year 6, which could be managed by FDI alone. IFM will be contracted by MTPTC, with close involvement of FDI in this process.

**Detailed arrangements for OGEF operations will be established in the Operating Guidelines**, which will charge both FDI and IFM with prudent management of OGEF resources on behalf of GOH, investing in potentially profitable and sustainable off-grid businesses, while maximizing the number of beneficiaries obtaining access to energy. OGEF operations will be overseen by the Advisory Committee, which is expected to comprise MEF, MTPTC, and three independent parties (representatives of the renewable energy sector, the financial sector and a reputable international organization).

Establishment of OGEF, execution of the Subsidiary Agreement between MEF and FDI, and selection of IFM are conditions of effectiveness. Adoption of Operating Guidelines is not a condition of

effectiveness, as it requires inputs from IFM that cannot be contracted prior to the Project's effectiveness. The same goes for the signing of the OGEF Partnership Agreement, which also cannot be done before effectiveness. Therefore, these are conditions of disbursement for all OGEF investments under Component 2.

### B. Monitoring and evaluation

The Project will use the indicators and mechanisms defined in Annex 1 for monitoring and evaluation (M&E) of results and intermediate outcomes. Overall responsibility for M&E lies with the MTPTC Energy Cell, which will consolidate M&E reporting based on updates provided in the Fund Manager's reports. Operating Guidelines will include a description of M&E responsibilities, data collection requirements and frequency, and division of the roles between MTPTC, FDI and the International Fund Manager; each provided with adequate budgets to carry out their roles diligently. Monitoring arrangements will also include independent *ex post* verification of results. The Project will carry out a baseline survey, using the SEforALL Multi-Tier Framework (MTF) methodology, and will use cell phone surveys (see below) to get regular updates on progress. At Project closure, the MTF survey will be repeated to capture impacts.

**The Project will also seek citizen engagement and beneficiary feedback in its implementation.** Citizens will be represented in OGEF's Advisory Committee. The Project will carry out annual household surveys (by cell phones and follow up home visits where required), which will cover both beneficiaries and non-beneficiaries. A free text messaging/hotline will be enabled to allow consumers to seek information, submit inquiries or file complaints about their service providers. Consumer feedback will be discussed between the Advisory Committee and the OGEF Fund Managers and corrective actions will be taken. Citizen engagement indicators are included in the Results Framework (Annex 1).

### C. Sustainability

**The Project will finance only those businesses that present viable business plans**, which will increase the likelihood of sustainable operations. The Project design and the business plan evaluation procedures will address common sustainability issues in mini-grid and off-grid systems, including: poor technical quality of systems/components, inadequate tariffs in mini-grids, low capacity to operate mini-grids and off-grid systems, lack of after-sales services and lack of financing for spare parts. Sustainability criteria will also include environmental and social sustainability, as defined in the environmental and social screening, assessment, and mitigation measures ("E&S Process"), which will form a part of the Operating Guidelines (see section VI, E).

## V. KEY RISKS AND MITIGATION MEASURES

**The overall risk of the Project is assessed as "High".** Key Project level risks and related mitigation measures are:

**Macroeconomic (Substantial)**: Worsening macroeconomic condition can affect performance of EDH and of private sector service providers. For example, significant devaluation of currency would likely have very negative impact on all service providers, which may source products/materials in US dollars but charge tariffs in local currency. Mitigation measures will include close monitoring of the economic situation, and adjusting project support (e.g. increasing grant amounts) as needed.

**Sector strategies and policies risk (High).** Government priorities may change away from clean energy and energy access. The mitigation measure is to build a broader consensus and support for energy access across all stakeholders: Government, Parliament, municipalities, civil society, etc.

**Governance and capacity risks (High)**. Poor governance and weak institutional capacity could undermine Project implementation, and the Project could face the following implementation risks:

- *Slow disbursements due to implementing agency capacity constraints*. Capacity in the sector, including MTPTC, remains very low with insufficient staffing. MTPTC's Energy Cell will be strengthened and will receive extensive capacity building under the IDA PRELEN and SREP Projects. FDI has demonstrated an adequate implementation capacity, and in addition, it will be strengthened with IFM, which will bring expertise in financing off-grid energy businesses.
- *Potential external interference in the evaluation of sub-projects*. Investments will be evaluated based on standardized and transparent criteria. A competitively contracted IFM will be ultimately responsible for investment decisions based on agreed rules and procedures stipulated clearly in the Operating Guidelines. Adherence to these rules will be overseen by the Advisory Committee, which will include both governmental and non-governmental members.
- *OGEF governance risks*. OGEF governance structure introduces checks and balances on individual stakeholders — including FDI and IFM. Operating Guidelines will include conflict of interest provisions, which will be monitored by the Advisory Committee (see Annex 3).

**OGEF disbursement risk (Substantial)**. An OGEF implementation risk is that the funds could remain unused due to (i) difficulty in attracting a qualified IFM, or (ii) a lack of interest or capacity of private sector applicants. Initial consultations, however, reveal an interest of several reputable IFMs to manage OGEF, and existence of an already strong investment pipeline (Annex 2).

**Regulatory risk (Moderate)**. There could be delays in enacting a comprehensive regulatory framework to reduce uncertainties, particularly for mini-grid investors. Minimum conditions for investing in off-grid electrification, however, already exist, and Component 1 puts an emphasis on further improvements of the regulatory framework.

**Coordination with EDH (Moderate).** Off-grid and mini-grid businesses will require time to recover costs and reach profitability. One of their risks is electrification of their target users by EDH before they can recover their costs. The risk is small given EDH's inability to expand to rural areas, but the Project will support the development of a regulatory framework clarifying the interface between the grid, mini-grids and the off-grid systems.

## VI. APPRAISAL SUMMARY

### A. Economic and financial analysis

The Economic and Financial Analysis shows that both EIRR and FIRR are significantly above hurdle rates for all probable cases, robust to the most probable stress scenarios, and attractive enough to allow for fast disbursement under the delegated Financial Intermediary scheme. *The Economic Analysis yields user-level EIRR between 30 percent and 50 percent* for the various stand-alone and municipal/village grid systems likely to draw on financing from the three funding windows (see Annex 5). The EIRR including carbon benefits is even higher. The exact aggregate Project-level EIRR will

ultimately depend on the actual mix of businesses and RE systems financed during implementation. *The Financial Analysis covers a very broad range of firm-level and market-level scenarios.* The fund manager's due diligence and close oversight (especially in the equity case) and firm qualification rules will further increase the probability that participating firms will meet the robust financial indicators shown to be feasible in Project analysis (Annex 5).

### B. Technical

**The Project will support products and sub-projects that meet quality standards.** For lanterns and solar kits, the Project will support Lighting Global[25] verified (or proven equivalent) products. Solar kits, with declining prices, increasing energy efficiency and convenience of an "in the box solution" can power domestic appliances such as TVs and fans, and are increasingly replacing the traditional SHSs of the past. Technical specifications ensuring quality for larger SHSs and mini-grids not covered by Lighting Global will be established and regularly updated. Technical support will be provided to the mini-grid operators to troubleshoot common technical issues.

### C. Financial management

The financial responsibilities of the Project will be managed by the PIU established for IDA PRELEN Project, while the technical aspects will be coordinated by the Energy Cell within MTPTC. The fiduciary aspects of Components 2 and 3 will be managed by FDI with the competitively selected International Fund Manager, who will manage the Fund under the oversight of the Advisory Committee and based on the Operating Guidelines approved by the World Bank for use of CTF resources. The World Bank has completed the MTPTC financial management assessment and proposed arrangements for the Project to ensure they meet the minimum fiduciary requirements under OP/BP10.00. The assessment of FDI and the International Fund Manager will be carried out after the Fund Manager's selection during Project implementation.

### D. Procurement

The majority of procurement transactions will be done directly by the selected beneficiary off-grid energy companies using commercial practices as spelled out in the Operating Guidelines. Traditional World Bank public procurement activities are very limited and will largely consist of the selection of the International Fund Manager to manage Components 2 and 3b. This process is to be carried out by the MTPTC, using the existing PIU. The PIU is familiar with World Bank procurement procedures, and its performance is generally satisfactory. The off-grid companies will use equity, grant, loans, and working capital provided by OGEF to procure goods, works, consulting and non-consulting services, and to fund operating expenses and training in accordance with the provisions of the Operating Guidelines and their business plans approved by OGEF.

### E. Environment and social (including safeguards)

The safeguards category is Financial Intermediary (FI), since the investment component of the CTF Project will be carried out by an FI – FDI, with the selected IFM. The Project is expected to have a positive social impact on the 490,000 direct beneficiaries, including women who are specifically

[25] Lighting Global is a WBG program supporting off-grid electricity sector. The program has established a quality assurance framework, including standards for pico-PV and solar home systems, which are now being also introduced as standards of the International Electromechanical Commission. See www.lightingglobal.org for more details.

targeted as beneficiaries. Most investments will consist of home/small business solar electrification with limited impacts. Given that sub-project sites are not known, the GOH prepared and adopted an "E&S Process", which is equivalent to the Environmental and Social Management Framework (ESMF), which is designed to address impacts ranging from small-scale PV and disposal of used batteries to more complex sub-projects (e.g., micro-grids, transmission lines, biomass, wind turbines, and micro-hydro). The Project triggers the following safeguard policies:

- *OP 4.01 Environmental Assessment.* Potential impacts relating to health and safety during construction and operation of home systems and micro-grids; waste from batteries; environmental, social, health and safety liabilities associated with retrofitting micro-grids; impacts on soil, vegetation and biodiversity when installing infrastructure (solar panels, distribution lines, biomass, wind turbines, run-of-river micro-hydro plants, etc.).
- *OP 4.12 Involuntary Resettlement.* It is possible that some Project activities (e.g. mini-grids) may lead to resettlement (particularly squatters), land acquisition, as well as loss of economic livelihood, and so OP 4.12 on Involuntary Resettlement is triggered. Because the sub-projects or their locations are currently unknown, GOH prepared and adopted a Resettlement Policy Framework (RPF), which will be integrated in the Operating Guidelines. Special attention will be given to the eligibility of potentially affected persons in the RPF and any subsequent Resettlement Action Plans (RAPs, per OP 4.12), including attention to those without formal legal land rights. FDI with IFM will review any proposed RAPs as needed; however, RAP preparation and implementation (including compensation) will be the responsibility of the private companies that are implementing the selected sub-projects.

The OGEF Fund Manager will screen all candidate sub-projects against an environmental and social checklist included in the Operating Guidelines. The Operating Guidelines will also indicate a list of sub-projects that will not be allowed to be financed from CTF resources, including those making use of pesticides within natural habitats, affecting physical cultural resources, and constructing dams (or any other hydro projects requiring water storage). Also, the Project will not finance any activities on international waterways. As per the Operating Guidelines, the Fund Manager is to submit all sub-projects with CTF support to the Bank for no objection in the first two years of implementation, after which only larger and more complex sub-projects (including those involving resettlement) will require the Bank's no objection. Beneficiary feedback and grievance mechanisms are integrated in the project design, including implementation of period household surveys, and a free text messaging/hotline allow consumers to seek information, submit inquiries or file complaints about their service providers.

The ESMF and the RPF were consulted in Haiti in September 2015, including workshops with key stakeholders (Government, private sector, and civil society) and field visits to potential beneficiaries. The consultations confirmed a broad-based support for the proposed project. The key recommendations were integrated in the design, including (i) the need to develop a long-term strategy for the disposal of batteries, and (ii) the need to ensure that beneficiary feedback is integrated in the project design, and that users are able to file complaints if dissatisfied with the service received from off-grid energy companies. The ESMF was disclosed in Haiti on Government's website on October 9, 2015 and on the World Bank's external website on October 26, 2015 (and after a minor modification re-disclosed in Haiti on May 2, 2016 and on the World Bank's external website on October 11, 2016). The RPF was disclosed on the World Bank's website on October 13, 2015 and GOH's website on October 16, 2015.

## F. World Bank grievance redress

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

## Annex 1. Results Framework and Monitoring
## Haiti Modern Energy Services for All

### Results Framework

**Project Development Objectives**

PDO Statement

The Project Development Objective is to accelerate private sector-driven, renewable energy-based off-grid electrification in rural and peri-urban areas of Haiti.

**Project Development Objective Indicators**

| Indicator Name | Core | Unit of Measure | Baseline | Cumulative Target Values | | | | | | Frequency | Data Source/ Methodology | Responsibility for Data Collection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | YR1 | YR2 | YR3 | YR4 | YR5 | YR6 (End Target) | | | |
| People provided with new or improved electricity service | ☒ | Number | 0 | 0 | 23,000 (of whom 11,500 are women) | 98,000 (of whom 49,000 are women) | 260,000 (of whom 130,000 are women) | 390,000 (of whom 195,000 are women) | 585,000 (of whom 250,000 are women) | Bi-annual | Project Progress Reports capturing data from enterprises | Energy Cell based on Fund Manager data |
| | | | | | | | | | | | | |
| Number of enterprises that started and/or scaled up their off-grid electrification activities with assistance of the project | ☐ | Number | 0 | 0 | 2 | 4 | 7 | 7 | 7 | Bi-annual | Project Progress Reports | Fund manager |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Private and Commercial Financing leveraged through CTF funding (US$ million) | ☒ | Number | 0 | 0 | 2 | 10 | 30 | 48 | 48 | Annual | Project Progress Reports capturing data from investments | Fund manager |
| Tons of GHG emissions reduced or avoided ANNUALLY (tCO2eq per year) | ☒ | Number | | - | 2,300 | 9,900 | 26,400 | 39,500 | 59,300 | Annual | Project Progress Reports capturing data from enterprises | Energy Cell based on Fund Manager data |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Intermediate Results Indicators** | | | | | | | | | | | | |
| **Component 1: Enabling Environment and OGEF Oversight** | | | | | | | | | | | | |
| Reform of regulatory framework towards facilitating an increased participation of the private sector within the off-grid energy sector | ☐ | Yes / No | No | No | Yes | Yes | Yes | Yes | Yes | Annual | Project Progress Reports | Energy Cell |
| Number of consumer awareness activities implemented | ☐ | Number | 0 | 2 | 4 | 6 | 8 | 10 | 10 | Annual | Project Progress Reports | Energy Cell |
| MTPTC structures reinforced and supervisory structure created to oversee project related investments | ☒ | Yes / No | No | Yes | Yes | Yes | Yes | Yes | Yes | Annual | Project Progress Reports | Energy Cell |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Component 2: Off-Grid Electrification Sub-Projects** | | | | | | | | | | | | |
| Investments opportunities presented to FI | ☐ | Number | 0 | 5 | 10 | 20 | 25 | 30 | 30 | Annual | Project Progress Reports | FDI/Fund manager |
| Number of Working Capital / Equity / Loan Investments provided for direct sales of lanterns, individual SHS and renewable energy systems for rural businesses | ☐ | Number | 0 | 0 | 3 | 6 | 9 | 12 | 12 | Annual | Project Progress Reports | FDI/Fund manager |
| Number of female jobs and female-headed (micro-) enterprises created | ☐ | Number | 0 | 0 | 0 | 100 | 500 | 800 | 1,000 | Annual | Project Progress Reports | Energy Cell |
| Number of products having benefited from a quality premium grant | ☐ | Number | 0 | 0 | 6,000 | 30,000 | 90,000 | 150,000 | 150,000 | Bi-Annual | Project Progress Reports | Fund manager |
| Installed capacity for power generation (MW) | ☒ | Number | 0 | 0 | 1 | 3 | 7 | 10 | 15 | Annual | Project Progress Reports capturing data collected from enterprises | Energy Cell based on /Fund Manager data |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Component 3: OGEF management, OGEF's operations pipeline development, and project implementation support** | | | | | | | | | | | | |
| Number of awareness building activities towards further pipeline development held | ☐ | Number | 0 | 4 | 8 | 10 | 10 | 10 | 10 | Annual | Project Progress Reports | Fund manager |
| Total number of entrepreneurs provided with technical assistance towards the launch or expansion of a business | ☐ | Number | 0 | 0 | 6 | 9 | 12 | 15 | 15 | Annual | Project Progress Reports | Energy Cell based on Fund manager data |
| **Citizen engagement and beneficiary feedback** | | | | | | | | | | | | |
| Actions are taken in a timely manner in response to beneficiary feedback from phone surveys and household visits | | No/yes | -- | -- | Yes | Yes | Yes | Yes | Yes | Annual | Project Progress Reports | Energy Cell |
| Percentage of users reporting systems working according to the advertised performance | | n/a | n/a | 60% | 80% | 80% | 80% | 80% | 80% | Annual | Project Progress Reports | Energy Cell (based on cell phone surveys) |

**Description of indicators**

| **Project Development Objective Indicators** | |
|---|---|
| Indicator Name | Description (indicator definition etc.) |
| People provided with new or improved electricity service | Number of people that were provided with access to electricity in the household. The indicator uses the number of systems or connections provided to individual households, multiplied by the average number of people per household. |
| Number of enterprises that started and/or scaled up their off-grid electrification activities with assistance of the Project | This indicator measures the number of enterprises (new or existing) that have either (i) started to provide off-grid energy services and products or (ii) scaled-up their activities towards providing off-grid energy with assistance of the Project. Assistance includes having benefited from both financial and non-financial resources provided under the Project. |
| Private and commercial financing leveraged through CTF funding (US$ million) | Private and commercial financing leveraged under the Project. This includes additional external commercial investments, user payments as well as private equity and additional lending to off-grid energy businesses supported by OGEF. |
| Tons of GHG emissions reduced or avoided annually ($tCO_2eq$) | This indicator measures the amount of GHG emission displaced or avoided from the provision of off-grid electricity annually, as well as over the CBA lifetime of the Project-supported systems. |
| **Intermediate Results Indicators** | |
| **Component 1: Enabling Environment and Program Oversight** | |
| Reform of regulatory framework towards facilitating an increased participation of the private sector within the off-grid energy sector | This indicator assesses changes to the regulatory framework with particular attention to (i) the creation of a level-playing field for renewable energy and fossil fuels alternatives (e.g. through import/VAT duty exemptions) and (ii) to the development of a clear regulatory framework for municipal grids, including licensing, tariffs and interface with grid. |
| Number of female beneficiaries | Number of women and girls in the household that were provided with off-grid electricity, and female entrepreneurs or employees having benefitted from OGEF funding. |

| | |
|---|---|
| Number of consumer awareness activities implemented | Activities aiming at increasing awareness of prospective off-grid renewable energy customers on the benefit, opportunities and quality considerations associated with the purchase of off-grid energy products and services. |
| MTPTC structures reinforced and supervisory structure created to oversee Project related investments | This indicator assesses the strengthening of MTPTC's Energy Cell (notably in terms of staff) and the creation of a well-functioning and adequately staffed supervisory structure overseeing Project investments as well as being in charge of the day-to-day management of the Project. |
| **Component 2: Credit facility** | |
| Investments opportunities presented to FI | Number of investment opportunities presented to Financial Institution for consideration. |
| Number of Working Capital / Equity / Loan Investments provided for direct sales of lanterns, PV kits, individual SHS and renewable energy systems for rural villages and businesses | Number of Working Capital / Equity / Loan investments provided to private sector entities towards the development of their activities related to lanterns, individual SHS and renewable energy systems for rural businesses. |
| Number of female jobs and female-headed (micro-) enterprises created | This indicator estimates the number of female jobs and female-headed (micro-) enterprises in the off-grid electricity sector that were created thanks to the Project support. This includes (i) entrepreneurs and female staff in the energy service companies provision supply chain (to be reported by enterprises benefitting from the Project support), and (ii) female entrepreneurs and female employees in the retail business of off-grid electricity solutions (to be reported by enterprises benefitting from the Project support). |
| Number of products having benefited from a quality premium grant | Number of Lighting Global certified pico-PV products that have benefitted from the quality premium grant made available under the Project. |
| Installed capacity for power generation (MW) | Installed capacity for power generation calculated in MW. |
| **Component 3: Fund management, pipeline development and technical support** | |
| Number of awareness building activities towards further pipeline development held | Number of awareness building activities directed at existing or prospective entrepreneurs towards the development of a larger pipeline of companies seeking support from the credit facility provided under the Project. |

| | |
|---|---|
| Total number of entrepreneurs provided with technical assistance towards the launch or expansion of a business | Number of entrepreneurs provided with technical support towards the launch or expansion of their off-grid energy related activities. |
| **Citizen engagement and beneficiary feedback** | |
| Actions are taken in a timely manner in response to beneficiary feedback from phone surveys and household visits | The Project will carry out annual household surveys (by cell phones and follow up home visits where required), which will cover both beneficiaries and non-beneficiaries. The issues found in the phone/household surveys are communicated to service providers and the Advisory Committee and FDI/the Fund Manager, which prepare and execute a plan for addressing the key issues. Feedback, Responses, and Action are monitored and reported on every 6 months. |
| Percentage of users reporting systems working according to the advertised performance | Percentage of respondents in the representative phone-based survey of beneficiaries who report their off-grid systems are working according to the advertised performance. |

## Annex 2. Detailed Project Description
## Haiti Modern Energy Services for All Project

### A. The Project Development Objective

1. The Project Development Objective (PDO) is to accelerate private sector-driven, renewable energy-based off-grid electrification in rural and peri-urban areas of Haiti. "Off-grid electrification" is understood as electrification of households, businesses or institutions with decentralized solutions not connected to the EDH grid. Target areas are rural towns, villages and peri-urban areas not served by EDH.[26]

2. Renewable energy-based off-grid electricity services will comprise a variety of technologies and business models, including individual systems, such as solar lanterns and solar kits/home systems, and village-based systems, such as mini- and micro-grids, powered by renewable energy or hybrid sources (renewables – such as solar PV, wind, biomass, micro-hydro – with a diesel back-up and/or battery storage). Private sector is understood to comprise also NGOs and community-based organizations/cooperatives.

### B. Approach

3. The Project objective will be achieved through improving the enabling environment for off-grid electrification and establishing an Off-Grid Electricity Fund (OGEF), which will provide equity, loans, grants and TA to businesses engaged in the provision of off-grid electricity services in Haiti.

4. The Project aims to accelerate market development. It will support a variety of business models and technologies to serve different market segments, from renewable energy solutions for agri-businesses and other productive uses to basic lighting solutions for the poorest. Through leveraging local renewable energy sources and local entrepreneurs, the Project will create a sustainable market for off-grid electricity services which will reduce the country's dependency on imported fossil fuels, such as diesel and kerosene, create jobs, improve productivity, alleviate poverty and improve gender equality.

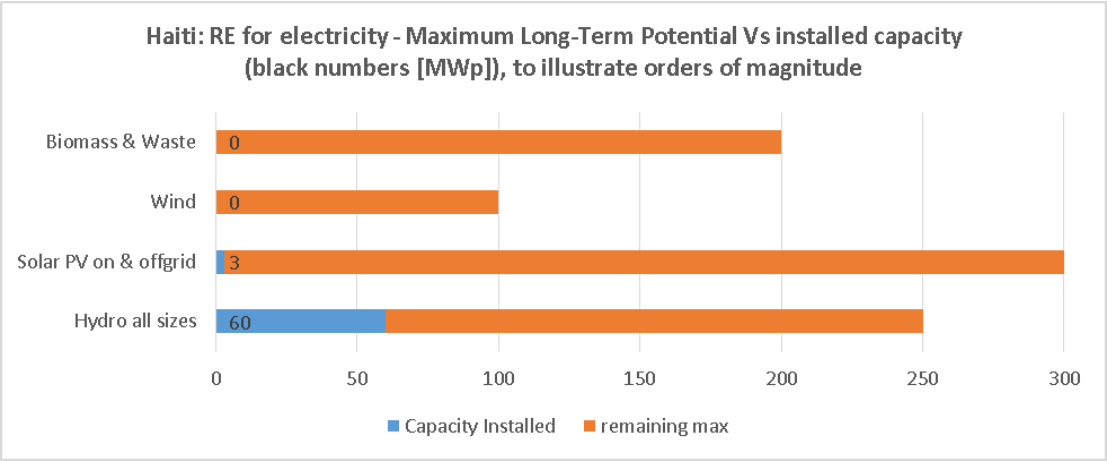
5. The Project will be based on the following key building blocks:

#### (i) The Project will support the use of locally available renewable energy.

6. Haiti has excellent, but largely untapped, RE potential, including hydro, biomass, wind and solar, as confirmed by recent studies. See Figure A2.1. However, despite such abundance, progress in harnessing it has been slow.

[26] The project targets households currently not served by EDH, although many of these off-grid households are likely to be electrified in a 10-20 year horizon. The program design takes this into account by supporting solutions that are (i) cost-effective in the short to medium term with short payback times and/or (ii) are grid compatible, e.g. mini-grids can be connected to the EDH grid once it arrives. This approach will allow Haitian households and businesses to reap the benefits of access to modern energy services years or decades earlier than the grid can expand.

Figure A2.1 Haiti Renewable Energy Potential




Source: GOH: SREP Haiti Investment Plan, 2015.

7. The Project will in particular leverage abundant solar energy, which has the advantage of (i) being available everywhere in Haiti, and (i) being modular – therefore possible to use in any quantity – from solar lanterns to village-size systems. By leveraging local renewable energy resources, the Project will reduce the country's dependency on imported fossil fuels (diesel and kerosene).

**(ii) The Project design leverages international best practices with what works best locally.**

8. The Project has analyzed lessons from the past and existing off-grid operations worldwide and compared them with the existing market conditions and emerging business models in Haiti (see section below).

9. The last decade, in particular, has seen tremendous developments in off-grid electrification, which changed some of the past paradigms. As a result, there is now a broad spectrum of proven electrification options available to satisfy the varied needs, geographic distribution, spending patterns and capacity to pay of non-electrified populations around the world. Many of these new options have now become, or are on the verge of becoming, financially viable in specific market segments at sufficient volumes to attract a critical mass of private sector players ("off-grid parity"). Even for the poorest segments of the population, small solar lighting solutions (which usually come with a much-desired phone charger) are in most cases less expensive than their base case alternative (kerosene, candles, and traditional flashlights). These off-grid electrification technologies are now also emerging in Haiti. See Box A2.1.

10. The Project is designed to support the emerging off-grid entrepreneurs in Haiti, with the flexibility to accommodate varied technologies and business models serving different segments of the population, including the poorest.

Box A2.1. Emerging off-grid renewable energy business models

Larger rooftop solar PV systems for businesses. Several PV companies are now selling rooftop PV systems (and increasingly also offering more innovative services, such as leasing) to larger industrial and commercial clients in the metropolitan areas to hybridize their diesel generation. These industries and businesses have intentionally isolated themselves from the unreliable EDH grid and self-generate with diesel gen-sets, which, however, substantially increases their production costs. Solar PV can reduce their energy costs and thus improve their competitiveness. There is currently about 3MW of solar PV installed capacity in Haiti, mostly by industries, businesses and larger public service institutions, such as hospitals. While these investments currently target the more lucrative urban market, eventually rural enterprises are also likely to benefit from this newly developing industry. Several potential, cost-effective applications of renewable energy for agri-businesses are already emerging, such as solar water pumping for drip irrigation, solar refrigeration for agri-businesses and rural stores, and RE applications for agriculture processing to displace more expensive diesel. A joint study with the Agriculture Global Practice is being launched to understand better the specific energy needs and constraints of rural agri-businesses and other rural SMEs.

Solar lanterns and other pico-PV Products. Paradoxically, the 2010 earthquake served as a catalyst for pico-PV diffusion in Haiti: With much of the electricity infrastructure destroyed, solar lanterns were brought into the country fast and in large scale, as a part of the post-earthquake assistance (including through an earlier World Bank project). Many of these lanterns, originally used by displaced people in the camps, have eventually found their way to rural areas and have in effect triggered demand for similar products. The penetration of solar lanterns and small kits is high in international comparison. More than 15 percent of Haitian households claim to own a solar lantern or a small solar kit, although many lanterns are used as a back-up to unreliable grid supply (ii) Development/Digicel survey, 2014). Too many of the solar lanterns introduced into Haiti since 2010, however, were and are of poor quality. Although over 150,000 high quality (Lighting Global verified) solar lanterns have been distributed by four leading distributors, this represents still a small share in the overall solar lantern penetration. The influx of low quality products has led to market spoilage and product deception at the consumer level, which keeps out suppliers of more solid quality products and keeps up the subjective risk premium of potential customers. All high quality lantern distributors report their sales slowing down due to the growing customer distrust of the technology.

Pay As You Go (PAYG)/Distributed Energy Services Company (DESCO) model. The PAYG business model (also referred to as DESCO model) has successfully developed in East Africa in the last five years and is now expanding to other geographies. There are many variations of the PAYG models, but the basic principle is the same. PAYG companies install rooftop solar PV systems in households or small businesses. Using mobile communications and locking mechanisms (such as meters with GSM chips) to remotely control the energy assets, PAYG companies can accept small payments every day, week or month from customers who can pay with mobile money. This model allows off-grid energy companies to service thousands of customers – or hundreds of thousands of customers – profitably, once reaching a certain scale. It also makes solar off-grid products more affordable – it enables customers to receive more energy services than they could afford on a cash retail purchase basis. PAYG companies in East Africa are reported to serve more than a million households now. In Kenya – the birthplace of this business model – products sold on a PAYG basis now account for over a quarter of quality-verified products. Some 700,000 solar home systems are estimated to have been sold through PAYG platforms.

Smart village grids. The falling costs of renewable energy technologies, especially solar PV, the advances in pre-paid metering and smart grid technologies, the already falling costs and the prospects of future breakthroughs in the energy storage technologies, and the continued improvements in energy efficient appliances led to a renaissance of micro-grids around the world as a promising solution for isolated but concentrated populations, such as small rural towns, especially where productive loads can be found. The "smart" technologies allow several innovations in micro-grids that reduce both their upfront costs (lower initial installed capacity needed due to better balancing of supply and demand); and O&M costs (cheaper and more effective metering and customer care). Several "smart" micro-grid companies have already started or are designing pilots in Haiti, using multiple RE resources (solar PV, biomass and wind). The most advanced, EarthSpark, has completed the first pilot and is successfully operating a 400-household solar PV/diesel hybrid micro-grid in Les Anglais; a similar biomass-powered Limyè Pa micro-grid serving 70 households has started operations in 2015. Both organizations have country-wide scale-up ambitions.

**(iii) The Project will provide affordable solutions, and support gender benefits.**

11. Haiti's rural poor spend a very large share of their total household budget on basic lighting and energy services for very poor service quality and quantity at high unit costs. According to Project preparation household surveys,[27] the departmental averages for rural households are between US$10 and US$20 a month – which is high by international comparison. These high costs are not only a burden on the rural household budgets, but they are also constraining growth and productivity of agri-businesses and other rural SMEs.

12. A range of renewable energy-based solutions exist today that can provide a much superior level of service at price points lower than what the Haitian consumers (both households and businesses) pay today. However, most Haitian households and businesses cannot afford the high upfront costs of these products. To increase affordability, the Project will (i) make sure that a range of system sizes are offered, including basic lighting kits for the poor, and (ii) support Pay-As-You-Go solutions, which allow households to spread the payments for the off-grid products and services over time. See Box A2.1.

13. The Project will have gender-differentiated benefits, tracked as part of Project implementation. Providing household and community electricity access can promote gender equality and women's empowerment, provide new employment opportunities for women, increase the efficiency of productive activities, and improve health and education for women and girls. Most of these gender benefits accrue because women tend to spend more time at home, initiate economic activities that are often in the vicinity of their homes, and are responsible for household chores that can be carried out more productively with electricity. However, available evidence also shows that these benefits are not always automatic. Complementary actions are often needed to ensure that benefits indeed accrue to women, and the Project is therefore integrating specific actions to support positive impacts of electrification on women as both consumers and suppliers of energy. In particular, the Project will build on several already emerging good practices about (i) targeting off-grid energy solutions to women's needs, and (ii) the integration of women in the supply chain. See Annex 6 for more details.

**(iv) The Project will address the key risk perceptions for both the user and the investors/financiers.**

14. The proposed market transformation approach aims at reducing key risk perceptions, which are currently constraining market growth on both the demand and supply side. Presently, the off-grid energy market is inefficient because almost all market agents lack (i) information on the actual quality, benefits and lifetime of the relatively new off-grid RE technologies and business models that the Project will diffuse, as well as (ii) access to financing for those.[28] Table A2.1. identifies

[27] Both ECVMAS (2012) and Digicel/iiDevelopment survey (2014) carried out for the preparation of the SREP Investment Plan and CTF project confirmed similar data. Details are described in the economic analysis in Annex 7.

[28] As a result, (i) the subjective, perceived risk of users or suppliers investing in these RE solutions is higher than objectively necessary (which increases the equity risk premium), and (ii) the same is true for debt providers (who may therefore not lend at all to households or retailers, or in turn apply inflated subjective risk premiums to the debt) so that (iii) the resulting pre-project weighted average capital costs (WACC) are unnecessarily high. The resulting higher discount factor (which is applied implicitly

the individual user and investor risks.

15. The objective of the Project is to build sustainable off-grid markets, which will continue growing even after the Project's end date. By demonstrating the actual lifetimes and benefits of the novel RE options, the Project reduces the risk perceptions, and thus subjective WACC of all market players, so that after the Project exit, even larger volumes can be achieved. In addition, the larger volume allows leveraging of fixed costs (such as rural branches or a PAYG software) over more sold units (economies of scale), which further reduces post-Project sully-loaded unit costs.[29]

Table A2.1. Project responses to individual user and investor risk perceptions

| Market challenge | Project response |
|---|---|
| User perceptions: "Large upfront payments for renewable energy products are not affordable and/or too risky (what if the products do not work?)." | • Promoting a range of products and services for different market segments with different capacities to pay<br>• Increasing market penetration and consumer awareness of high quality off-grid electricity/lighting products<br>• Promoting service-oriented approaches to help overcome barriers of upfront payment and risk perception |
| Investor/financier perceptions: "Investments in renewable energy in Haiti is too risky due to lack of clarity on policy and regulatory environment, unfair competition from fossil fuels, and uncertainty about market prospects." | • Demonstrating and growing businesses with profitability and scalability potential<br>• Reducing investor risk by creating a favorable policy and regulatory environment<br>• Leveling playing field with fossil fuel alternatives |

## C. Results

16. The Project is expected to result in an increased market penetration of high quality solar off-grid products from the current 19 percent to 40 percent of the estimated total market potential; and of mini-grid connections from 3 percent to 25 percent by year 6 of the projects, resulting in electricity access for over 500,000 people (of which at least 50 percent are women).

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or explicitly when estimating the net benefits of investing in such a new alternative) affects RE solutions much more than other rural energy options, because the former are "front loaded". Therefore, demand and supply for these superior off-grid RE technology solutions don't meet in the present "without project" situation – they are "locked out" by the prevalent market inefficiencies. In addition, the very few well informed users who already may have a high WTP for the new products don't suffice to allow suppliers to sell at a minimum volume needed for market entry.

[29] To give a simple example, a given rural household may well (and rationally) not believe today the claims of a new PV off-grid retailer that his novel lantern or PV kit has a 5 year lifetime - and therefore this users will decide to buy instead a low-quality solar lantern at half the price, even though it lasts only half a year. After the CTF Project, this same user would subjectively (and usually intuitively, not explicitly) weigh the 5-year lifetime with a higher probability, plus he might be able to borrow from a local MFI or lease from a DESCO if needed - so this time, the very same user would buy the product with the higher net benefit.

## D. Project Components

17. The Project will have the following three components as summarized below:

(i) Enabling Environment and OGEF Oversight;
(ii) Off-grid Electrification Sub-projects; and
(iii) OGEF Management, Operations Pipeline Development, and Project Implementation Support.

### (i) Component 1: Enabling Environment and OGEF Oversight (CTF US$1.43 million)

18. This component will be implemented by MTPTC. The Project will provide support to MTPTC to (i) strengthen the regulatory and policy framework governing off-grid electrification; (ii) provide capacity building and technical support to key stakeholders; and (iii) improve inter-institutional coordination, and support the Advisory Committee to conduct general oversight of the OGEF operations.

19. To achieve the desired off-grid electrification acceleration, it is essential to improve the business environment. While minimum conditions for operating off-grid businesses in Haiti exist today, as demonstrated by the vibrant (yet low quality) solar lantern market and emerging innovative business models, their scale-up is constrained by a number of factors. Various consultations carried out for the preparation of the CTF and SREP Projects have yielded similar results in terms of the most frequently cited barriers, which (apart from access to finance) include: (i) lack of a consistent policy and regulatory framework; (ii) market spoilage by the penetration of low quality products; (iii) lack of consumer awareness of modern renewable energy technologies (beyond small solar lanterns); and (iv) skill constraints (at all levels – from RE professionals to qualified technicians in rural areas).

20. The proposed component will tackle these barriers through the following efforts:

- Creating a level-playing field for renewable energy versus fossil fuels alternatives (e.g. through supporting Government to modify import duty/tax regime);
- Development of a clear regulatory framework for municipal grids, including licensing, tariffs and interface with the grid;
- Setting quality standards for systems applicable for the Project support;
- Public and community outreach and specifically carrying out community/consumer awareness campaigns about renewable energy benefits, opportunities, quality considerations, energy efficiency and energy usage – including for productive uses, and good environmental practices, and building local ownership and support for the Project among the communities;
- Supporting capacity and skill development, particularly vocational training for solar PV technicians in rural areas; as well as training related to environmental and social safeguards;
- Supporting gender mainstreaming in Project activities through identifying and responding to women's energy needs;

- Supporting the use of energy efficient appliances and other energy efficiency measures (e.g. in micro-grid management); and
- South-South exchanges.

**(ii) Component 2: Off-Grid Electrification Sub-projects (CTF: US$12 million, SREP US$3 million)**

21. Component 2 will support the Off-Grid Electricity Fund's (OGEF's) provision of financing to energy enterprises providing off-grid electricity services ("eligible beneficiaries") to carry out "off-grid electrification sub-projects" – investments in off-grid electrification activities.

22. OGEF is designed to provide flexible financing in the form of equity, loans and limited grant financing modalities,[30] to meet the investment needs of energy enterprises serving different off-grid consumer segments: large and small; local and international; providing lanterns, solar kits/home systems or micro-grids. This flexibility is essential at this early stage of the development of the Haitian market, where there is no prevailing business model, but where various business models co-exist, serving different market segments. As the off-grid market develops, it is possible that some businesses will also begin to manufacture or assemble off-grid products or product components in Haiti, and such investments (with additional benefits for the Haitian economy and jobs) will also be eligible for OGEF support.

23. OGEF will be created as a special program of the Industrial Development Fund (*Fonds de Développement Industriel* – FDI). FDI will enter in a Partnership Agreement with an experienced International Fund Manager to jointly manage OGEF. CTF funds are expected to be disbursed during the Project life; however, OGEF, is expected to have duration of 11 years, and will have the ability to make additional investments using proceeds from initial investments (liquidated equity holdings and repaid loans) or from any new capital rose from other sources. OGEF will be initially funded by CTF resources, but it is anticipated that other financiers may join in the future.

24. OGEF will finance equity investments, loans and limited grant funding for off-grid energy businesses. The CTF funds will be used for equity and/or loans. The parallel SREP Project will add US$3 million grant funding for OGEF for off-grid energy businesses. These will include: (i) grants for quality-verified solar products to support penetration of higher quality products on the Haitian market; (ii) grants for piloting viable, scalable and sustainable business models; and (iii) grants for growth of early stage off-grid businesses with viable business plans.

25. Operating Guidelines will include details on the project/sponsor eligibility, guidelines for the evaluation of business plans, legal and financing terms for the individual business lines, and the governance structure for the Fund. See Annex 3 for more detail on implementation arrangements.

26. The OGEF will be structured according to the following lines – with flexible allocation of funds across these lines depending on the market demand:

[30] In the future, guarantees will also be considered as an eligible modality, particularly in the later years of OGEF, when there will be more potential to attract commercial bank co-financing. Inclusion of guarantees among eligible financing modalities will be considered during the mid-term review.

*(a) Equity and grant financing for DESCOs, including municipal grids.*

27. DESCOs provide energy services to households with RE solutions, typically rooftop solar PV systems, for which they receive payments from the customer, typically through a mobile money network, most widely referred to as pay-as-you-go (PAYG). See Box A2.2

**Box A2.2. Pay As You Go (PAYG) / Distributed Energy Service Company (DESCO) model**

The PAYG business model (also referred to as DESCO model) has successfully developed in East Africa in the last five years and is now expanding to other geographies.

There are many variations of the PAYG models, but the basic principle is the same. PAYG companies install rooftop solar PV systems in households or small businesses. Using mobile communications and locking mechanisms (such as meters with GSM chips) to remotely control the energy assets, PAYG companies can accept small payments every day, week or month from customers who can pay with mobile money.

There are two basic variations of the PAYG model: (1) The 'lease finance' variation where customers lease the systems until they repay their value, when the ownership passes to them or (2) the "services", 'utility', 'pay-per-use', 'pure lease' variation, where a customer pays either for the time it uses the assets or based upon the energy services (light, phone charging, radio, TV etc.) utilized. In either variation, the PAYG companies monetize the energy assets provided to the customer's use over time.

This model allows off-grid energy companies to service thousands of customers – or hundreds of thousands of customers – profitably, once reaching a certain scale. It also makes solar off-grid products more affordable – it enables customers to receive more energy services (lights, mobile phone charging, TVs, fans, radios) than they could afford on a cash retail purchase basis. The approach also supports confidence-building – customers do not need to commit themselves to significant purchase amounts until they are satisfied that the systems work properly and meets their needs.

PAYG companies in East Africa are reported to serve more than a million households now. In Kenya – the birthplace of this business model – products sold on a PAYG basis now account for over a quarter of quality-verified products – some 700,000 solar home systems are estimated to have been sold through PAYG platforms.

28. Two more Haitian off-grid energy companies (Emote and DigitalKap) are now also introducing a PAYG product to the market. However, Haiti's relative isolation from the main markets in Africa and South Asia, as well as a number of domestic barriers (high import duties and VAT, high level of market spoilage by low quality products, difficulty to access financing, etc.) slow down market development. The Sub-component 2c aims at unlocking the enormous market potential for DESCOs to provide solar home system and pico-PV solutions to households and microenterprises, using new technologies and business models, such as PAYG.

29. OGEF will invest equity and grants in DESCO companies in Haiti—in line with emerging best practices from the more advanced off-grid energy markets in East Africa and South Asia—which have shown that a combination of equity and grants is the most effective way to boost the early stage DESCOs. This business line will therefore be used for financing equity, start-up grants and results based grants for DESCOs. Results-based grants will be linked to the equity investments (will be matched by at least an equivalent amount in equity) and will aim at incentivizing early stage results necessary for a successful scale-up. See Box A2.4. Small start-up grants will be available to launch new DESCOs.

30. Haiti is beginning to catch up with these trends. The relatively high penetration of solar lanterns in Haiti (about 15 percent) shows that Haitians are appreciating these new technologies. Most of the lanterns on the market, however, are not quality certified and do not provide sustainable access. More recently, several companies have started to experiment with PAYG solutions. Three Haitian companies are currently in the process of launching, piloting or scaling

up PAYG business models. Re-volt is most advanced, having already piloted its products (developed in partnership with d.light – major global pico-PV manufacturer), and is now scaling up this business model across Haiti (see Box A2.3).

**Box A2.3. Re-Volt - service approach with individual PV systems**

Re-Volt, an innovative start-up "off-grid utility", aims at providing a highly efficient Direct Current (DC), pay-as-you-go, solar-powered, energy service to Haiti's residents at affordable prices. Re-volt was conceived in 2012 and the first two years were spent refining the concept and visiting successful international programs of similar intent (OMC in India, Off-Grid Electric, M-Kopa, M-Power, and d.light Design in East Africa). In 2014, Re-volt began piloting the program in Haiti and after seeing great success during the pilot phase have since entered into a commercial roll out plan. To-date, Re-Volt has sold over 5,000 products. In 2016, 2,600 units were sold and 2017 projections are to sell 3,000.

Re-Volt has a Memorandum of Understanding signed with Digicel, the main telecommunications provider in Haiti, to integrate with their TchoTcho mobile payments system and use their Machine-to-Machine (M2M) SIM cards in the Re-Volt Systems to allow monitoring of the performance of the units and to track the amount of energy credit purchased and used.

Re-Volt differentiates itself from common Solar Home System businesses by providing a service rather than a "box" – Re-Volt customers are guaranteed 98 percent availability of their systems, have access to a 24/7 call center, will benefit from promotions and upgrades, and will get access to highly efficient DC powered appliances and devices. Currently, Re-Volt offers a 2-year lease of the systems, after which the system is repaid and passed on to the customer's ownership.

The initial Re-Volt product is a solar powered "DC Energy System" that features 3 LED light fixtures and a charging plug for mobile phones and other small device. As a result of demand, Re-Volt has plans to release a larger system with capacities to power a TV in 2017. Post-installation customers will receive a lifetime "utility like" service from the DC Energy Systems. Partnership with Digicel provides an opportunity to offer integrated electricity and telecom services.

How it works: Customer sign up to the service at one of many "Re-Volt Power Agent locations" or are approached on a door-to-door basis by Re-Volt Agents. Re-Volt will charge a small deposit or "connection fee" which includes the installation of the System and basic training on how to use it efficiently. Currently this cost is set at US$10.

Once the system is installed at the home of the customer, they are able to "top up" the credit on their system in a similar fashion to buying pre-paid credit on a mobile phone.

Re-Volt as a company expects to grow significantly in the next 5 years. Based on their initial estimates, the company sees potential for up to 150,000 units to be installed during the first 5 years of operation in Haiti. By year 5, Re-Volt expects production costs to decrease and revenue per user per month to increase as additional services associated to the off-grid system are launched, such as Internet/communications, entertainment, refrigeration, and a range of other DC appliances.

31. Two more Haitian off-grid energy companies (Ekotek and DigitalKap) are now also introducing a PAYG product to the market. However, Haiti's relative isolation from the main markets in Africa and South Asia, as well as a number of domestic barriers (high import duties and VAT, high level of market spoilage by low quality products, difficulty to access financing, etc.) slow down market development. The Sub-component 2c aims at unlocking the enormous market potential for DESCOs to provide solar home system and pico-PV solutions to households and microenterprises, using new technologies and business models, such as PAYG.

32. OGEF will invest equity and grants in DESCO companies in Haiti—in line with emerging best practices from the more advanced off-grid energy markets in East Africa and South Asia—which have shown that a combination of equity and grants is the most effective way to boost the

early stage DESCOs.31 This business line will therefore be used for financing equity, start-up grants and results based grants for DESCOs. Results-based grants will be linked to the equity investments (will be matched by at least an equivalent amount in equity) and will aim at incentivizing early stage results necessary for a successful scale-up. See Box A2.4. Small start-up grants will be available to launch new DESCOs.

33. The same formula will be used to support commercial investments in municipal (pico-,micro- and mini-) grids. The emerging Haitian micro-grid business model is based on the municipal public-private partnership (PPP). In this model, Government/municipalities would subsidize the distribution infrastructure, which will be built according to the technical specifications, and will hence allow its interconnection with the EDH main grid when it arrives. The private sector will invest in generation and commercialization of electricity and will operate the mini-grid as a municipal concession. In particular, as for the starting point for the CTF intervention, there are over 30 existing municipal diesel grids that have been built according to the EDH grid specifications but are not operational due to the lack of fuel/generation equipment. These systems can be hybridized with renewable energy and operated as a concession by the private sector on a profitable basis.32 Several micro-grid companies are already present in Haiti with ambitious scale-up plans. See Box A2.7 for an example of EarthSpark, which has successfully piloted its first smart micro-grid, and is currently planning an expansion to 80 villages by 2020.

**Box A2.4. Why equity and results-based grants**

Global investment experience has demonstrated that equity investors bring a financial rigor and discipline to business development and growth that is absent in grant funding. Business modeling, measuring financial performance (versus measuring impact performance) has been critical to the current success of the DESCO sector in Africa. Key to this is investors' very real financial stake in the success of the companies invested in. Private sector experience has shown that this is true for equity investment managers as well as pure investors. Even potential upside returns alone (where the manager does not face risk of loss), can lead to diligent, professional management.

At the same time, experience with DESCOs in Africa has shown that a portion of start-up capital is best provided as a grant. Provision of grant funding minimizes dilution of the entrepreneurs' ownership, which will bolster their incentive to perform well. Recently, "Results-Based Financing" (RBF) has been increasingly favored as an approach to effective grant making, including in the energy access sector. While RBF may be effective in ensuring that donor funds are not disbursed unless the targeted result is achieved, the after-the-fact character of these disbursements means that the grants do not finance the achievement of the targeted result. Thus, typical RBF may help a well-capitalized business grow by reimbursing its expenditure of capital, but it will not help capital-hungry growth businesses develop new markets.

OGEF will utilize a hybrid RBF approach (H-RBF). Under the H-RBF approach, grant capital will be disbursed on a "just-in-time" basis. For example, if a DESCO is about to order more products to launch a new market, or a mini-grid business is about to start construction of a new grid, OGEF would disburse the H-RBF capital as needed for those investments, as long as the businesses demonstrate that they have met key conditions for the successful scale-up (provided in tranches against key milestones reached). If the company fails to meet the H-RBF objectives, it could be disqualified from further grants.

[31] In spite of recent robust growth of the DESCO sector in Africa, purely commercial venture capital investors are not prepared to provide seed and very early venture capital investments to the sector without some grants or other support to partially de-risk their investment.

[32] A study is underway to document the state of infrastructure in each of these municipal grids and assess the feasibility of its hybridization and commercial operation of the micro-grid.

*(b) Medium-term loans for DESCOs, including municipal grids*

34. While an equity/grant combination is usually needed to start a new off-grid venture, the expansion of the business will require debt financing, ideally in the local currency (although both US$ and local currency loans will be offered by OGEF), of likely maturity of 3-6 years, which will allow companies to pre-finance equipment and recover investment through fees/tariffs over time. This is currently the main financing bottleneck of the fast developing DESCOs in Africa and elsewhere, and it is, therefore, important to integrate this business line in OGEF to support off-grid businesses growth. The loans will be provided on commercial terms. As debt financing will likely be the main source of financing of companies in the expansion phase, this business line will also start creating evidence of viable business opportunities for local commercial banks. Local commercial banks are envisaged to become the main funder of these companies after the closure of the proposed OGEF fund.

*(c) Working capital and results-based grants for premium quality solar lanterns*

35. Experience from Haiti, as well as other countries, shows that local solar lantern distributors (mostly SMEs or NGOs) face problems with access to short-term working capital, which would allow them to (i) import quality products at greater quantities; and (ii) provide better financing terms to their retailers and/or end users. Access to working capital would therefore be provided by OGEF to enable a faster market penetration for solar lanterns/solar kits. Design of this activity will draw on the recent successful experience of the IDA Electricity Network Reinforcement and Expansion Project (ENREP) in Ethiopia. See Box A2.5.

**Box A2.5. Ethiopia's successful financing experience with working capital**

Since 2012, the IDA-Project Electricity Network Reinforcement and Expansion Project (ENREP) targets the private sector led development of stand-alone renewable energy and energy efficient products in Ethiopia. Past interventions in the sector in Ethiopia had revealed that the importers of Solar Lighting Products were not able to secure working capital loans and were also not able to secure foreign currency (National Bank of Ethiopia regulations) needed to place orders of these products overseas. In addition, a major constraint for Private Sector Enterprises (PSEs) interested in raising project financing or working capital type of loans has been the requirement from Ethiopian financial institutions to secure up to 125 percent of the loans as collaterals, especially for projects with movable assets.

The design of the financing mechanism under ENREP creates a market-driven, private-sector led approach and addresses the following main issues to enhance the market for renewable energy in Ethiopia: access to finance at relatively lower cost of capital, access to foreign currency, and improvements to the general lending environment (e.g. fair-market collateral values). As a result, ENREP's design entails a US$20 million credit line (as a Financial Intermediary Loan) for renewable energy and energy efficiency products administered by the Bank of Ethiopia. There are no limitations placed on the lending type (either PSE or MFI/HH lending), or the technologies/products being supported, so long as they are of approved quality standards (e.g. Lighting Global) under the RE/EE initiatives of the Government.

As to date, ENREP's credit line has been a huge boost to PSEs: The credit line has already resulted in the local sale of 248,093 Lighting Africa quality verified solar portable lanterns (15,000 target in PAD) and is on track for surpassing 2 million products by end of 2016.

As such, ENREP demonstrated demand for Lighting Global quality verified products versus other technologies in market and increasing PSE and consumer demand.

36. In addition, this business line will provide a time-based limited support in the form of results-based financing (RBF) for premium quality products (Lighting Global certified). High quality lanterns and other pico/micro PV products are currently facing significant regulatory and market constraints as a result of high import duties and influx of very low quality off-grid lighting products contributing to market spoilage. To level the playing field, the Project will offer quality premium grants for Lighting Global certified pico-PV products. This will be a limited and time-bound "pump priming" support aimed at further expanding the share of high quality off-grid products in this crucial stage of market transformation in Haiti. In order to support a long-term sustainability, the grants will not exceed 30 percent of the product retail value, which currently is the amount paid in import duties and taxes, and will be phased out to 0 by the end of the Project (or faster if import duties/VAT are removed).

**(iii) Component 3: OGEF's Management, Operations Pipeline Development, and Project Implementation Support (CTF US$2.22 million)**

37. This component will cover (a) payment of the Fund Manager Fee, and (b) provision of support to FDI for OGEF for: (i) the development of a pipeline of off-grid electrification sub-projects; (ii) the carrying out of due diligence in respect to financings and off-grid electrification sub-projects, including on environmental and social safeguards screening; (iii) monitoring and evaluation of off-grid electrification sub-projects and Project activities - including citizen engagement activities as described in Section IV.B below (household phone and in-house surveys and a customer hot line); and (iv) FDI's operating costs. Sub-Component 3a) (management fees) will be implemented by MTPTC and Sub-Component 3b) (other than management fees) by FDI.

38. The pipeline and market development activities will focus on enhancing the quantity and quality of potential investments presented to OGEF and increasing the chances of success of businesses that have received an investment. In order to ensure other financiers joining in the future, FDI – together with the International Fund Manager – will actively seek to engage with potential financiers, including local commercial banks (e.g. for the provision of working capital).

**D. Emerging investment pipeline in Haiti**

39. The Project aims at both helping existing Haitian enterprises to scale-up their activities and on attracting new businesses and investors to the Haitian market. The initial Project pipeline is likely to consist of supporting the existing enterprises, with viable business models, as they are ready for a scale-up in the short term. See Box A2.1 above. Considering the magnitude of the universal access challenge in Haiti however, parallel efforts will be made to attract additional companies in the promising market segments.

40. Haiti has the benefit of a very wide range of existing off-grid electrification experiences, which seem to have mushroomed in the last five years, although many of them are small-scale or still in the pilot stage. These Projects typically have roots in diaspora efforts and have often started with NGO and/or donor support. Only recently have private-sector driven interventions been increasingly taking roots in Haiti. It is upon this foundation that the proposed Project's interventions are designed in order to support scalability of the most promising emerging business models – ideally with the potential for local value creation.

41. *Solar lanterns / pico-PV systems* play a very important role in Haiti's effort to reach universal electricity access, as they are (i) the lowest cost alternative to kerosene, and (ii) usually the first experience of rural households with modern energy services. The first wave of lantern/pico-PV products reached Haiti after the 2010 magnitude 7 earthquake, when lanterns where distributed as part of a rapid aid package. Soon thereafter, the lanterns found their way to rural areas and have since triggered demand, which has led to the private sector supplying the market. According to data from the 2014 Digicel/iiDevelopment survey, a striking 15 percent of all households in Haiti own a solar lantern or a small solar home system (although some of them use it as a back-up to unreliable electricity). This is very high in international comparison.

42. There are currently four active distributors of high quality pico-PV products (Lighting Global certified or in the certification process), which compete in Haiti's market (Palmis, DigitalKap, Re-Volt, and EkoTek). It is estimated that between 150,000 and 200,000 Lighting Global certified products have been distributed in Haiti. However, this is a small portion of the overall lantern market, which is characterized generally by low-quality, low-performing lighting products. The influx of low quality products has led to significant market spoilage and product deception at the consumer level, which is now affecting sales of higher quality lanterns. Nevertheless, active competition among the distributors has led to the innovation in business models, which constitute a good base on which the CTF Project can build.

43. *Distributed Energy Service Companies (DESCOs):* Some of the lantern companies see moving from pico- to mini- solutions as an essential way to stay competitive. Other companies are being set up with a particular objective to serve this market. See above Box A2.3 on Re-Volt, an emerging start-up, developed in partnership with Digicel, which is currently the largest cell phone operator in Haiti. Globally, companies in this market segment have experienced a very fast market growth, building on the emerging potential that "pay as you go" (PAYG) technology offers – in particular the simultaneous ability to address the issue of the high upfront payment and consumer risk aversion, while also creating opportunities for cost-effective service delivery from the business perspective. The Haitian market seems to provide enough space to support competition among 3-4 similar DESCOs.

44. Apart from households, the Project will actively pursue electrification solutions for rural industries and businesses, which would typically consist of larger systems. These solutions can also be integrated in the DESCO model. As a starting point, synergies will be built with the Haiti Relaunching Agriculture Project to support renewable energy solutions for agri-businesses (currently typically using diesel systems) to reduce their costs and improve productivity.

45. Anecdotal evidence shows a number of potential, cost-effective applications of renewable energy for agri-businesses already taking place in Haiti, e.g. solar water pumping for drip irrigation, solar refrigeration for agri-businesses and rural stores, and RE applications for agriculture processing to displace more expensive diesel.[33] See Box A2.6.

[33] A joint study with the Agriculture GP is being launched to understand better the specific energy needs and constraints of rural agri-businesses and other rural SMEs.

**Box A2.6. Electricity for rural enterprises and agriculture in Haiti**

There are a variety of productive uses of electricity that can be advanced in rural areas of Haiti benefiting rural enterprises and agribusinesses. Here are three specific examples:

*Solar-Powered Refrigeration for rural stores*

Solar Powered Refrigerators for rural stores is a common application in the LAC Region. The energy efficient Sundanzer 12V refrigerators which uses a high quality Danfoss compressor has over a decade of track record in the region. A Productive PV (PPV) system includes one 250W solar module, mounting structure, a 20amp MPPT charge controller, and two 6V, 220Ah deep cycle batteries. A rural store can power the refrigerator, lighting and cell phone charging. Cold drinks, dairy items such as cheese and butter as well as other food items can be preserved in the refrigerator.

*Solar-powered water pumping for drip irrigation*

Solar-powered submersible water pumps can extract water from a tube well during sunny hours to fill a storage tank that is situated at an elevation. Water can then be delivered by gravity as needed by drip irrigation to water high value cash crops. The system requires no batteries as the submersible pump is powered directly by the solar array during daytime hours. There is a positive correlation between dry periods when irrigation is needed and high solar insolation. The Rotary International Foundation funded a number of these systems in Haiti for agricultural cooperatives.

*Food Processing*

Les Anglais Solar-Powered Micro-grid with Agribusiness benefits: Earthspark is a 2013 awardee of the USAID powering agriculture program. In 2015, EarthSpark expanded its existing electricity system in Les Anglais, adding solar generation and expanding smart controls, to deliver affordable, reliable, clean energy to community members, farmers and agribusinesses in a financially sustainable way. See Box A2.8. EarthSpark is assisting agribusinesses with upgrading to efficient electric mills to modernize local processing. The Project is specifically focused on highly nutritious breadfruit crops that often rot due to lack of processing. Converting the fruit to flour or chips extends the shelf life by months and significantly increases the value and *marketability*.

46. *Multi-user systems – mini-grids.* Apart from the single user solutions, Haiti has a growing experience with renewable energy mini- and micro-grids of varied sizes and technologies. Currently, three mini-grid companies are operating under this framework. EarthSpark and Sigora are private mini-grids, operating with a concession from a municipality, both with nation-wide scale-up ambitions. Separately, NRECA International has successfully piloted a cooperative model. See Box A2.7 for the description of these three municipal grids, which are to serve as prototypes for further expansion. All three mini-grids charge cost-reflected tariffs and use smart meters and energy efficiency measures to minimize the costs and maximize the service to their customers.

**Box A2.7 Smart micro-grids in Haiti**

EarthSpark, a non-profit working as an incubator for clean energy enterprises, is leading an innovative approach to delivering sustainable energy services in off-grid Haiti. They launched an exemplary micro-grid in the town of Les Anglais in 2012 and by 2015 they had expanded 24/7 electricity service to 450 households and businesses—representing the majority of Les Anglais downtown area. The grid is powered by a hybrid generation system including 90 kWp of PV capacity, 400 kWh of battery capacity and a small diesel backup generator. EarthSpark is using the SparkMeter technology as a pre-pay system that has enabled improved access for their micro-grid customers. In addition, EarthSpark is also enabling access by supporting what they call "deep efficiency" – encompassing end-use, grid management, and power generation – establishing high-quality energy services at low generation costs. EarthSpark has ambitious scale-up plans with a commitment to build 80 micro-grids in Haiti by 2020. In addition to the Les Anglais micro-grid, EarthSpark anticipates to have not only its 2nd grid (in Tiburon)

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| complete but also two more 'starter grids' launched by mid-2017. Just recently, EarthSpark received funding from USAID to build out the 'investable plan' for their next 40 grids in Haiti. Although the Les Anglais mini-grid was severely damaged by Hurricane Matthew, re-building is in process, and EarthSpark broader expansion plans have not changed. |
| Sigora Haiti serves as a premier provider of pay-as-you-go electricity and is the only private utility in the country. It's also part of parent company Sigora International's broader mission to deploy smart grid technology around the globe to those who are still without access to modern electricity. Sigora is spearheading a micro-utility business model tailored for frontier markets. The startup is designing, installing, owning and operating a system of interconnected microgrids, which are designed to scale quickly and cost-competitively. As a starting point, Sigora has been powering with 24/7 electricity the Northwestern Haitian community of Môle-Saint-Nicolas and neighboring Presqu'île with two 100-kilowatt diesel generators and a small-scale solar project. In early 2017, Sigora Haiti, raised US$2.5 million from the European Union's Electrification Financing Initiative (ElectriFI) to expand its existing grid network of 1,000 accounts serving 5,000 people, to a network that will serve tens of thousands. The funding will also go toward the build-out of a 200-kilowatt solar array. |
| NRECA International has pioneered safe and affordable rural electric service in many countries by designing and building distributed power generation-distribution systems, designing and installing renewable energy systems and creating community owned and operated sustainable utilities. In southwestern Haiti, NRECA International helped to establish the Cooperative Electrique de l'Arrondissement des Coteaux (CEAC), an electric cooperative providing member-owners in Coteaux, Port-a-Piment, and Roche-a-Bateau with affordable and reliable power. NRECA International has also partnered with Solar Electric Light Fund (SELF) to design and construct a 140kW solar-diesel hybrid system for the co-op, which serves 53,000 consumers. |

## Annex 3. Implementation Arrangements
## Haiti Modern Energy Services for All Project

### A. Project Institutional and Implementation Arrangements

1. The overall Project oversight will be with The Ministry of Public Works, Transportation and Communications (MTPTC) through its Energy Cell. MTPTC created the Energy Cell in 2012 to support energy sector development. The Energy Cell is staffed with competent renewable energy and access specialists.

2. FDI (in partnership with a competitively selected International Fund Manager (IFM) will be the key implementing agency for OGEF. MEF will be closely involved in the Project oversight through its participation in OGEF's Advisory Committee. MEF will also support inter-institutional coordination.

### B. Specific responsibilities

3. The Project has two implementing agencies: MTPTC (Component 1 and 3a) and FDI with a competitively selected IFM (Component 2 and 3b).

4. MTPTC, through its Energy Cell will implement Component 1 (Enabling Environment and Program Oversight) and 3a (OGEF Management – Payment of the Fund Manager Fee).

5. MTPTC is already implementing the IDA-financed Rebuilding Energy Infrastructure and Access Project (PRELEN Project), P127203, and the same arrangement and (strengthened) team will be used for the implementation of Component 1 and 3a. MTPTC's Energy Cell will provide technical oversight for all activities, while procurement and financial management will be carried out initially through the MTPTC Project Implementation Unit, which was established for the IDA PRELEN Project implementation. The roles and responsibilities and implementation details will be included in the Project Operations Manual, which is an effectiveness condition for the loan.

6. FDI, with a competitively selected IFM, will implement Components 2 (Off-grid Electrification Sub-Projects) and 3b (pipeline development, implementation support etc.).

7. OGEF will be a separate financing window, with its own financing, management and governance structure. It will be initially financed with CTF funds, but will allow entry of future financiers.[34] The Ministry of Economy and Finance (MEF) will sign a Subsidiary Agreement with FDI under terms and conditions approved by the World Bank, which will include, among others OGEF obligations for carrying out Components 2 and 3b and obligations of OGEF beneficiaries in carrying out their sub-projects in accordance with the Operating Guidelines and the Bank's Anti-Corruption Guidelines; OGEF reporting obligations; and the right of the Borrower to take remedial actions against FDI in case of OGEF's non-compliance with its obligations. MEF will transfer funds to FDI free of charge.

8. OGEF will be established for 11 years, which will include 10 years of active operation and one year for closing. The Subsidiary Agreement will require FDI to establish a segregated account for all proceeds from CTF-funded OGEF investments (liquidated equity holdings and repaid loans).

[34] Operating Guidelines will set the conditions and screening criteria for future partners.

These proceeds could be reinvested during the OGEF life (10 years), but all would need to be liquidated by Year 11. At Year 11, all funds in the CTF segregated account, up to a maximum of the disbursed amount of CTF financing for OGEF, and after the payment of OGEF Fund Managers fees and any other closing expenses, would be returned to the World Bank, acting as a trustee for CTF.

9. FDI and MTPTC will enter into an agreement with an International Fund Manager for the management of OGEF (OGEF Partnership Agreement), which will specify roles of FDI and the International Fund Manager in the management of OGEF (henceforth, 'Fund Manager' will refer here to this joint partnership — to be distinguished from the individual International Fund Manager (IFM)). FDI will play the role of local financial intermediary with an investment track record in start-up/SME, providing knowledge of local financial and SME landscape. However, since private off-grid businesses have not yet been developed at scale in Haiti, there is no local expertise in off-grid energy investments. FDI will, therefore, team up with an International Fund Manager (IFM) with a proven track record in financing off-grid energy businesses internationally. FDI and IFM will jointly evaluate investments. The International Fund Manager will help build FDI capacity to eventually manage similar funding on its own. OGEF will be created for 11 years, but all CTF funds will be required to be invested in the first six years. FDI, however, could establish its own successor fund at Year 6, which it could manage on its own. IFM will provide capacity-building to FDI to allow it to manage the successor on its own. The length of the IFM Partnership Agreement will be established in the Operating Guidelines, but it is expected to cover all 11 years. The Project will cover the IFM fees during the investment period of the first six years. IFM remuneration for the following five years would be covered from the OGEF investment proceeds.

10. The IFM will be contracted by MTPTC with the close participation of FDI in the selection process. The draft OGEF Partnership Agreement will be provided to potential bidders as a part of the Request for Proposals (RfP).

11. Detailed arrangements for OGEF operations will be established in the Operating Guidelines, which will charge both FDI and the International Fund Manager with managing OGEF prudently on behalf of GOH, investing in potentially profitable and sustainable off-grid energy businesses, while maximizing the number of beneficiaries obtaining access to energy.

12. OGEF operations will be overseen by the Advisory Committee, which is expected to comprise of, inter alia, MEF, MTPTC and three independent parties (representatives of the renewable energy industry, financial sector and a reputable international organization, such as the Global Off-Grid Lighting Association - GOGLA).

13. The OGEF is designed using best practices to motivate the Fund Manager to perform at the highest level to meet the Fund's objectives. Part of the IFM and FDI compensation will be based on investment success, aligning the incentives of the Fund Manager with the Government's and CTF interests. There will be checks and balances on OGEF operations: FDI and the International Fund Manager will report to the Advisory Committee that will oversee OGEF activities.

### C. OGEF Governance Structure

14. The OGEF governance structure, reflecting lessons learned from similar funds globally, is designed to create incentives for the Fund Manager to seek the best opportunities to develop energy access businesses in Haiti while ensuring that adequate safeguards are in place to prevent abuse of the Fund Manager's investment discretion.

15. FDI and the International Fund Manager will operate under a set of Operating Guidelines that will be agreed to and incorporated into the Fund Manager's contract with the Government. The Guidelines charge the Fund Manager with the goal of maximizing the number of people obtaining access to energy by investing in businesses that will contribute towards that goal. The Guidelines require the Fund Manager to do this by using the OGEF's investment capital to develop and support the growth of renewable energy businesses that become sustainable, profitable and can attract commercial capital (loans and equity) for scalable growth. The Fund Manager has broad investment discretion in this process; part of the International Fund Manager's compensation will be based on the success of this investing. This broad investment discretion and participation in successful investing are commercial features that are good practices in private equity funds. In this way, the OGEF is designed to draw on the best practices on incentive structures to motivate the Fund Manager to perform at the highest level. While the International Fund Manager will have ultimate investment discretion, all investment evaluations will be carried out jointly with FDI. In the case of the potential divergence, IFM's decision would prevail, but the difference of opinions wouldl be flagged in no objection requests. One of the International Fund Manager's tasks will be to build capacity in FDI to participate in the evaluation of individual transactions and participate in the decision-making process, so that over time FDI could eventually manage OGEF on its own. E.g. FDI could open a successor fund at Year 6 of OGEF.

16. Although the OGEF Operating Guidelines take a commercially-based approach to investments of the Fund, the governance structure of the OGEF includes several layers of safeguards to prevent potential abuse and to ensure that the impact goals of the OGEF are pursued. Some of the key safeguards are:

- An Advisory Committee comprised of Government Representatives and independent parties will oversee OGEF operations with quarterly meetings and transparent reporting.
- FDI and the International Fund Manager jointly (i.e. Fund Manager) must establish transparent investment process rules (including an open application process for anyone). Selection and rejection decisions must be documented and reported to the Advisory Committee on a quarterly basis. The Fund Manager's investment process rules and changes to Operating Guidelines are subject to approval by the Advisory Committee, and the Bank's no objection.
- FDI and the International Fund Manager will sign a Partnership Agreement. FDI will participate in the investment evaluation, with a seat in the Investment Committee. Potential divergence in investment decisions between FDI and the International Fund Manager will be flagged in no objection requests.
- The Advisory Committee has the authority to remove the International Fund Manager for material breaches of its obligations (neglect, malfeasance, etc.). FDI can initiate this process.
- The Guidelines impose strict conflicts of interest rules on the Fund Manager and Advisory Committee members.
- The World Bank will have a "no objection" right relating to all investments in the first two years and all large and/or environmentally or socially complex investments throughout the Project life, as well as for all investment decisions with diverging opinion between FDI and IFM.

## D. Capacity

17. The MTPTC is already an implementing agency for the IDA PRELEN Project. The same arrangements will be used for the proposed CTF-funded Project. Energy Cell and PIU are staffed with competent professionals, but as their responsibilities under SREP and CTF Projects increase, they will need to be strengthened with additional staff and/or consultants to support their duties. Acknowledging the importance of the CTF/SREP renewable energy projects, MTPTC has appointed a dedicated SREP/CTF Program Coordinator. Appointment of additional staff is in process. The Energy Cell is also in the process of strengthening its procurement and FM capacity, and will also include additional staff/consultants for safeguards.

18. PRELEN is already supporting capacity-building activities for MTPTC and its Energy Cell and PIU, and this capacity building effort will continue, further supported by SREP's capacity building component. In addition, CTF's Component 1 will include support to the Energy Cell for an effective supervision of OGEF, including the fiduciary and safeguards aspects, as well as monitoring and evaluation.

19. The FDI is a specialized institution of the Central Bank of Haiti (BRH) created in 1981 with funding from the World Bank and the EU. The General Manager of the FDI is appointed by the BRH. Its financial and operational independence is sufficient to ensure an enhanced internal control environment. FDI currently manages approximately US$70 million in assets (double of US$35 million managed in 2010), and it has a good knowledge of the financial sector, local SME landscape and the overall business environment in Haiti. It is also managing a venture capital program, providing equity to SMEs, in addition to its lending and guarantee portfolio. It has in place a satisfactory internal control environment. FDI's institutional capacity is thus assessed as sufficient to play a role of the local FI partner in the management of OGEF. Its technical implementation capacity will be strengthened through entering into a Partnership Agreement with the International Fund Manager (and MTPTC) with a specific expertise in investing in off-grid businesses, a skill that FDI seeks to develop.

20. The International Fund Manager (IFM) will be competitively procured. The minimum capability criteria include:

- The IFM should be capable of equity investment management.
- The IFM should have experience with early stage companies, start-ups and/or backing entrepreneurs.
- The IFM should have experience investing in and developing DESCOs in markets where DESCOs are already growing.
- The IFM jointly with FDI should have capacity to manage World Bank funds, as established through the FM assessment.

## E. Readiness of Project team

21. The MTPTC Energy Cell and PIU have the key staff necessary to start implementation, such as the selection process of the Fund Manager. FDI also has staff available to be assigned to OGEF. The International Fund Manager will be competitively procured. In the recent years, several funds have been set-up (or existing funds have expanded to) to invest in the emerging off-grid business

market, in particular in the East African and South Asian markets. Some of these fund managers have expressed a tentative interest in the CTF scheme.

22. Establishment of OGEF, execution of the Subsidiary Agreement between MEF and FDI, selection of the International Fund Manager, and adoption of the Project Operations Manual (for activities implemented by MTPTC) are all conditions of effectiveness. Adoption of Operating Guidelines is not a condition of effectiveness, as it requires inputs from the International Fund Manager who cannot be contracted prior to the Project's effectiveness. The same goes for the signing of the OGEF Partnership Agreement, which cannot be done before the Project's effectiveness. Therefore, these are conditions of disbursement for all OGEF investments under Component 2.

**F. Financial Management, Disbursements and Procurement**

**Financial Management (FM)**

23. *FM Assessment*: In line with the strategy of the Bank and other main development partners, the financial responsibilities of the Project will utilize existing capacity as much as possible. As indicated, the fiduciary aspects of Component 1 and 3a of the Project will be managed by the PIU established for IDA PRELEN (P127203), while the technical aspects will be coordinated by the Energy Cell within MTPTC. The fiduciary aspects of Component 2 and 3b will be managed by FDI, with the assistance of a competitively selected International Fund Manager. The World Bank has completed the FM assessment and proposed FM arrangements for the Project to ensure they meet the minimum fiduciary requirements under OP/BP10.00. The Financial Management assessment of FDI and the International Fund Manager will be carried out after the International Fund Manager's selection during Project implementation.

24. *Staffing*: In the PIU established for IDA PRELEN (P127203), staff capacity and structure are adequate for Project FM purposes. However, the prospective increase in transactions may call for additional staff assistance, once the Project becomes effective, which would be financed by the Project.

25. *Budgeting Process*: The budget process will be clearly stipulated in the administrative, financial and accounting procedures manuals. Annual budgets and work plans will be coordinated and prepared by the PIU established for PRELEN, in coordination with the Energy Cell established within MTPTC, and with the help of the different actors of the Project. It will be submitted to the Bank for its no objection at the beginning of the fiscal year. Any changes in the budget and work plans will also be submitted to the Bank on a no objection basis.

26. *Accounting Policies and Procedures*: The Project will use Cash Basis Accounting for preparation of the Project's semi-annual interim financial statements and audited annual financial statements, in accordance with the International Public Accounting Standards (IPSAS) and the national Accounting Standards. A financial management section will be prepared as part of the Project's Operations Manual (OM) and will include appropriate accounting policies and financial reporting procedures.

27. *Accounting System*. The PIU established for PRELEN has computerized accounting software (ACCPAC), which is already in use for the PRELEN Project (P127203). An additional Project code and chart of accounts should be easy to set-up in the system. The system meets the Bank's financial management requirements for Project expenditures tracking and reporting. However,

some technical adjustments are needed to update the system. The PIU was working in contracting a vendor to make those adjustments.

28. *Internal Controls and Internal audit*: The PIU will maintain its strong system of internal controls and procedures that will be documented in the OM.

29. *Financial Reporting arrangements*: IFRs are regularly prepared and transmitted to the World Bank for the PRELEN Project. Under the proposed Project, the PIU will prepare and transmit semi-annual IFRs to the World Bank. The IFRs will be submitted to the Bank no later than forty-five (45) days after the end of the semester. The format and content of the IFRs will be agreed by negotiations and reflected in the OM.

30. *Auditing Arrangements*: As for PRELEN, whose financial statements have been regularly audited, the proposed Project will follow the same auditing requirements:

- Annual audited financial statements of the Project will be transmitted to the World Bank not later than six (6) months after the end of each recipient's fiscal year.
- The external audit will be undertaken by a private firm selected in accordance with independence and competency criteria acceptable to IDA.

31. *Fund Manager*: As mentioned, an International Fund Manager will be competitively hired to assist FDI to manage components 2 and 3b. The IFM capacity will therefore be evaluated jointly for FDI and the International Fund Manager. The capacity of the International Fund Manager will be included as a selection criteria during the hiring process and evaluated once the International Fund Manager is selected.

32. *Implementation Support*: As part of Project implementation support, based on a risk-based approach, FM supervisions will be conducted approximately every six months. These will pay particular attention to: (i) Project accounting and internal control systems; (ii) budgeting and financial planning arrangements; (iii) review of IFRs; (iv) review of audit reports, including financial statements, and remedial actions recommended in the auditor's Management Letter; and (v) disbursement management and financial flows. FM supervision will pay particular attention to any incidences of corrupt practices involving Project resources for Project implementation.

33. *Disbursement Arrangements and Flow of Funds*. The primary disbursement methods will be Advances and Direct Payments. Reimbursements and Special Commitments will also be made available. To facilitate timely disbursements for the Project's eligible expenditures under component 1 and 3a (managed by MTPTC), the Recipient, through the PIU, will open and operate a segregated Designated Account (DA) in US$ at the Central Bank (*Banque de la République d'Haïti*/BRH). Subsequently, another account (the operating account) denominated in Haitian Gourdes (HTG) will be opened at BRH and will also be managed by the PIU to process payments to vendors in local currency. The PIU will be responsible for the appropriate accounting of the funds deposited into the designated account, for reporting on the use of these funds and for ensuring that they are included in the audits of the financial statements. The ceiling of the DAs and the Minimum Application size for Direct Payment or Special Commitment will be determined in the Disbursement Letter.

34. To facilitate timely disbursements for the Project's eligible expenditures under component 2 and 3b (managed by FDI/International Fund Manager), the Recipient, will open and operate a segregated Designated Account (DA) in US$ at the Central Bank (*Banque de la République d'Haïti* /BRH). Subsequently, another account (the operating account) denominated in Haitian

Gourdes (HTG) could be opened at BRH to process payments to vendors in local currency. The FDI/International Fund Manager will be responsible for the appropriate accounting of the funds deposited into the designated account, for reporting on the use of these funds and for ensuring that they are included in the audits of the financial statements. Ceiling of the DAs and the Minimum Application size for Direct Payment or Special Commitment will be determined in the Disbursement Letter. However, until the completion of the FM assessment of the FDI and the International Fund Manager and its satisfactory conclusion, the Advance method will not be available for these components.

35. Summary Sheets with Records and Statements of Expenditures (SOE) will be required for documenting eligible expenditures and reimbursements to be paid by the DA. Direct Payments will be documented by Records. Applications documenting the advances to the DA will be made on a monthly basis.

36. SOE limits for expenditures against contracts for works; goods; consultant services for consulting firms; and individual consultant services will be determined in the Disbursement Letter. Documentation supporting expenditures claimed against SOEs will be retained by the implementing agency and will be available for review when requested by the World Bank supervision missions and the Project's auditors.

37. The Project will have a Disbursement Deadline Date (final date on which the World Bank will accept applications for withdrawal from the Recipient or documentation on the use of Grant proceeds already advanced by the World Bank) of four months after the Closing Date of the Project. This "Grace Period" is granted in order to permit orderly Project completion and closure of the Grant account via the submission of applications and supporting documentation for expenditures incurred on or before the Closing Date. Expenditures incurred between the Closing Date and the Disbursement Deadline Date are not eligible for disbursement. All documentation for expenditures submitted for disbursements will be retained at the PIU during the lifetime of the Project and be made available to the external auditors for their annual audit, and to the World Bank and its representatives if requested. After Project closing, the relevant documentation will be retained for two years, following the Government's regulations on record keeping and archiving. In the event that auditors or the World Bank implementation support missions find that disbursements made were not justified by the supporting documentation, or are ineligible, the World Bank may, at its discretion, require the Recipient to: (i) refund an equivalent amount to the World Bank, or (ii) exceptionally, provide substitute documentation evidencing other eligible expenditures.

38. Before the World Bank closes the Grant account (two months after the Disbursement Deadline Date), the Recipient must provide supporting documentation satisfactory to the World Bank that shows the expenditures paid out of the DA, or refund any undocumented balance.

**Procurement**

39. Procurement for the proposed Project will be carried out in accordance with the World Bank's Procurement Regulations for Borrowers under Investment Project Financing" dated July 1, 2016, the Anti-Corruption Guidelines, the Procurement Plan, and the provisions stipulated in the Financing Agreement.

40. The majority of procurement transactions under this Project will be done directly by the selected beneficiary off-grid energy companies using commercial practices as spelled out in the Operating Guidelines. Traditional World Bank public procurement activities are very limited and will largely consist of the selection of the International Fund Manager to manage Components 2 and 3b.

41. Activities under Component 1 and 3a will be procured following the Project Procurement Plan. The procurement plan would be updated at least annually or as required to reflect the actual Project implementation needs and improvement in institutional capacity. Activities under Component 2 and 3b will be procured using commercial practices as spelled out in the Operating Guidelines.

42. *Procurement risks and mitigation measures.* An assessment of procurement risks was carried out in 2015 for PRELEN PIU. The PRELEN PIU has extensive experience with procurement using country procurement regulations and using World Bank procedures. However, the public procurement system in Haiti remains relatively weak, despite reforms in the legal and institutional framework for procurement. Inconsistency in the application of rules and procedures, inadequate planning, insufficient use of standard documents, poor contract management and political interference are frequently observed. This generally risky environment for procurement creates significant obstacles to Project implementation. Consequently, the overall Project risk for procurement is SUBSTANTIAL.

43. The measures aimed at mitigating the main procurement risks were finalized during appraisal. The risk for procurement was considered as Substantial when the assessment was conducted. The risk can be significantly reduced if in the view of the relevant Bank Procurement Specialist the agreed measures are correctly applied.

44. *Procurement Plan, Thresholds for Procurement Methods and World Bank Review.* The summary procurement plan for Project implementation was agreed between the Recipient and the Project Team during Negotiations and the plan will be updated at least annually or as required to reflect actual Project implementation needs and improvements in institutional capacity. Bidding documents will be made available to the public through MTPTC's website. For component 1 and 3b, the recommended thresholds for the use of the procurement methods specified in the Financing Agreement are identified in Table A3.1 below. As already indicated, activities under Component 2 and 3a will be procured using commercial practices. Supervision of procurement will be carried out primarily through prior review supplemented by supervision missions at least twice a year.

Table A3.1. Thresholds for Procurement Methods and Prior Review

| Expenditure Category | Contract Value (Threshold) US$ thousands | Procurement Method | Contracts Subject to Prior Review (US$ thousands) |
|---|---|---|---|
| 2. Goods | >500 | ICB | All |
| | -500 | NCB | First contract |
| | 500 | Shopping | First contract |
| | Regardless of value | Direct Contracting | All |
| | Regardless of value | UN agencies | All |
| 3.Consulting Services | Regardless of value | QCBS,QBS,FBS,LCS | All contracts above 200 |
| -3.A Firms | <500 | CQS | All contracts above 200 |

| | | | |
|---|---|---|---|
| | Regardless of value | Single Source | All |
| -3.B Individuals | Regardless of value | In accordance with Chapter V of Consultant Guidelines | TORs and All contracts above 100 and all single source selection |

Abbreviations:
ICB = International Competitive Bidding
NCB = National Competitive Bidding
DC = Direct Contracting
LCS = Least-Cost Selection
CQS = Selection Based on Consultants' Qualifications
QCBS = Quality- and Cost-Based Selection
QBS = Quality-Based Selection
FBS = Fixed Budget Selection
SSS = Single Source Selection

## G. Environmental and Social (including safeguards)

45. The Project is classified as "Category FI - Financial Intermediary", as the exact scale and location of future sub-projects (mainly small-scale solar investments) are not known, and will effectively be implemented by a Financial Intermediary (the OGEF). The Project is adopting a "programmatic" ("framework") approach whereby the implementing agency will have the responsibility to evaluate and screen every investment (sub-project) for potential social and environmental impacts, and implement appropriate mitigation measures.

46. The Safeguards category of the Project is Financial Intermediary (FI) as its only investment component will be carried out by an FI (the Off-Grid Electricity Fund – OGEF – Fund Manager) under Component 2 and 3b. Under this component, most investments will consist of individual home/small business solar electrification, which are expected to have limited negative impacts. Additionally, some investments may be in micro-grids, which may be powered by solar or other sources of renewable energy, including biomass, wind turbines and micro-hydroelectricity. Retrofits/rehabilitation of existing micro-grids will also be considered. Other Project components will not have any safeguards-related impacts.

47. Potential impacts from the Project relate to health and safety during construction and operation of home systems and micro-grids; production of waste in the form of batteries, possibly on a large scale; environmental, social, health and safety liabilities associated with retrofitting existing micro-grids; removal of soil, vegetation and/or biodiversity when installing infrastructure (arrays of solar panels, power transmission lines, biomass digesters/furnaces, wind turbines, and turbines in the case of micro-hydro, etc.); and land acquisition resulting in involuntary resettlement, including loss of resources. The Project triggers the following safeguard policies: OP 4.01 Environmental Assessment and OP 4.12 Involuntary Resettlement.

48. Negative List: the Project will exclude the following activities: any use of herbicide or other pesticide, as defined in OP 4.09 – Pest Management, e.g., for chemical control of weeds; sub-projects within any natural habitat, as defined in OP 4.04 – Natural Habitats, e.g., mangroves, humid forest, cloud forest, etc.; sub-projects affecting cultural assets, as defined under OP 4.11 – Physical Cultural Resources, when installing infrastructure (e.g., religious, traditional, historically or culturally significant resources). In the case of micro-hydro, the Project would finance only run-of-river Projects and rule out any sub-project with an existing or a new dam or requiring water storage, irrespective of its size. The Project will not finance any activities on international waterways.

49. The following approach was adopted by the Project to address these impacts: the Operating Guidelines for the OGEF, which will guide all investments under the Project, was complemented

by the Environmental and Social (E&S) screening, assessment, and mitigation measures (the "E&S Process", equivalent to the Environmental and Social Management Framework - ESMF). The E&S Process was integrated into the overall approval procedure of RE investments. It includes screening checklists for each type of sub-project and adequate mitigation measures for all impacts identified.

50. The E&S Process was designed to address the most likely impacts under the Project, specifically home/small business PV systems, which have relatively low environmental impacts. The most likely impact at Project scale will be the disposal of large numbers of used Lithium-ion (Li-ion) batteries. The E&S Process includes measures for battery storage and ultimate recycling. As the field is emerging, and standard procedures for recycling Li-ion batteries are not yet developed, the measures will reflect the emerging best international practice.

51. Training will be provided to the managers of the CTF Fund, the Energy Cell, off-grid energy companies, municipalities, solar technicians, and to other stakeholders in the implementation of this E&S Process as part of Component 1 and 3a. Training at many levels will be required as this is a very new field, with many of the stakeholders (financers, entrepreneurs, municipalities) not being familiar with environmental impact procedures. Specific modules will be developed further, and a budget allocated specifically to them. Training is expected to be over the duration of the Project, to ensure that staff turnover does not erode E&S knowledge.

52. In the event that the E&S Process identifies more considerable impacts, for example in the case of micro-grid, biomass, wind turbine and micro-hydroelectric investments, the E&S Process indicates a requirement for more detailed studies, for example a separate EA/EIA or Resettlement Action Plan (RAP), as a condition for financing. In the event of chance finds, a chance finds procedure was included in the E&S Process; however the policy on Physical Cultural Resources was not triggered, as the Project Negative List excludes any investments affecting Physical Cultural Resources as defined by the Bank.

53. The E&S Process was consulted on in-country in a stakeholder workshop and disclosed prior to Appraisal on October 10, 2015. The E&S Process was disclosed in Haiti on Government's website on October 9, 2015 and on the World Bank's external website on October 26, 2015 (and after a minor modification re-disclosed in Haiti on May 2, 2016 and on the World Bank's external website on October 11, 2016). During implementation, the OGEF will benefit from an E&S Fund to cover some of the cost for the identification of impacts and preparation of mitigation measures. Costs for mitigation measures, however, will be borne as part of each sub-project, by each sub-project proponent (e.g. DESCO).

54. Overall responsibility for ensuring that the E&S Process is adequately implemented will be with FDI and the International Fund Manager, supervised by the Energy Cell of the MTPTC. The Energy Cell will also be responsible for monitoring and reporting on a regular basis, based on the information provided by the FDI/International Fund Manager (integrated in the M&E requirements established in the Operating Guidelines).

55. *Staffing:* Additional staffing is not expected under the Project; FDI jointly with the International Fund Manager, after receiving some training, will apply the E&S Process for the "routine" sub-projects (home/small business PV systems) without any specialized assistance; however, for sub-projects that are more complex (mini-grids, biomass, wind turbines and micro-hydroelectric plants), FDI/International Fund Manager would hire the necessary experts, as needed. Additionally, for the first two years of operation, the Bank will require that the

FDI/International Fund Manager obtains a no objection from the Bank for all sub-projects; thereafter FDI/International Fund Manager would obtain a no objection from the Bank only for relatively complex sub-projects (mini-grids, biomass, wind turbines and micro-hydroelectric plants).

56. *Involuntary Resettlement (OP/BP 4.12).* It is possible that the Project activities may lead to resettlement (particularly squatters), land acquisition as well as loss of economic livelihood under Component 2. OP 4.12- Involuntary Resettlement- is therefore triggered. Activities that may result in land acquisition and resettlement include the support of commercial investments in village-grids where the business model is based on the municipal PPP and where the Government would subsidize the distribution infrastructure and the private sector would be granted to operate grids as concessions.

57. As the sub-projects or locations are currently unknown, a Resettlement Policy Framework (RPF), laying out the overall guidelines, was prepared. The consultations on the RPF took place on September 9-10, 2015 and the document was disclosed on the World Bank's external website on October 13, 2015 and Government's website on October 16, 2015. Special attention will be given to the eligibility of potentially affected persons to ensure that the rights of those without formal legal rights to land are recognized in the RPF and subsequent RAPs, per OP 4.12.

58. FDI jointly with the International Fund Manager will be responsible for site-specific screening of sub-projects for social impacts, and monitoring Resettlement Action Plans (RAPs) as needed. The RAP preparation and implementation (including compensation) will be the responsibility of the private companies that are implementing the sub-projects. FDI, the International Fund Manager and the implementing companies of sub-projects will be provided with support and training during the course of the Project to ensure adequate social impact monitoring.

59. As for environmental impacts, the responsibility for preparing RAPs or abbreviated RAPs would be with the proponent/sponsor of the investment. The E&S Process will have provisions for when significant social/resettlements impacts are likely, included as an annex to the Operating Guidelines. Review of the RAP/abbreviated RAP will be by FDI jointly with the International Fund Manager, the Energy Cell, and the Bank. During the first two years of Project implementation, FDI/International Fund Manager will seek the Bank's no objection for all sub-projects. Following this time period, only sub-projects that are deemed complex (mini-grids and beyond) will require the Bank's approval.

60. Beyond resettlement aspects, social impact screening (a checklist) will cover labor safety and standards, community health and safety issues, and potential violence and security risks in the proposed site.

61. Follow up and reporting of the mitigation measures: MTPTC Energy Cell will have the overall responsibility for the safeguards reporting and follow up, as well as, overall responsibility for ensuring all Project-related queries and complaints are addressed and documented appropriately. FDI/International Fund Manager will have the responsibility to oversee the compliance with the E&S Process established in the Operating Guidelines and will be responsible for ensuring that complaints linked to sub-projects are appropriately addressed, resolved and documented.

62. As part of efforts to benefit the most vulnerable of the Project's intended beneficiaries, including women, the Project design includes support for: (a) solar lanterns with phone charging systems appealing to poorer market segments; (b) differentiated products at a range of price points

responding to different needs and economic means of users, including women; (c) service based approaches for poorer users to pay as they use electricity; (d) consumer awareness/education campaigns to also target female-headed households and carried out in a gender-sensitive manner; (e) annual satisfaction surveys to include poorer consumer segments, women users and youth as key target groups; and (e) facilitation of training or opportunities with emerging RE businesses for women entrepreneurs, as well as, for small business owners currently offering fee-based mobile phone charging services who may go out of business as a result of Project activities that expand access. More information on gender impacts of rural electrification and Project activities targeting women can be found in Annex 6.

## H. Monitoring & Evaluation

63. The Project will use the indicators and mechanisms defined in Annex 1 for monitoring and evaluation (M&E) of results and intermediate outcomes. Overall responsibility for M&E lies with the MTPTC Energy Cell, which will consolidate M&E reporting based on updates provided in the Fund Manager's quarterly reports. Operating Guidelines will include description of M&E responsibilities, data collection requirements and frequency, and division of the roles between MTPTC and the Fund Manager, each provided with adequate budgets to carry out their roles diligently.

64. Progress in providing energy access services will be measured through the application of emerging good practice methods, such as "iMERVA" (*Integrated Lean Framework for Monitoring, Evaluation, Safeguards, Reporting, Verification, and Audits*). Monitoring arrangements will also include independent *ex post* verification of results.

65. The Project will also carry out a baseline survey, using the SEforALL Multi-Tier Framework methodology,[35] and will use cell phone surveys (see below) to get regular updates on progress. The mid-term review will be conducted at Project's mid-term to assess Project's implementation progress. The regular M&E data, the survey data/beneficiary feedback and the MTR analysis will be used to assess Project's implementation progress, whether OGEF is functioning as expected, whether the Project design is still relevant and suited to the Haitian conditions (particularly considering the fast evolution of off-grid technologies and business models globally), whether beneficiaries are receiving adequate services, whether desired gender impacts are being produced and overall whether the Project is on track meeting the PDO and the key indicators. Based on these assessments, modifications to the Operating Guidelines (and if necessary to the broader Project design) will be proposed and discussed with the Government and implementation stakeholders. At Project closure, MTF survey will be repeated to capture impacts.

66. *Citizen Engagement / Beneficiary Feedback*. The Project will seek citizen engagement and beneficiary feedback in its implementation. This will be done at several levels.

- Non-governmental representatives will be included in the Advisory Committee of the Off-Grid Electricity Fund (OGEF) overseeing OGEF operations and adherence to the rules and procedures set in the Operating Guidelines.
- The Project will carry out annual household surveys (by cell phones primarily and complementary home visits when needed), which will cover both beneficiaries and non-

[35] World Bank/SEforALL: Beyond Connections: Energy Access Redefined (2015)

beneficiaries to track (i) consumers' satisfaction with the off-grid electricity services; (ii) performance/sustainability over time; (iii) emerging impacts (e.g. appliances used, income generating activities enabled etc.), (iv) reasons for not having access for households not served by the Project. The feedback will also provide gender-disaggregated data to assess potential emerging gender issues and impacts.

- A free text messaging service /a hotline will be available to respond to customer queries. The success rate in resolving customer queries and complaints will be tracked throughout Project implementation.

67. Citizen engagement indicators are included in the Results Framework (Annex 1): "Corrective actions taken based on beneficiary feedback from phone surveys and household visits" and "Percentage of users reporting systems working according to the advertised performance."

## Annex 4. Implementation Support Plan
## Haiti Modern Energy Services for All Project

### Strategy and Approach for Implementation Support

1. The strategy for Bank Project Implementation Support (IS) reflects the nature of the Project and its risk profile (outlined in the Project SORT) and aims to enhance the quality and impact of the proposed Project interventions. The IS focuses on risk mitigation measures identified in the PAD and standard Bank supervision (including technical, institutional, environmental and social safeguards) and fiduciary aspects (financial management and procurement).

### Implementation Support Plan

2. Quarterly Implementation Support (IS) missions (including field visits to investments financed under Component 2) will concentrate on the following areas:

#### *A. Strategic*

3. The supervision mission will review the progress in the implementation of each component and assess whether the proposed design is still valid and/or whether course corrections are needed. This assessment will be based on discussions with all key stakeholders including MTPTC, MEF, FDI, the International Fund Manager and Project beneficiaries, including those met on field visits.

#### *B. Technical*

4. The supervision mission will monitor whether the Project follows provisions established in the Operating Guidelines. The field visits will assess whether the quality assurance provisions of the Operating Guidelines are being followed.

#### *C. Safeguards*

5. Overall responsibility for ensuring that the E&S Process is adequately implemented will be with the Energy Unit of the MTPTC. The Energy Unit will also be responsible for monitoring and reporting on a regular basis. FDI, jointly with the International Fund Manager, will have the responsibility to oversee the compliance with the E&S Process established in the Operating Guidelines. The Bank supervision mission will follow compliance with the safeguards requirements.

#### *D. Fiduciary*

6. The supervision missions will ascertain whether the procurement and FM provisions of the Operating Guidelines are being followed. In particular, regarding FM, based on a risk-based approach, FM supervisions will be conducted approximately every six months. These will pay particular attention to: (i) Project accounting and internal control systems; (ii) budgeting and financial planning arrangements; (iii) review of IFRs; (iv) review of audit reports, including financial statements, and remedial actions recommended in the auditor's Management Letter; and (v) disbursement management and financial flows. FM supervision will pay particular attention to any incidences of corrupt practices involving Project resources for Project implementation. Supervision of procurement will be carried out primarily through prior review supplemented by

supervision missions at least twice a year. The missions will also discuss progress in the implementation of the Procurement Plan established for Components 1 and 3.

### *E. Client relations*

7. The mission will consult with all Project stakeholders.

Table A4.1. Skills Mix Required

| Skills Needed | # Staff Weeks per FY | # Trips per FY | Comments |
|---|---|---|---|
| Task Team Leader (Supervision) | 8 | 4 | HQ-based |
| Energy Specialist | 20 | | Country based |
| RE Specialist (technical) | 4 | 2 | HQ-based or other region |
| RE Specialist (policy and regulation) | 4 | 3 | HQ-based or other region |
| Procurement Specialist | 3 | 2 | HQ-based or Country-based |
| Financial Management Specialist | 3 | 2 | HQ-based or Country-based |
| Environmental Specialist | 3 | 2 | Country-based |
| Social Specialist | 3 | 2 | Country-based |
| Gender Specialist | 3 | 1 | HQ-based |
| Legal Counsel | 3 | 1 | HQ-based |

Table A4.2. Partners

| Name | Institution/Country | Role |
|---|---|---|
| Client | MTPTC, MEF | Project Counterparts, overall responsible for Project implementation, in compliance with agreements spelled out in Financing Agreement coordinating the GOH's support for the Project. |
| Implementing entities | MTPTC, FDI, International Fund Manager | Responsible for execution of Project components. |
| Project Partner Institutions (Members of the Advisory Committee) | Inter alia<br>(i) MTPTC<br>(ii) MEF<br>(iii) representative of local private sector<br>(iv) representative of financial sector<br>(v) representative of a reputable international institution (e.g. GOGLA) | Participate in the Advisory Committee for OGEF. |
| Project Partner Institutions (Beneficiary off-grid energy enterprises) | Enterprises which have received Project support. | Provide off-grid energy services to rural and peri-urban clients with support from the Project. |
| Local Institutions and Authorities | Municipal authorities | Local level representation of ministries: key actors in the coordination as well as participatory and decision-making mechanisms supported in the Project. |

| | | |
|---|---|---|
| | | Local municipal authorities: key role in the development of micro-grids. Provide mini-grid concessions on their territories. |
| Other financial and technical partners | IDB, UNEP, UNDP, USAID, PanAmerican Foundation and other potential funders of off-grid electricity Projects | Ensure coordination so that financed programs complement one another in terms of sectors of intervention, geographical areas of intervention, timeline and sequencing, etc. to leverage development impacts. |
| NGOs | Local NGOs | Non-governmental partners to support awareness-building activities. |

## Annex 5. Economic and Financial Analysis
## Haiti Modern Energy Services for All Project

1. Economic and Financial Analysis shows that both the Economic Internal Rate of Return (EIRR) and the Financial Internal Rate of Return (FIRR) are significantly above hurdle rates for all probable cases, robust to the most probable stress scenarios, and attractive enough to allow for fast disbursement under the chosen delegated FI scheme. EIRR for the various stand-alone and municipal grid system types eligible for support under the three CTF funding windows vary between 30 percent and 50 percent (excluding Carbon case),[36] well above the country hurdle rate.

### A. Method and Scope

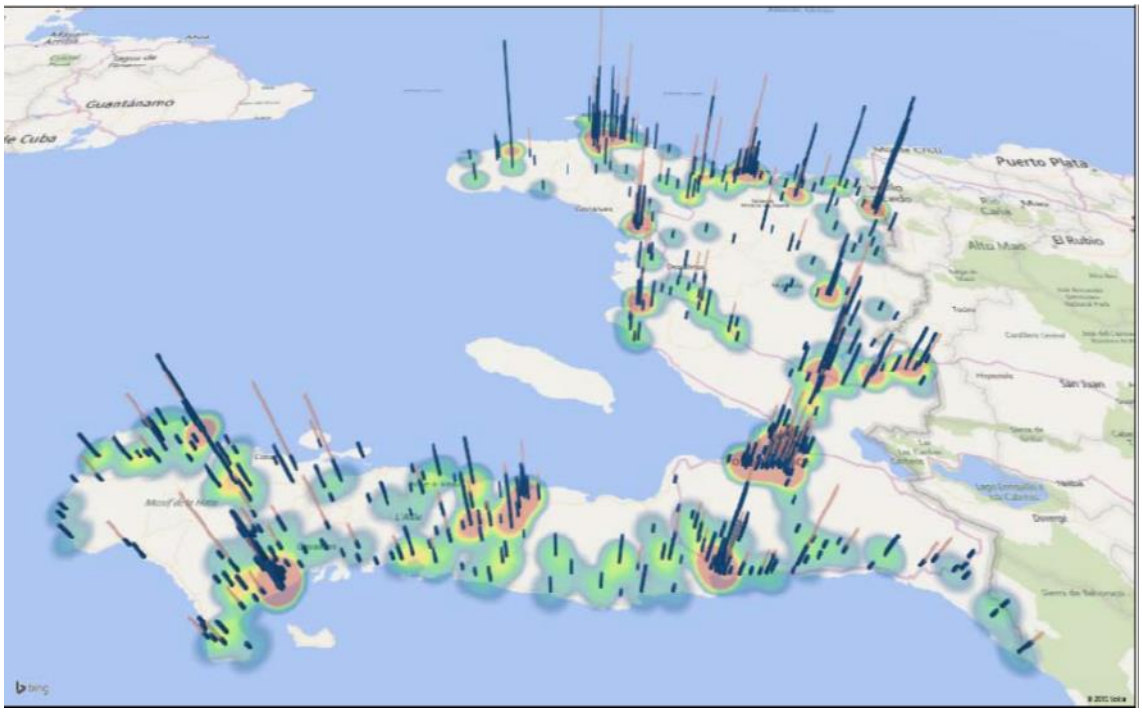
2. The Economic and Financial Analysis of the proposed Haiti CTF-funded Project analyzed potential investments with a broad range of off-grid electrification options to account for all possible off-grid business models and system types and sizes that are eligible under the OGEF. These cases are based on the actual universe of existing users, villages and firms in Haiti. The cases cover various (i) off-grid RE technologies (mainly PV and PV hybrid, but covering a range of system sizes and types for the stand-alone as well as the municipal systems), (ii) firm sizes (small retailers to large DESCOs), and (iii) different business models (PAYG, Li-ion and/or iMeter-based "smart" off-grid systems with higher upfront costs, as well as more traditional SHS and municipal grids with lead acid batteries and low-cost billing).

3. This open, more comprehensive approach to off-grid electrification reflects (i) local conditions and a multitude of emerging business models serving different market segments in Haiti; and (ii) the current stage of international off-grid markets, where a growing diversity of solid and viable approaches has emerged. This unusually extensive analysis is made possible thanks to (i) the synergies with SREP IP preparation, (ii) the deeper information available from nascent IT-based off-grid businesses in situ, and (iii) the Digicel/iiDevelopment mobile-phone survey (N=1400) which allowed to construct income-corrected demand curves as well as WTP-distributions by department (see Figure A7.1).

4. In total, the analysis covers four municipal/village grid cases, representative of Haiti's universe, ten sizes of stand-alone PV users (from low-end PicoPV to large SHS and productive PV uses); as well as several supply company types and types of financial support. A comprehensive description of the demand- and supply side analysis, and the choice of cases, can be found in the related SREP IP and its background documents. This Annex focuses on the most representative cases, based on the most promising pipeline candidates (such as Re-Volt, EarthSpark, etc.) and probable market growth scenarios. The aggregate Project-level analysis based on the probable scenario is presented below.[37]

[36] The EIRR is even higher when pricing Carbon Benefits in, as shown in the CTF Annex 10. For Carbon Benefit Valuation, the latest WBG guidance (2014) and UNFCCC Access method (2015) were applied for the most relevant CTF system types and sizes.
[37] As per WB convention for rural energy projects, and for ease of clear comparison, all installations assumed in year 1 for the aggregate cash-flows are used in Economic Analysis, while they will be spread from year 1 to 6 in reality.

Figure A5.1. The geospatial spread of the Digicel/iiDevelopment 2014 energy survey




5. The final mix of cases may vary from the mix assumed in the Base Case Analysis and the sensitivity scenarios, as it will be determined by the actual private sector demand and implementation of the three OGEF windows (retailer working capital, equity & RBF for nascent DESCOs and mini-grids, and medium term loans for mature DESCOs and mini-grids). In any case, the FI due diligence will assure that the minimum requirements of economic least cost and financial robustness are met also by each individual "sub-project" that is accepted for funding.

Tables A5.1 – A5.3. Project Scenarios and Assumptions across many offgrid system types relevant for OGEF

| CTF gross funding (in millions) | 16.0 | |
|---|---|---|
| of which goes to companies ("net") | 12.0 | 75% |
| Overhead, TA and fees | 4.0 | 25%[38] |

[38]The "overhead" of 25 percent is well in line with good practice by Energising Development (EnDev), a leading GIZ-implemented multi-country access vehicle.

| Typical CTF Funding Scenarios BY SYSTEM CATEGORY (final mix depends on private sector demand and FI due diligence) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Scenario A** | firms | USD M | | subs/HH | subs/firm | systems | HH/system | HH | people | | Tier target |
| Pico Retailers | 5 | 1.00 | 8% | 15 | **0.2** | 66,666.7 | 1 | 66,666.7 | 333,333 | 37% | 2 |
| SHS & solar saver DESCOs | 5 | 8.00 | 67% | 75 | **1.6** | 106,666.7 | 1 | 106,666.7 | 533,333 | 59% | 2-3 |
| CTF Village Large = Case 8s | 0 | 0.00 | 0% | 500 | 0 | - | 10000 | - | - | 0% | 3 |
| CTF Village Medium | 4 | 3.00 | 25% | 500 | 0.75 | **8** | 750 | 6,000.0 | 30,000 | 3% | 3-4 |
| | 14 | **12.00** | 100% | | | | | 179,333 | **896,667** | 100% | |
| | | | | | | | Thus $/beneficiary net: | | $ 13.38 | | |
| | | | | | | | and $/beneficiary gross: | | $ 17.84 | | |
| **Scenario B** | firms | USD M | | subs/HH | subs/firm | systems | HH/system | HH | people | | Tier target |
| Pico Retailers | 5 | 1.00 | 8% | 15 | **0.2** | 66,666.7 | 1 | 66,666.7 | 333,333 | 46% | 1 |
| SHS & solar saver DESCOs | 3 | 5.00 | 42% | 75 | **1.67** | 66,664.0 | 1 | 66,664.0 | 333,320 | 46% | 2-3 |
| CTF Village Large = Case 8s | 0 | 0.00 | 0% | 500 | 0 | - | 10000 | - | - | 0% | 3 |
| CTF Village Medium | 4 | 6.00 | 50% | 500 | 1.5 | **16** | 750 | 12,000.0 | 60,000 | 8% | 3-4 |
| | 12 | **12.00** | 100% | | | | | 145,331 | **726,653** | 100% | |
| | | | | | | | Thus $/beneficiary net: | | $ 16.51 | | |
| | | | | | | | and $/beneficiary gross: | | $ 22.02 | | |
| **Scenario C** | firms | USD M | | subs/HH | subs/firm | systems | HH/system | HH | people | | Tier target |
| Pico Retailers | 3 | 0.60 | 5% | 15 | **0.2** | 40,000.0 | 1 | 40,000.0 | 200,000 | 30% | 1 |
| SHS & solar saver DESCOs | 4 | 6.40 | 53% | 75 | **1.6** | 85,333.3 | 1 | 85,333.3 | 426,667 | 63% | 2-3 |
| CTF Village Large = Case 8s | 1 | 5.00 | 42% | 500 | 0 | **1** | 10000 | 10,000.0 | 50,000 | 7% | 3 |
| CTF Village Medium | 0 | 0.00 | 0% | 500 | 0 | **0** | 750 | - | - | 0% | 3-4 |
| | 8 | **12.00** | 100% | | | | | 135,333 | **676,667** | 100% | |
| | | | | | | | Thus $/beneficiary net: | | $ 17.73 | | |
| | | | | | | | and $/beneficiary gross: | | $ 23.65 | | |

| OFFGRID Sub-Segments: **"with project"** case (A) CTF (B) Full SREP incl CTF* | Pico Low Quality | **PicoPV high quality lantern or kit: 2-20 W** | **SHS & solar savers: 20-200 W** | village case 6: Small | **VILLAGE case 7: MED** | village case 8: Large | Social solar off LV | street lights | solar savers |
|---|---|---|---|---|---|---|---|---|---|
| HH/system average of class | 1 | 1 | 1 | 100 | **750** | 30,000 | n.a. | n.a. | n.a. |
| Def Pmin | 0.25 | 2 | 20 | 50 | 100 | 100 | | | |
| Pmax | 2 | 20 | 200 | 200 | 500 | 1,000 | | | |
| PV W/HH (weighted ave. of class) | 1 | **10** | **50** | 100 | **200** | 400 | | | |
| Lifetime Min | 0.5 | 2 | O&M ! | O&M ! | O&M ! | O&M ! | O&M ! | 2 | O&M ! |
| Max | 2 | 15 | O&M ! | O&M ! | O&M ! | O&M ! | O&M ! | 15 | O&M ! |
| **Typical Lifetime** | 1 | **6.5** | **20** | 20 | 20 | 20 | 20 | 6.5 | 20 |
| Capex Unit Cost Min [$/W] | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Max | 20 | 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| **Typical Capex** for mix of systems & biz plans [USD/HH] | | **100** | **500** | | **1,500** | | | | |
| **Typical CTF Support per HH** | | **15** | **75** | | **500** | | | | in shs case |
| Battery mostly: | Li-Ion | Li-Ion | LeadAcid | LeadAcid | LeadAcid | LeadAcid | LeadAcid | Li-Ion | LeadAcid |

## B. Economic Analysis

6. The main challenge of rural energy cost-benefit analysis is to estimate BENEFITS correctly. Thanks to the Digicel/iiDevelopment 2014 mobile phone Project preparation survey and the ECVMAS 2012 survey, there was sufficient data supporting benefit calculations using two complementary methods: (i) via income-adjusted kWh demand curves based on actual and stated WTP (a very conservative estimate which tends to underestimate actual benefits, but is economically correct – called "Method 2" in this document); as well as (ii) via lumenhour-based consumer surplus estimated based on reported actual energy use (the best practice method recommended by IEG[39] - called "Method 1" in this document - which yields higher results than Method 2, and may thus overestimate benefits (particularly for high-quality, low-cost modern LED/Li-ion systems) and is therefore complemented by the more conservative Method 2. To stay on the conservative side, the economic analysis calculates the benefits as the average of Methods 1 and 2 (which is always smaller than the IEG Method 1) for EIRR and NPV estimates, and for the scenario analysis summarized below.

7. To these WTP and consumer-surplus-based benefits, the GLOBAL ENVIRONMENTAL BENEFITS from carbon abatement (see CTF Annex 7) for different fuel switch scenarios, solar system lifetimes and carbon prices can be added. For the Economic Analysis and the CTF Annex, recommendations from the latest World Bank Guidance (2014) were followed to this end. The analysis includes: (i) a CBA scenario completely without Carbon Benefits; as well as (ii) a BASE CASE and (iii) a LOW CASE scenario for the CARBON PRICE ("Social Value") of abated Carbon (base case carbon price starting at US$30/t in 2015 and low case price scenario starting at US$15/t in 2015).[40] For the abated CARBON QUANTITIES, the latest (2015) recommendations by WBG and UNFCCC for small off-grid access systems were applied to the three main system classes targeted by CTF:

- pico lanterns and kits with Li-ion batteries - the actual physical lifetimes (3-10 years) and no O&M costs are assumed, and no carbon benefits are counted after product life;
- "classic" solar home systems of 20-200 Wp (historically mostly with lead-acid batteries, but an increasing share of Li-Ion expected for the later project implementation years) which are installed by a technician and have O&M costs and a lifetime of 20 years;
- the Medium-Size solar hybrid Municipal/Village Grids which have around 200 Wp/user and therefore can be treated as 200 Wp SHS for carbon benefit purposes (but not for Capex and Opex, which include the LV grid etc.).

8. The main assumptions and resulting Carbon Benefits by System Type and Segment are illustrated in the tables below. All these methods yield positive NPVs and above-hurdle rate EIRRs for the probable Project scenarios.

[39] World Bank Independent Evaluations Group: The Welfare Impact of Rural Electrification: Reassessment of Costs and Benefits, 2008.

[40] World Bank: Investment Project Financing: Economic Analysis Guidance Note, 2014 / World Bank: Social Value of Carbon in project appraisal; Guidance note to the World Bank Group staff; 2014.

## Tables A5.4 and A5.5. Estimating Carbon Benefits

**Carbon "Social Value" WBG standard Economic Analysis as per Guidance Note 2014.**

| | 2015 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| **Low** | 15 | $ 20 | $ 30 | $ 40 | $ 50 |
| **Base** | 30 | $ 35 | $ 50 | $ 65 | $ 80 |
| High | $ 50 | $ 60 | $ 90 | $ 120 | $ 150 |

| **Total Carbon abated by CTF:** | weighted averages by type, PER SYSTEM: | | | | | AGGREGATE SAVINGS BY TYPE | | | Total "Social Value" Carbon | |
|---|---|---|---|---|---|---|---|---|---|---|
| **CTF System Type:** | **t p.a.** | **Wp** | kWh/a | average lifetime of system type | **t CO2 lifetime** | # of users (mostly HH) | **Annual CO2 project year [t]** | **CO2 lifetime** | **Low Case** | **Base Case** |
| 1: PicoPV Li-Ion 2-20 Wp | 0.13 | 10.5 | 19 | 6 | **0.8** | 66,667 | **8,667** | **53,333** | 1,070,081 | 1,870,081 |
| 2: SHS 20-200 Wp Lead-Acid | 0.47 | 67.25 | 135 | 20 | **9.3** | 106,667 | **49,600** | **992,000** | 26,702,092 | 41,582,092 |
| 3: Village Grid 200 Wp average/HH | 0.780 | 200 | 400 | 20 | **15.6** | 6,000 | **4,680** | **93,600** | 2,519,472 | 3,923,472 |
| | | | | | | | **62,947** | **1,138,933** | 30,291,644 | **47,375,644** |

| | | | | | | |
|---|---|---|---|---|---|---|
| CTF Funding | 16 | Thus Carbon efficiency: | | **CTF/ton** | **$ 14.05** | |
| Private incl HH | 48 | | | | | |
| **Total Cost** | **64** | | | **Total/ton** | **$ 56.19** | CO2 cost [USD/t] |

9. COSTS are comparatively easy to estimate, because there is far more international literature on off-grid solar prices - for instance, thanks to Lighting Global – today than there were in the past for comparable PADs.[41] In addition, the actual costs of Haiti-based Projects were collected during SREP IP preparation. See below the results of the economic analysis.

## Table A5.6. Key Results of the Economic Analysis

| **I. CBA ASSUMPTIONS FOR TYPICAL CTF SYSTEM SIZES** | | | | | | | **II. RESULTING ECONOMIC INDICATORS WITHOUT CARBON** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| System Size [Wp] | CTF System Type | Hybrid Village Grid? | Li-Ion bat. | Life-time | CapEx [USD] | Present Value OpEx [USD] | Present Value COST [USD] | Annual Value BENEFITS ex Carbon [USD] | **Net Present Value without Carbon @ hurlde rate [USD]** | **EIRR without Carbon** | Switching Value Capex in % of assumed cost |
| | | | | | | | *10%* | *10%* | *10%* | | *10%* |
| 2.5 | 1 | No | yes | 3 | 70 | - | 70 | 33 | **18** | **48%** | 126% |
| 5 | 1 | No | yes | 4 | 150 | - | 150 | 50 | **53** | **35%** | 135% |
| **10** | **1** | No | yes | 6 | 250 | - | 250 | 70 | **114** | **31%** | 146% |
| 20 | 1 | No | yes | 8 | 400 | - | 400 | 107 | **254** | **33%** | 163% |
| 20 | 2 | No | No | 20 | 250 | | 450 | 94 | **445** | **46%** | 278% |
| **50** | **2** | No | No | 20 | 500 | 200 | 700 | 194 | **1,024** | **53%** | 305% |
| 100 | 2 | No | No | 20 | 900 | 360 | 1,260 | 349 | **1,845** | **53%** | 305% |
| 100 | 3 | yes | No | 20 | 800 | 1,022 | 1,822 | 362 | **1,337** | **43%** | 267% |
| **200** | **3** | yes | No | 20 | 1,600 | 2,043 | 3,643 | 665 | **2,160** | **36%** | 235% |

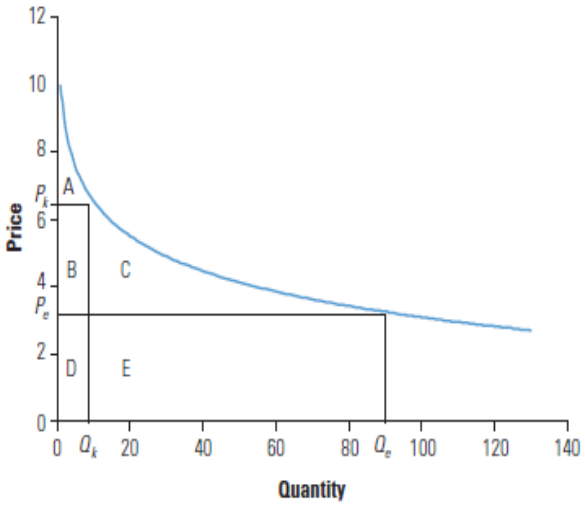
[41] It should be noted that a simple comparison with older PADs may be misleading, because the high-quality systems increasingly applied by DESCOs have much higher Capex (due to PAYG and smart meter fixed costs at low initial sales volumes; long-life Li-ion batteries; as well as power LEDs and other extremely efficient appliances) compared to the low-cost systems of much higher Wp capacities (but lower lifetimes and performance – including lifetime-lumenhours).

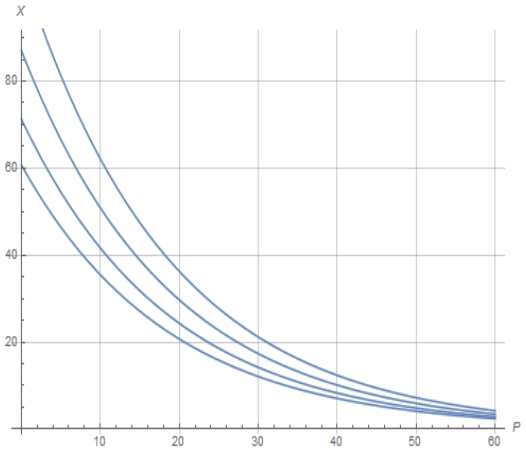
Table A5.7. Results of the Economic Analysis for the most typical system types that shall be covered by CTF, including ERR, NPV at country hurdle rate (10 percent) and switching values for Capex (the most critical variable as per our sensitivity analysis), with and without Carbon Benefits.

| | III. RESULTING ECONOMIC INDICATORS WITH CARBON | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CTF System Type | Carbon savings p.a. [t] | Carbon savings lifetime [t] | Lveelized Annual Value of Carbon Low Case* [USD] | Annual Value of Carbon Base Start Price Only *** [USD] | **Levelized Annual Value of Carbon Base Case** [USD]** | Annual Value BENEFITS cum Carbon Base Case [USD] | Net Present Value WITH Carbon BASE CASE @ hurlde rate [USD] | EIRR with Carbon Base Case [USD] | Switching Value Capex in % of assumed cost |
| | | | *10%* | *10%* | *10%* | *10%* | *10%* | | *10%* |
| 1 | 0.03 | 0.1 | 0.61 | 0.95 | 1.07 | 34 | **21** | **55%** | 130% |
| 1 | 0.06 | 0.2 | 1.2 | 1.9 | 2.1 | 52 | **61** | **39%** | 140% |
| **1** | 0.12 | 0.7 | 2.5 | 3.8 | 4.3 | 74 | **135** | **36%** | 154% |
| 1 | 0.245 | 2.0 | 4.9 | 7.6 | 8.6 | 116 | **303** | **38%** | 176% |
| 2 | 0.272 | 5.4 | 7.3 | 8.4 | 11.4 | 105 | **542** | **57%** | 317% |
| **2** | 0.43 | 8.7 | 11.6 | 13.4 | 18.1 | 212 | **1,178** | **62%** | 336% |
| 2 | 0.56 | 11.3 | 15.1 | 17.4 | 23.6 | 372 | **2,045** | **60%** | 327% |
| 3 | 0.56 | 11.3 | 15.1 | 17.4 | 23.6 | 386 | **1,537** | **50%** | 292% |
| **3** | 0.78 | 15.6 | 20.9 | 24.1 | 32.6 | 697 | **2,438** | **40%** | 252% |

I.

Figure A5.2. Illustration of Benefit Estimates by Method 1 IEG (left) and Method 2 Reiche/Teplitz[42] (right)



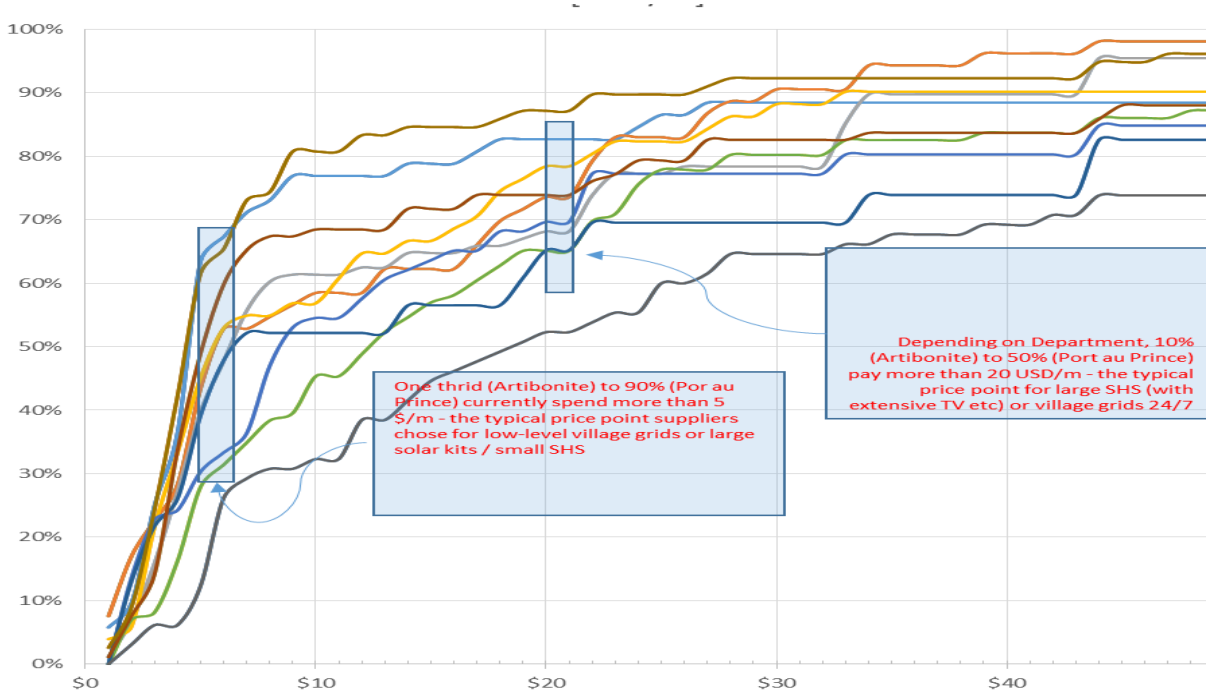
[42] K. Reiche and W. Teplitz (2009). Energy Subsidies: Why, When and How? Think piece prepared by iiDevelopment on behalf of GIZ.

## C. Financial Analysis

10. Financial Analysis indicates that a broad range of private sector business models and system sizes could qualify for the OGEF. The analysis includes modeling and stress-testing of cash-flows and balance sheets for all major firm types with and without Project support, and for all types of support to be provided by the OGEF. The resulting key financial indicators are sound and robust. Based on this analysis, the three CTF funding windows (PicoPV working capital; DESCO equity; and DESCO Medium Term Lending, each complemented with RBF elements as appropriate) have been pre-designed such that IRR and equity returns, as well as Debt/Equity ratio and DSCR, remain well inside the boundaries considered conservative and appropriate for sector and country players.

11. The sample size and broad coverage of the Digicel/iiDevelopment energy survey allowed for stratification by Department. As can be seen from the Figure below, the resulting cumulative distributions of current energy expenditures vary significantly between departments, and have been used for the Financial Analysis to gauge probable sales prices and volumes for each of the relevant off-grid market segments. Together with the data from pipeline firms, this was the basis for the price and sales volume scenarios (on market level) and analysis of probable model cash-flows and balance sheets (on firm level) which is illustrated in this chapter.

Figure A5.3. Cumulative distribution of current energy expenditures (ten Haiti departments = 10 curves).*




12. Together with the significant number of analyzed specific pipeline firms – all of whom have revealed solid interest and a robust and scalable business approach – should allow for fast disbursement under the chosen delegated FI scheme. However, in light of country risk and sector challenges (see main text), 1-2 of the participating DESCOs may (i) underperform on access targets (which form part of the Fund Manager performance fee) and/or (ii) not grow healthy enough to allow for a profitable exit at FI level. These scenarios have been accounted for in the stress tests, and aggregate disbursements as well as access KPI (namely, the 500k beneficiaries

and the carbon targets) will be met even under this unfavorable scenario. In addition, such losses should be overcompensated by over-performers, who may meet targets early and allow for additional "second round" effects of the Fund, as the lifetime of the latter (10 years) will exceed the initial Project duration (6 years), so as to allow for added impacts, which have NOT been counted against the conservative minimum targets in Econ & Fin Analysis.

13. Of the analyzed segments, the municipal systems carry the highest risk (regulatory risk and anchor client risk) and the DESCO model seems best suited for fast firm-level growth (due to its sustainable debt/equity ratio at exit), while the PicoPV retailer models will probably retain national total sales levels, but replace low quality products with higher quality, long-lifetime Li-ion kits. The Fund Manager's diligence and the Fund qualification rules will assure that all participating firms can meet the robust financial indicators which this analysis has shown to be feasible.

14. The tables on the following pages illustrate the financial analysis for several of the most probable business types and support measures of the Haiti CTF portfolio, including key financial parameters.

Table A5.8. The start-up cost structure and amount of a typical new DESCO starting up in Haiti; the total amount is close to USD 200k.

| **Start-up Phase** | | |
|---|---|---|
| | | |
| | **1st 6 months** | |
| **Start-up activities** | **Cost** | **Assumption** |
| Business planning and modeling | 12,000 | 10-15% of Mgt time |
| Build up and training of operations team | 12,000 | 10-15% of Mgt time |
| System implementation | 5,000 | Salaries & recruiting |
| Sales and service | 5,000 | Salaries & recruiting |
| Call centre | 10,000 | Salaries & recruiting |
| Technicians | 2,500 | Salaries & recruiting |
| General administration | 25,000 | 10-15% of Mgt time, fees, etc |
| Sourcing of technology platform | 50,000 | Licensing fee |
| Fixed asset investment | 20,000 | vehicles, computers, etc |
| Markteting | 5,000 | |
| 1st product orders (250 systems) | 37,500 | Pilot systems for testing |
| | | |
| Funding Need | **184,000.00** | |
| Funding Source | Equity* and Grants | |
| * May be in the form of convertible debt | | |

Table A5.9.The cash flow of a typical early growth phase (the first 2 years) for the new Haiti DESCO introduced in the previous table. The DESCO needs to pre-finance all systems (RE technologies are "front loaded" when compared to base case diesel gen-sets, candles or wick lamps) which are then "rented out" to users under the typical pay as you go scheme that has been implemented with so much success in SSA recently. While monthly results reach positive levels from month 21 in this typical example, the total aggregate result needs more time to break even, as shown in the next table below. Therefore, OGEF funding is needed for this early growth.

**Typical DESCO Early Growth Phase**

| **Month:** | | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # systems installed | | | 100 | 200 | 300 | 300 | 300 | 400 | 500 | 600 | 600 | 600 | 800 | 1,000 | 1,250 | 1,500 | 2,000 | 2,500 | 3,500 | 4,500 | 6,000 | 7,500 | 9,000 | 11,000 | 13,000 | 15,000 |
| # Sales and service staff | | 15 | 17 | 18 | 20 | 22 | 24 | 27 | 29 | 32 | 35 | 39 | 43 | 47 | 52 | 57 | 63 | 69 | 76 | 83 | 92 | 101 | 111 | 122 | 134 | 150 |
| **Costs** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Start-up expense | | 184,000 | | | | | | | | | | | | | | | | | | | | | | | | |
| Systems | 150 | - | 15,000 | 15,000 | 15,000 | | | | | | | | | | | | | | | | | 225,000 | 225,000 | 300,000 | 300,000 | 300,000 |
| Operations | 250 | | 4,125 | 4,538 | 4,991 | | | | | | | | | | | | | | | | | 25,228 | 27,751 | 30,526 | 33,579 | 37,500 |
| Overhead | 15,000 | | 15,000 | 15,300 | 15,606 | | | | | | | | | | | | | | | | | 21,852 | 22,289 | 22,735 | 23,190 | 23,653 |
| Rent | 1,000 | | 1,000 | 1,000 | 1,000 | | | | | | | | | | | | | | | | | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Fixed Assets | 2,000 | | 2,000 | 2,000 | 2,000 | | | | | | | | | | | | | | | | | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Variance | 20% | | 4,425 | 4,568 | 4,719 | | | | | | | | | | | | | | | | | 10,016 | 10,608 | 11,252 | 11,954 | 12,831 |
| **Revenue** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System payments | 7.5 | | 750 | 1,500 | 2,250 | | | | | | | | | | | | | | | | | 56,250 | 67,500 | 82,500 | 97,500 | 112,500 |
| **Result from operations** | | | **- 25,800** | **- 25,905** | **- 26,067** | | | | | | | | | | | | | | | | | **- 3,846** | **3,852** | **14,987** | **25,778** | **35,516** |
| Net result | | - 183,993 | - 40,800 | - 40,905 | - 41,067 | | | | | | | | | | | | | | | | | - 228,846 | - 221,148 | - 285,013 | - 274,222 | - 264,484 |
| Funding Need | | - 183,993 | - 224,793 | - 265,698 | - 306,764 | | | | | | | | | | | | | | | | | - 1,843,481 | - 2,064,630 | - 2,349,643 | - 2,623,865 | - 2,888,349 |
| ***Funding Sources*** | | * | | | | | | | | | | | | | ** | | | | | | *** | | | | | |

columns for months 4-19 have been collapsed for readibility

| **Summary Need** | **Systems** | **Cost** |
|---|---|---|
| 12 months | 1,000 | - 681,712 |
| 24 months | 15,000 | - 2,888,349 |

* *~1,000,000 (equity, reduced by up to $500,000 in grants over the first 12 months of Early Growth Phase)*

** *1,900,000 (reduced by grants and/or concessionary debt of up to 1,000,000 over months 13-24)*

*** *10000000: 2.5mm additional debt, 7.5mm debt*

Table A5.10. Once a DESCO has reached stable operation, attractive returns are typically reached, so that OGEF can exit and further growth is possible without additional ODA.

| ***A DESCO operating at scale*** | | | | | |
|---|---|---|---|---|---|
| INPUTS | Customers | | 100,000 | # | cumulative |
| | Growth Rate | | 150,000 | # / year | annuallized |
| | ARPU | | 7.50 | USD | The revenue DESCOs can expect from customers should drive the size of the system they provide |
| | Simple payback | | 20 | months | |
| | System Cost | | 150 | USD | DESCOs manage AIPU against ARPU and target a simple payback of ~20 |
| | Average life | | 6 | years | |
| | Monthly amort | | 2.08 | USD | To maintain ARPU DESCOs need to replace assets as the deteriorate. |
| **INCOME** | Revenue | | 750,000 | USD | |
| **COSTS** | Collection & control | 4% | 30,000 | USD | Mobile money fees, commission to agents |
| | Maintenance | 15% | 112,500 | USD | Salaries for service and technician |
| | Service | 10% | 75,000 | USD | Salaries for call centre |
| | Management | 5% | 37,500 | USD | Overhead |
| **GROSS** | **EBITDA** | **66%** | **495,000** | **USD** | |
| | Amortization | 28% | 208,333 | USD | driven by system cost and average life |
| | Capital Need | | 15,000,000 | USD | driven by system cost and # customers |
| | Debt | 50% | 7,500,000 | USD | Leverage could be higher or lower |
| | Interest | 10% | 62,500 | USD | Interest rates could be higher or lower |
| **NET** | Net result | | 224,167 | USD | EBT, before taxes |
| **PROFIT** | **ROC** | | 18% | | |
| | **ROE** | | 36% | | |

## Annex 6. Gender Dimension of Energy Access in Haiti
## Haiti Modern Energy Services for All Project

### A. Gender inequalities in Haiti

1. According to the recent poverty assessment report[43], many inequalities between men and women in Haiti persist. Women and girls in Haiti face significant obstacles when accumulating assets, including human capital, and they register lower education and health outcomes. Despite sizable progress in school enrollment among younger cohorts, adult women are still less well educated than adult men and are more likely to be illiterate. Underage marriage represents an additional threat for girls who are not in school: 17 percent of Haitian women are married in adolescence, compared with 2 percent of men, while this number drops among girls with higher education.

2. Women are significantly disadvantaged in using their assets and obtaining the relevant returns, particularly in the labor market. Apart from initial differences in endowments, women in Haiti seem to face additional obstacles in participating in the labor market. Holding constant several social and demographic characteristics, one finds that women are 20 percentage points more likely than men to be unemployed and, if working, 6 percentage points more likely to be in the informal sector. Wages among women are also 32 percent lower than wages among men. Statistical tests show that over two-thirds of this difference is unexplained by observable characteristics, suggesting that discrimination could play a role in accounting for the result.

3. Maternal mortality, at 380 deaths per 100,000 live births, is still five times higher than the regional average. Poor nutrition is also a threat for both children and mothers: 22 percent of children are stunted or too short for their age, while nearly half of women aged 15–49 have anemia. The prevalence of HIV/AIDS is higher among women (2.7 percent) than men (1.7 percent), reflecting both knowledge differentials (only 15 percent of young women have correct information on how to prevent sexual HIV transmission, versus 28 percent of young men), lack of agency, and physical differences. Furthermore, poor education and gender norms interact with health outcomes.

4. Gender-based violence and low participation in the public sphere are widespread in Haiti, reflecting weak agency. Gender-based violence is a chronic problem: 13 percent of Haitian women have experienced sexual violence, and 29 percent of women who have ever been married have experienced spousal violence, whether emotional, physical, or sexual.

### B. Overview of gender differentiated benefits of energy access

5. Energy access interventions can affect women and men differently, as they have different roles and voices in the household and wider community. The literature on gender and energy suggests that providing household and community electricity access can promote gender equality, and women's empowerment can provide new employment opportunities for women, and can improve

[43] World Bank: Creating Opportunities for Poverty Reduction in Haiti, 2015.

health and education for women and girls. Most of these gender benefits accrue, because women tend to spend more time at home, are responsible for household chores and home-based income-generating activities that can be carried out more productively with electricity.[44] Key benefits include:

- **Improved safety and reduced gender-based violence**. Community electrification, especially street lighting, increases safety for women and girls, and allows them to move more freely after dark – which also increases a possibility of socializing, education and income-generating activities in the evening hours.
- **Women empowerment through better access to information.** Greater access to mass media can influence knowledge about health, beliefs and attitudes about gender roles, and awareness of the rights of women. For example, gender assessment carried out for Bank's Bangladesh RERED Project has shown that access to media through solar home system ownership increased mobility and entrepreneurial ambitions for women.[45]
- **Increased productivity of time allocated to "domestic" and "reproductive" chores.** There is evidence that electricity increases productivity of women spent on domestic chores but there is less clarity on how the women spend the freed-up time. Some studies show increased income generating activities; others point to increased socialization and leisure and more time for child-care; while some actually show an increase in time spent on domestic chores due to the prolongation of the productive day.
- **Expanded income generating opportunities at home and outside home.** Access to electricity at home can result in income generating activities for women – particularly in those countries where there are not too many other obstacles for women to start a business. A study in Tanzania, Bolivia and Vietnam found that locating the enterprise in the household allowed women to combine income-generating tasks with household duties. In Bangladesh, access to electricity was found to be correlated with time women allocated to income generating activities and the probability of employment. In addition, men's and women's business and retail enterprises can continue operating and keeping their stores open during the evening.
- In Haiti, women demonstrate a similar pattern of engaging in income-generating activities in the household. For example, in the Artibonite region, activities range from producing fruit juice, ice cream, as well as raising chickens for commercial use in facilities next to their homes. Outside of homes, common activities include growing and selling agricultural products and selling bottled drinks in small shops. Women consider having electricity to support cooling systems as the priority for income-generating activities. Charging cell phones is also among the top priorities. The availability of electricity-use of solar lamps that last through the night will allow the chickens to be more frequently fed and grow at a faster

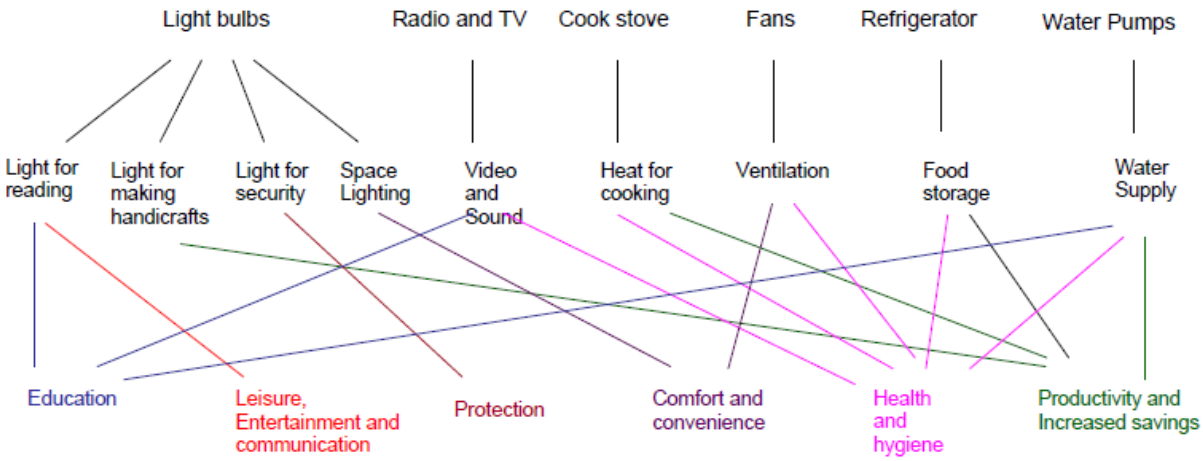
[44] This overview is based on a vast literature review summarized in two recent reports: Köhlin, Sills, Pattanayak, Wilfong: Energy, Gender and Development; What are the Linkages? Where is the Evidence? World Bank, 2011; and World Bank/Sustainable Energy for All: Global Tracking Framework, World Bank, 2015, as well as ESMAP/WBI e-learning module on gender and energy. In addition, the overview draws in particular on two recent studies from Bangladesh (Samad, Khandker, Asaduzzaman, and Yunus: The Benefits of Solar Home Systems: An Analysis from Bangladesh, Policy Research Working Paper 6724, World Bank, 2013); and Rwanda (Grimm, Munyehirwe, Peters, Sievert: A First Step Up the Energy Ladder? Low Cost Solar Kits and Household's Welfare in Rural Rwanda; RUHR Economic Papers #544, 2015) as they provide recent evidence on impacts of programs similar to the proposed Project.

[45] Sadeque, Rysankova, Elahi, Soni: Scaling up Access to Electricity: the Case of Bangladesh, World Bank Livewire, 2014

speed. In places without electricity, women need to travel long distances by foot to cell-phone charging booths, which also charge a fee. Having electricity to charge cell phones in their own vicinities will significantly save them time. The battery duration was reported to be the most important quality for female-headed businesses and households.

- Some studies also show positive correlation between rural electrification and employment, especially for younger women. For example, electrification of rural communities in South Africa and Guatemala resulted in a 9 percent increase in female employment, but no comparable increase in male employment. In addition, studies show that there are win-win opportunities for integrating women in energy supply chain. Encouraging women to become involved in the energy sector, for example as energy entrepreneurs, offers multiple development benefits, like expanding economic activities for women, diversifying productive options, and creating new sources of wealth and income to support family investments in education and health. (See Box A8.1. for emerging examples of these win-win models in Haiti). Women's economic empowerment in energy (as in other sectors) contributes to broader aspects of empowerment, such as political participation and consultation in interventions where women are the identified beneficiaries.
- **Health and education benefits.** The health benefits of electricity stem from cleaner air, reduced risk of burns, fires, and accidents, better nutrition and food safety from refrigeration, and improved health knowledge from access to mass media, as well as improved health services due to electrification of health clinics. There is some emerging (although still limited) evidence that women and children are those who benefit most from the switch from health-damaging kerosene lighting. A recent study reports that accidental ingestion of kerosene is the primary case of child poisoning in the developing world, and a frequent cause of infant burns (e.g. in Bangladesh, kerosene lamps are responsible for 23 percent of infant burns). In addition, women and children spend a larger proportion of their time indoors and thus experience a greater exposure to pollutants than males. A recent impact study of Bangladesh solar home system program showed that solar power had a positive health impact, especially for women. Adopting a solar home system reduced respiratory disease in women by aged 16 and above by 1.2 percent (while no comparable effect was found for men). Studies also report positive impact on education (primarily increased time to study) for both boys and girls.

Figure A6.1: Electrification benefits




Source: Köhlin, Sills, Pattanayak, Wilfong: Energy, Gender and Development; What are the Linkages? Where is the Evidence? World Bank, 2011

## C. Overview of best practices to facilitate gender benefits of electricity access

6. Available research shows that the above mentioned gender benefits are neither definite nor assured in all situations.[46] For example, electric light after dark may improve the quality of life for some, by allowing reading, entertainment, or education via radio and television, whereas for others it may simply extend the working day. Reaching equitable outcomes is challenging as women often have less influence over decisions and exercise less control over their own lives and resources. Available evidence and experience, therefore, points out to a need to complement the electricity interventions with specific actions to ensure that electricity benefits indeed do accrue to both men and women. This can be done through several avenues:

- **Making it easier for female-headed households to receive electricity connections.** For example, Bank-supported Lao PDR "Power to the Poor" program aimed at increasing the density of connections by subsidizing the connection costs. The program's effectiveness was increased by specifically targeting poor female-headed households, which had difficulty obtaining connections due to a combination of economic and socio-cultural factors. In addition, high up-front costs of access to modern energy services may more severely affect female-headed households, often overrepresented in poorer quintiles. Low-income groups, particularly women, rarely have access to finance from formal institutions. This circumstance calls for an introduction of a range of financing schemes.
- **Making sure that women are well educated about the benefits and opportunities of electricity access**. Often, projects finance consumer education campaigns, but it is important to ensure that these campaigns are carried out in such a way that they effectively reach women. For example, Bangladesh RERED project has been providing training for all SHS users, but the gender-focused social assessment of the RERED project found out that the

[46] Or in fact, that in some cases, electricity can have a negative impact on women – e.g. some studies have shown that electricity has resulted in longer work days with less leisure time for women, which may maximize overall household utility but may be detrimental to women in the household. Also, some studies have shown that electrification of communities, which led to greater mechanization, resulted in reduced employment opportunities for women.

place and time of training was sometimes difficult to attend for women. As a result, a more gender-sensitive training approach was designed.

- **Creating opportunities for women to become integrated in the supply chain**. This is in particular relevant for off-grid electrification market development programs. These programs (like Haiti) aim at market transformation – from kerosene-based lighting to modern electricity/lighting, often supporting the creation of a new industry and supply chains. There is a growing evidence on how women's integration in these supply chains can be a win-win solution. A growing number of energy enterprises have begun to employ women as sales representatives to reach low-income consumers at the base of the pyramid with lighting and cooking solutions. Women help ensure that energy products reflect the priorities of women users, increasing the likelihood of adoption and continued use.[47] Such cases, in fact, are already emerging in Haiti.

**Box A8.1. Women and off-grid electricity business opportunities – emerging evidence from Haiti**

Integrating women in the off-grid electricity supply chain can be a win-win situation. For women, this represents new entrepreneurial and employment opportunities, while the businesses can strengthen their supply chains, improve the effectiveness of their marketing strategies, and ultimately increase their profitability and sustainability. For example, EarthSpark, a micro-grid operator, has demonstrated successfully that involving women in the development and operation of micro-grids promotes sustainability. For example, all micro-grid "ambassadors" (promoters of the micro-grid) are women, and half the energy vendors in the town are female. These vendors generate new income by selling energy credits similar to the way that mobile phone credits are sold. As the next step, EarthSpark is also planning to offer a loan product for women connected to the grid to start or expand agriculture-processing and food-preparation businesses. See Annex 2 for a more detailed description of this business model, built on an active participation of women in the off-grid energy supply.

- **Reducing time used on domestic chores.** Electricity is not the end by itself but an input for a variety of services. As discussed above, electricity can significantly reduce time needed for domestic chores, but the time-saving appliances are not always available and affordable to women. Electrification has been found to have greater positive impacts on women when accompanied by effective social marketing and financing schemes for appliances that reduce the time required for domestic chores.[48]
- **Providing additional support for women to use electricity for productive uses.** There is a mixed evidence overall to what extent the electrified households, and women in particular, use electricity for income-generating activities. Often, electricity is only one of many constraints for productive uses and if other constraints persist, impact on income generation may be limited.[49] Additional measures to reduce other barriers may therefore be needed. For example, Bank-supported Mali Household Energy and Universal Access project has successfully supported a partnership with microfinance institutions to support women's micro-enterprises using newly provided electricity services.

[47] See World Bank/SEFORALL: Global Tracking Framework, 2015
[48] ESMAP: 2013. Integrating Gender Considerations into Energy Operations. World Bank, 2013
[49] Barriers related to low levels of ownership and control over resources, illiteracy, lack of exposure, and poor information and training may affect women more than men, as women are often excluded from decision-making. Informal nature of many women's enterprises is linked to problems of access to credit, equipment, and other support services

7. The project integrates these lessons in the Project design, focusing on measures consistent with the private sector-led nature of the Project.

Table A6.1: Summary of Gender issues and corresponding actions

| Issue addressed | Project action |
|---|---|
| Support female-headed households to get electricity access.<br>Female-headed households tend to be disproportionately represented in poorer quintiles. The high upfront costs of renewable energy products, combined with lack of access to credit, can serve as an important barrier for them to access off-grid electricity services. | 1. The Project is supporting a range of renewable energy products and business models, including the basic products for the base of the pyramid, such as solar lanterns.<br>2. The Project is in particular supporting a service-oriented approach, such as pay-as-you-go (PAYG) models, which minimize the need for upfront investment, and allow consumers to pay for services the same way they currently pay for kerosene (in small quantities, based on demand).<br>3. The Project will carry out a consumer awareness campaign, which will also target female-headed households. Overall, the consumer awareness/education activities will be carried out in a gender-sensitive manner.<br>4. The Project will have a beneficiary feedback mechanism through cell phone surveys, which will provide gender disaggregated data, and will provide feedback whether additional measures to support female-headed households are needed. |
| Reduce time women spend on domestic chores.<br>Electricity can significantly reduce time needed for domestic chores, but the time-saving appliances are not always available and affordable to women. | The Project will not only provide access to electricity, but to the extent possible will also promote provision of energy efficient appliances, particularly in mini-grids. The Project's service oriented approach provides an opportunity for bundling electricity service provision with leasing or other form of financing for these energy efficient appliances. |
| Support income-generating activities by women.<br>There is a growing evidence on how women's integration in these supply chains can be a win-win solution. Women can help ensure that energy products reflect the priorities of women users, increasing the likelihood of adoption and continued use. | The Project will take specific actions to integrate women in the emerging off-grid electricity supply chains, building already on positive examples emerging from the ongoing off-grid electricity activities in Haiti (see Box A8.1). The specific actions will include:<br>1. The Operating Guidelines task the Fund Manager to pay attention to gender impacts of the supported off-grid electrification investments.<br>2. The off-grid energy companies will be required to elaborate in their business plans the approaches to integrate women in their supply chains, which will be considered a bonus in evaluating these plans.<br>3. The Project will support knowledge exchange about the best practices within and outside Haiti.<br>4. The Project will provide training, specifically targeting women entrepreneurs. |

## Annex 7. Clean Technology Fund (CTF)
## Haiti Modern Energy Services for All Project

### A. Results Framework[50]

| Indicator | Baseline 2014 | CTF-funded Haiti modern Energy Services for All Project (by 2024) | Scaled-up Phase, including CTF&SREP (by 2030) |
|---|---|---|---|
| Installed off-grid RE capacity for power generation [MWp] | 3 | >10 | >20 |
| Number of direct people using low carbon off-grid electricity [n. of people] | 300k (incl. with low quality products) | >500k (only quality products) | >2M (only quality products) |
| Energy generated by off-grid electricity = savings + increased use [GWh/yr] | 10 incl low qual | >20 | >40 |
| Tons of GHG emissions reduced or avoided<br>- Tons per year [$tCO_{2eq}$]<br>-Tons over weighted aggregate lifetime of project systems [$tCO_{2eq}$] – details see end of this Annex | | tons per year: >60 thousand<br>tons over system lifetimes: >1 million | tons per year: >200k<br>tons over system lifetimes: >4 million |
| Additional Financing leveraged through CTF funding [$ million] | 0 | 48 (private) | 160 (private) |
| CTF leverage ratio [1:X] | | 1:3 | 1:10 |
| Cost effectiveness<br>- CTF cost effectiveness [$\$_{CTF}/tCO_{2eq}$ avoided over lifetime of project systems] | | CTF Cost Effectiveness: 15 US$/t | n.a. |
| - Total project cost effectiveness [$/$tCO_{2eq}$ avoided over lifetime of project systems] | | Total Cost Effectiveness: 60 US$/t | |
| Other co-benefits | (i) Increased availability of power through increased renewable energy (RE) development in rural Haiti<br>(ii) Efficiency gains through improved RE technology for domestic appliances and machinery for productive uses<br>(iii) Increased energy access and Improved reliability through locally adjusted RE service provision models<br>(iv) Development of local industry and increased employment from RE expansion into rural Haiti<br>(v) Local environmental benefits from lower pollution from diesel generation, kerosene, candles, batteries | | |

[50] The CTF Results Framework includes expected results from the CTF operation only. The results projections take into account the impact of the parallel SREP-funded Renewable Energy for All Project. However, to avoid double-counting for those components that are funded by both sources of funding, overall Program results (CTF+SREP) were determined and then the results indicators were attributed proportionally to CTF and SREP Project, based on the percentage of non-TA financing from each source (66 percent for CTF and 34 percent for SREP).

| | |
|---|---|
| | (vi) Gender strengthening through targeted interventions<br>(vii) Social and economic impacts of the new off-grid energy access and use |

## B. Introduction

1. *Country background*. Haiti's geography, people, and history provide it with many opportunities. The third largest Caribbean nation by area and population (10.4 million), Haiti shares the island of Kiskeya with the Dominican Republic. In addition to an illustrious early history, as the first independent nation in the region and the first nation in the world to be led to independence by former slaves, Haiti benefits from proximity and access to major markets, a young labor force, a dynamic diaspora, and substantial geographic, historical, and cultural assets, which offer a range of economic opportunities. However, Haiti's population of 10.4 million, half of which is rural, remains poor. According to the most recent national household survey (ECVMAS, 2012),[51] nearly 60 percent of the Haitian population was classified as poor and almost a quarter of the population was extremely poor. Haiti is the most unequal country in the region. The richest quintile holds over 64 percent of the total country income, while the poorest quintile holds less than 1 percent. There are also strong gender inequalities and disparities between urban and rural areas. Moving forward, and more inclusive growth will be needed to significantly reduce poverty, which will require also more attention to creating growth opportunities in secondary cities and rural areas

2. Haiti is considered a Fragile State as per the Bank's harmonized list of Fragile and Conflict-affected States (FCS). Its economic performance has repeatedly been compromised by political shocks and natural disasters. The most devastating impact was registered from the 2010 magnitude 7 earthquake, which killed around 300,000 people and displaced 1.5 million in Haiti's capital and nearby towns, making it one of the deadliest natural disasters on record. It resulted in damages and losses of around US$8 billion (120 percent of GDP) from which Haiti had just started to recover, when the next major natural disaster hit the country in October 2016. The deadly Category 4 Hurricane Matthew hit Haiti on October 4, 2015, affecting over 2 million people (20 percent of Haiti's population), and .causing damages of US$1.9 billion, the equivalent of 22 percent of GDP.

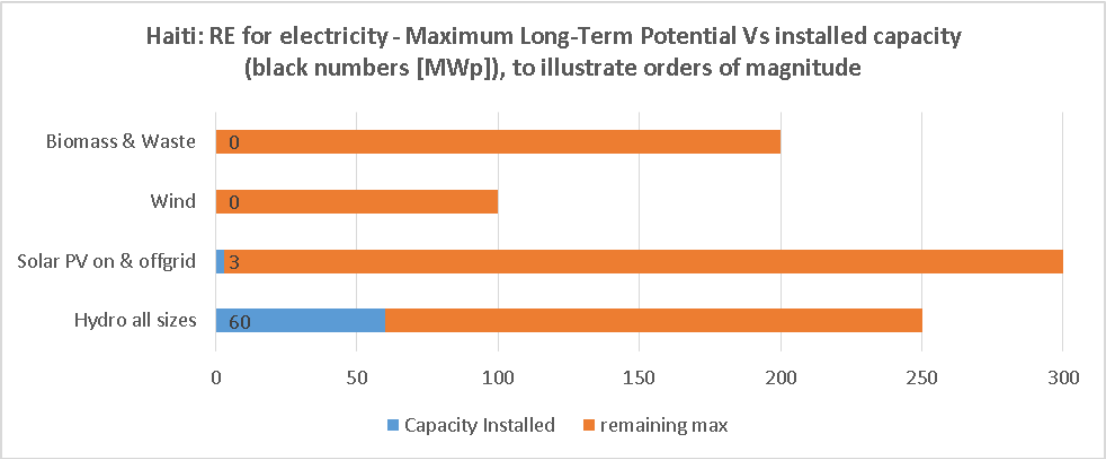
3. .*Power sector in Haiti.* The main provider of electricity services in Haiti is the national, government-owned utility Electricity of Haiti (*Electricité d'Haïti*; EDH), serving some 270,000 (legal) customers, mostly in the Port-au-Prince metropolitan area – with additional nine isolated grids scattered throughout the country. Current electricity infrastructure is aging and has been poorly maintained. Installed generation capacity is about 320 MW, of which only 176 MW is available - insufficient to meet estimated peak load demand of more than 500 MW, resulting in frequent load-shedding and service interruptions. Most of the power (81 percent) is supplied through oil-based thermal generation (diesel and fuel oil) with EDH-owned hydropower contributing 19 percent. These fossil-fuel generation plants are expensive for EDH, straining its financial situation. EDH faces considerable technical, managerial and financial challenges. Technical and nontechnical losses are 65 percent. Further, the collection rate is only two–thirds. Consequently, EDH faces difficulties in paying for fuels, basic maintenance, and other operating costs, and depends on government subsidies to bridge the gap. The average daily electricity service of only 16 hours compels most industries to self-generate. It is estimated that the cumulative

[51] ECVMAS survey; 2012

capacity of individual diesel generators in the country is more than 500 MW (three times as much as EDH's available capacity).

4. *Renewable energy resources in Haiti.* Haiti has excellent, but largely untapped, RE potential, including hydro, biomass, wind, and solar, as confirmed by recent and current studies (see figure below). However, despite such abundance, progress in harnessing it has been slow.

Figure A7.1 Haiti Renewable Energy Potential




Source: GOH: SREP Haiti Investment Plan, 2015.

5. *Haiti's off-grid energy pathway and challenges ahead.* Investments in rural electrification in Haiti have remained scarce in the last 30 years, resulting in an official rural electrification rate (legal grid connections) kept more or less constant at around 5 percent. With EDH absent from most of the rural areas, local governments and users have been left on their own to find solutions to their electricity needs. Considering the high costs of running a diesel gen-set, most rural households (i) rely on kerosene and candles for lighting, at extremely high unit costs and low quality; (ii) charge their increasingly spread and vital mobile phones at commercial charging stations; and (iii) buy disposable batteries for their radios and other similar appliances. Only recently have solar lanterns started to emerge as an alternative, but most of the lanterns sold on the market are of low quality, delivering poor service and breaking frequently.

6. Haiti's rural poor spend a very large share of their total household budget on basic lighting and energy services for very poor service quality and quantity and at high unit costs. According to project preparation household surveys,[52] the departmental averages for rural households are between US$10 and US$20 a month – which is high in international comparison. These high costs are not only a burden on rural household budgets, but they are also constraining growth and productivity of agri-businesses and other rural SMEs.

7. A range of renewable energy-based solutions exist today that can provide much superior level of service at price points lower than what the Haitian consumers (both households and businesses) pay today. Not surprisingly, many of these products and technologies are now also emerging on

[52] Both ECVMAS (2012) and Digicel/iiDevelopment survey (2014) carried out for the preparation of the SREP Investment Plan and CTF Project confirmed similar data. Details described in the economic analysis Annex 7.

the Haitian market, although their penetration levels are still very low and entry barriers are significant.

8. The first two RE markets that have emerged in Haiti in post-earthquake years are those for (i) solar lanterns/pico-PV products, and (ii) larger roof-top solar PV systems for self-supply for (mostly urban) businesses and industries to reduce diesel spending (the ”fuel-savers”). More innovative business models, such as pay-as-you-go (PAYG) solar kits and smart micro-grids (see Annex 1 for details), are now also beginning to emerge. Therefore, off-grid electrification is a viable option in Haiti: (i) consumers have unmet demand and capacity to pay for off-grid solutions, as demonstrated by already high average monthly payments for inferior alternatives; and (ii) various supply options, which can deliver services to different market segments, exist and have been demonstrated (at least on a pilot basis) to work in Haiti. The challenge is to scale-up from thousands of households served to hundreds of thousands and millions. The scale-up is currently constrained by early market stage inefficiencies. The key barriers identified in consultation with the existing off-grid energy companies, and supported by consumer surveys and market data, include:

- Consumers lack of confidence due to market spoilage by inferior quality products and difficulty to pay high upfront payments for higher-end products,
- Unfair competition between fossil fuels and renewable energy products/technologies,
- Lack of private sector financing due to the nascent character of the off-grid industry and underdevelopment of the Haitian financial markets, and
- Regulatory uncertainties increasing investors risk premium.

9. An effective public sector intervention therefore should focus on removing these early stage market inefficiencies, in particular addressing various (initially inflated) risk perceptions from consumers and investors alike in order to build necessary conditions that would allow phasing out of the public support over time. This in particular includes:

- Building consumer confidence in renewable energy technologies by (i) increasing the market share of high quality products, (ii) leveling the playing field with fossil fuel alternatives and (iii) focusing on the development of business models that allow consumers to “test” technologies at low risk.
- Building investors and financier confidence by (i) reducing regulatory risk, and (ii) demonstrating profitable business models with growth potential.
- Fill in the financing gap before private sector funding can materialize at larger scale.

**C. Brief Project Description**

10. The Haiti Modern Energy Services for All Project is proposed to be financed from the CTF window of the Dedicated Private Sector Programs for renewable energy mini-grids and distributed power generation to encourage private sector to invest in filling the gap in the energy access for off-grid households and businesses.

11. The Project Development Objective (PDO) is to accelerate private sector-driven, renewable energy-based off-grid electrification in rural and peri-urban areas of Haiti.

12. This objective will be achieved primarily through assisting the Government with the creation of an enabling regulatory framework; and providing funding and market development activities

(through the Off-Grid Electricity Fund- OGEF) for commercially viable off-grid electrification investments with a potential for replication and scale-up in the Haitian conditions.

13. Renewable energy-based off-grid electricity services will comprise a variety of technologies and business models, including individual systems, such as solar lanterns and solar home systems, and village-based systems, such as mini- and micro-grids, powered by renewable energy or hybrid sources (renewables with a diesel back-up and/or battery storage). Private sector is understood to comprise also NGOs and cooperatives.

14. The financing is envisaged as a combination of a Grant (US$1.43 million) and Contingent Recovery Grant (US$14.22 million) to GOH. The grant would cover the policy and regulatory support, the Contingent Recovery Grant will finance OGEF, which will provide equity and debt to commercially viable off-grid energy enterprises. The use of the Contingent Recover Grant would allow the World Bank (as CTF trustee) to recover the proceeds from OGEF investments and lending at OGEF closure up to a maximum of the disbursed amount of CTF financing for OGEF, and after the payment of OGEF Fund Managers fees and any other closing expenses.

15. The CTF Modern Energy Services for All Project proposes to accelerate market development, and thereby jump-start the scale up of diverse off-grid electrification solutions in Haiti. This will be done primarily through overcoming the initial market inefficiencies on both demand and supply side. In particular, the project will address the current high risk perception of off-grid RE technologies and business models by both the potential users and the potential investors by:

- increasing penetration and consumer awareness of high quality off-grid electricity/lighting products at the market,
- promoting service-oriented approaches, such as PAYG that help users overcome the initial upfront payment and risk perception barriers,
- demonstrating and growing businesses with profitability and scalability potential, and
- reducing investor risk by creating a favorable business environment.

**Project Components**

16. The project will have the three following components as summarized below and detailed further in Annex 2:

(i) Enabling environment and OGEF oversight

(ii) Off-grid electrification sub-projects

(iii) OGEF management, OGEF's operations development and project implementation support

*(i) Component 1: Enabling environment and OGEF oversight (US$1.43 million), i*mplemented by the Energy Cell of the Ministry of Public Works, Transportation and Communications (MTPTC).

17. To achieve the desired off-grid electrification acceleration, it is essential to improve the business environment. While minimum conditions for operating off-grid business in Haiti exist today, as demonstrated by the vibrant (yet low quality) solar lantern market and emerging innovative business models, their scale-up is constrained by the early market inefficiencies. Component 1 will include TA activities related to improving fiscal and regulatory environment, setting quality standards and promoting energy efficient solutions, improving consumer awareness of RE technologies, promoting gender-sensitive approaches, strengthening capacities and carrying out knowledge exchanges. It will also support the Energy Cell of MTPTC to oversee OGEF via the Advisory Committee.

*(ii) Component 2: Off-Grid Electrification Sub-projects (CTF Contingent recovery grant US$12 million),* [53] implemented by the Industrial Development Fund (FDI), in partnership with the competitively selected International Fund Manager (see Annex 2 & 3 for details).

18. This component will establish an Off-Grid Electricity Fund (OGEF), consisting of equity, loans and results-based financing modalities responding to different needs of the off-grid energy enterprises, serving different consumer segments. It will support OGEF's provision of financing to Eligible Beneficiaries (energy enterprises providing off-grid electricity services) to carry out off-grid electrification sub-projects. "Off-grid electrification subproject" means an investment or series of investments in off-grid electrification activities (including generation, distribution and commercialization of off-grid electricity). It could also potentially include assembly/manufacturing of off-grid electricity products and parts to serve the growing Haitian off-grid market.

19. OGEF will be structured as a technology-neutral investment vehicle initially funded by CTF resources. OGEF will be a Government-owned fund, which will be professionally managed by a Partnership of local and international fund managers. The Industrial Development Fund (*Fonds de Développement Industriel* – FDI) will play the role of the local fund manager. Haiti's Ministry of Economy and Finance will sign a Subsidiary Agreement with FDI to task it to enter into a partnership with an International Fund Manager to manage OGEF on Government behalf.

20. FDI is a specialized financial institution of the Bank of the Republic of Haiti (Haiti's Central Bank), with demonstrated experience in investing in and lending to SMEs in Haiti. FDI's local investing experience will be complemented by the expertise of the International Fund Manager (IFM), which will be competitively selected and will have demonstrated experience with investing in off-grid energy businesses internationally. FDI and IFM will sign a Partnership Agreement to manage OGEF. They will be tasked to manage OGEF on GOH's behalf, and they will be incentivized to create positive financial returns on the Fund while creating positive social and environmental impacts in line with Government and CTF interests. FDI and the International Fund Manager will have investment autonomy. They will be authorized to take investment decisions, based on the principles provided in the Operating Guidelines, without a need for additional approvals from the Government. OGEF operations, however, will be supervised by an Advisory Committee, which will include two governmental and three non-governmental members. The Advisory Committee will be involved in higher level decisions, such as the change in the Operating Guidelines, but it will not approve investments. OGEF's managerial and financial autonomy will be further reinforced by disbursement arrangements – e.g. World Bank's direct disbursements to the FDI's account.

21. CTF funds will be disbursed during the investment period of the first 6 years; however, OGEF is expected to have a duration of 11 years (last year for closing arrangements), and will have the ability to make additional investments using proceeds from initial investments (liquidated equity holdings and repaid loans) up to Year 10.

22. The Subsidiary Agreement signed between MEF and FDI will require FDI to establish a segregated account for all proceeds from CTF-funded OGEF investments and lending (liquidated equity holdings and repaid loans). These proceeds could be reinvested during the OGEF life (10

[53] Additional US$ 3 million will be provided to OGEF for the provision of limited grant funding for off-grid energy businesses, along the business lines described below.

years), but all of them would need to be liquidated by Year 11. At Year 11, all funds in the CTF segregated account, up to a maximum of the disbursed amount of CTF financing for OGEF, and after the payment of OGEF Fund Managers fees and any other closing expenses, would be returned to the World Bank, acting as a trustee for CTF..

23. OGEF will offer the following types of support:

- *Equity and grant financing[54] for DESCOs, including municipal grids.* The initial market analysis demonstrates that the Haitian market could support 3-4 DESCO-type businesses, which provide energy services to households, businesses with individual solar kits/home systems, using pre-paid pay-as-you-go meters (see description in Box A2.2, Annex 2), as well as 3-4 micro-grid companies with national reach. Based on the historic development of DESCOs and smart micro-grids in other countries, early stage equity and grants will be needed to launch these businesses.
- *Medium-term loans for DESCOs and mini-grids.* While equity/grant combination is usually needed to start a new off-grid venture, the expansion of businesses will require debt financing, ideally in the local currency, 3-6 year tenors, which will allow companies to pre-finance equipment and recover investment through fees/tariffs over time. As debt financing will likely be the main source of financing of companies in the expansion phase, this business line will also start creating evidence of viable business opportunities for local commercial banks, which should become the main funder of these companies once the market grows and the financial viability of these investments is demonstrated.
- *Working capital and results-based grants[55] for premium quality solar lanterns.* Experience from Haiti, as well as other countries, shows that local distributors (mostly SMEs or NGOs) face problems with access to short-term working capital, which would allow them to (i) import quality products at greater quantities and (ii) provide better financing terms to their retailers and/or final users. Access to working capital would therefore enable a faster market penetration for solar lanterns/solar kits. In addition, this component will provide a time-based limited support in terms of results-based financing (RBF) for premium quality (Lighting Global certified or equivalent) products. This will be a limited and time-bound "pump priming" support aimed at further expanding the share of high quality off-grid products in this crucial stage of market transformation in Haiti.

24. The CTF funds will be used for equity and/or loans. The parallel SREP Project will add US$3 million grant funding for OGEF for off-grid energy businesses. These will include the grants mentioned above: (i) results-based grants for quality-verified solar products to support penetration of higher quality products on the Haitian market; (ii) start-up grants for piloting viable, scalable and sustainable business models; and (iii) hybrid results-based grants for growth of early stage off-grid businesses with viable business plans.

*(iii) Component 3: OGEF Management, operations pipeline development and project implementation support (CTF Contingent recovery grant US$2.22 million)*

[54] Grant financing will be provided through parallel financing under the SREP Renewable Energy for All Project.
[55] Results-based grants will be provided under the parallel SREP-funded Renewable Energy for All Project.

25. Sub-Component 3a) will be implemented by MTPTC and Sub-Component 3b) by FDI in partnership with the International Fund Manager. See Annex 2 & 3 for details.

26. This component will finance (a) the payment of the Fund Manager Fee, and (b) the provision of support to the FDI/International Fund Manager for: (i) the development of a pipeline of off-grid electrification subprojects; (ii) the carrying out of due diligence in respect of Financings and off-grid electrification subprojects, including on environmental and social safeguards screening; and (iii) the monitoring and evaluation of off-grid electrification sub-projects and project activities.

### D. Linkages with the SREP-Haiti Investment Plan

27. The proposed CTF-funded project forms an inherent part of Government's vision for renewable energy development, as formulated in the SREP Investment Plan (SREP IP), endorsed by the SREP sub-committee in May 2015. Haiti SREP program is conceived as a comprehensive program, with the objective to initiate a transformation from the underdeveloped, unreliable, and expensive fossil fuel–based electricity generation mix to a modern and sustainable energy system relying on diverse sources of power, responding to GOH's vision for Haiti becoming an emerging economy by 2030. This vision includes a parallel track for reaching universal access to electricity:

- Improving EDH performance and supporting on-grid generation capacity. The aim is to enable EDH to provide reliable and affordable electricity services in urban areas and surroundings.
- Supporting private sector solutions for off-grid electrification for households, businesses, and institutions not served by EDH.[56]

28. The World Bank Group is scaling up its support to GOH to implement the vision, through three separate financing windows: IDA (US$90 million – existing PRELEN project, which has been restructured in July 2017 to provide increasing amount of financing for renewable energy and access to complement the CTF and SREP interventions), SREP (US$30 million – IP endorsed, projects ready for the Board presentation) and CTF (US$16 million – the proposed Modern Energy Services for All Project), which jointly cover a wide range of public and private approaches to expand electricity access in both urban and rural areas. See Table A7.1.

Table A7.1. WBG interventions for a range of public and private off-grid electrification approaches

| | IDA | | SREP | | CTF |
|---|---|---|---|---|---|
| Urban areas | WB | | WB | IFC | |
| Rural areas | WB | WB | WB | | WB |
| | Public sector approaches | | PPP | Private sector approaches | |

[56] As formulated in GOH: SREP-Haiti Investment Plan, 2015

29. Together, IDA, SREP and CTF will address the universe of electrification options, leveraging private sector in several on-grid and off-grid electrification segments. See Table A7.2 showing complementarity and leveraging of IDA, SREP and CTF investments.

30. Specifically, the proposed CTF-funded project is expected to complement and leverage IDA and SREP investments by focusing on those market segments that – once reaching a critical scale – can be run as profitable businesses, without any public sector support. SREP projects will then expand the private sector participation to more challenging areas, requiring stronger policy and regulatory frameworks, subsidies and/or public-private approaches.

Table A7.2. Complementarity and synergies among IDA, SREP and CTF

| | CTF | SREP | IDA | Complementarity and synergies with CTF |
|---|---|---|---|---|
| **Urban areas** | | | | |
| **EDH** | NONE | RE PPP for grid-connected RE (EDH grids) | Complementary investments in grid reinforcement and EDH loss reduction | Complementary |
| **Non-EDH (off-grid)** | NONE | IFC-led market development of RE solutions for large industrial and business clients | NONE | Complementary |
| **Rural (and non-served peri-urban) areas** | | | | |
| **Solar lanterns** | Working capital to expand the market for high quality products | RBF financing to expand share high quality products | NONE | **Synergies built in**. CTF invests in viable off-grid businesses in the solar lantern/pico-PV segment. SREP provides time-bound RBF subsidies to boost sales of quality products to support consumer confidence in these products |
| **Solar kits/SHS** | Equity and loans for the development of market for solar kits/SHS through supporting innovative business models, such as PAYG | Start-up and expansion grants for promising off-grid businesses | NONE | **Synergies built in** CTF invests in equity and provides loans to viable off-grid energy businesses. SREP provides initial start-up grants for new entrants to Haiti market to pilot business models and hybrid RBF to accelerate the growth of companies in which CTF equity is placed. |
| **Larger PV systems** | Business clients integrated in PAYG and mini-grid model if can be served on profitable/sustainable basis | Productive use pilot | Public funding for productive and social applications (e.g. schools, health clinics, | **Potential synergies** (i) SREP productive use pilot aims at providing grant funding for innovative business models for productive uses that can |

| | | | | |
|---|---|---|---|---|
| | | | water pumping, street lighting) | then be scaled up under OGEF.<br>(ii) Public sector financing/subsidies for rural community and social uses could be integrated in the PAYG models as an additional revenue stream for PAYG companies, while strengthening sustainability of public investments. |
| **Private-sector driven, "smart" micro-grids** | Private-sector driven micro-grid – focus on those investments that do not require subsidies (e.g. retrofitting of existing municipal diesel grids) or can invest in private sector side of PPPs under SREP | PPP arrangement for micro-grids – provision of subsidies for the grid infrastructure, while private sector would finance generation assets. | Potential for piloting of innovative approaches | **Potential synergies**<br>Expanding the universe of private sector-driven micro-grids by providing subsidies for distribution infrastructure - allowing faster expansion to green-field mini-grids, and greater social inclusion (lower tariff which would allow connecting more users). |

## E. CTF Investment Plan and Leveraging

31. CTF will leverage US$48 million of private sector resources. In addition, as indicated in Table A10.2 above, CTF will also leverage impact of SREP intervention by developing viable off-grid businesses, which can then be leveraged for the PPP structures foreseen by the SREP interventions, as well as additional IDA resources. The IDA-funded Rebuilding Energy Infrastructure and Access Project (PRELEN) has been restructured to provide additional support to the renewable energy program, funded by CTF and SREP. See Table A10.3.

Table A7.3. Specific CTF project investment break-down

| CTF component | CTF (US$ M) (excluding fees)* | SREP (US$ M) | IDA PRELEN (US$ M) | Private sector leveraged (US$ M) |
|---|---|---|---|---|
| 1. Enabling environment and OGEF oversight | 1.43 | 1 | 4.6 | |
| 2. Off-grid electrification sub-projects | 12 | 7.62** | 12.4*** | 48 |

| | | | | |
|---|---|---|---|---|
| 3. OGEF management, operations pipeline development, and project implementation support | 2.22 | | | |

*The administrative fees are US$ 0.35 million.
** US$ 3 million for grants under OGEF, US$ 3.62 million for the PPP for mini-grids, and US$ 1 million for a pilot program to support productive uses of off-grid energy.
*** Mostly for complementary publicly funded productive and community applications of off-grid energy, such as for schools, health centers, street lighting and water pumping. The same off-grid energy companies developed under OGEF could also serve this market.

## F. Assessment of Proposed Project with CTF Investment Criteria

32. For convenience, Table A10.4 and the next paragraph summarize key calculations and assumptions underlying this section analysis.

Table A7..4. Project's expected energy and GHG results: simplified summary of assumptions and key calculations

| CTF System Type: | PicoPV high quality lantern or kit: 2-20 Wp | SHS: 20-200+ Wp | Municipal/village grids: (10-500kWp) | Productive uses (200+ Wp) | Total |
|---|---|---|---|---|---|
| CTF Main Segment Number: | 1 | 2 | 3 | 4 | |
| Typical Lifetime | 5 to 10 | 20 | 20 | 20 | |
| CTF-funded HH | 47,450 | 60,450 | 9,100 | | 117,000 |
| CTF-funded BENEFICIARIES (PEOPLE) | 237,250 | 302,250 | 45,500 | | 585,000 |
| Productive use capacity (GWh) | | | | 13.5 | |
| GHG [$tCO_2$] per user (probable weighted average over systems and lifetimes per column)** | 1.13/user | 9.45 /user | 13.95/user | 2,698/GWh | |
| Aggregate GHG replaced/abated over lifetime of systems installed during project | 53,606 | 571,252 | 126,945 | 315,510 | 1,067,315 |
| US$/t GHG replaced (social value): As per WB Guidance, Baseline estimate of social value of carbon starting at US$30 in 2015 and increasing to US$80 in real terms by 2050. | $35.06 | $41.92 | $41.92 | $41.92 | |
| Total value of carbon benefits, Base Case Min | $ 1,879,667 | $ 23,945,437 | $ 5,321,208 | $ 13,226,198 | $ 44,327,510 |

**Potential for GHG Emissions Savings**

33. *Emission reduction potential of investment.* The total emission reduction potential is estimated at more than one million $tCO_2$ avoided (1,068,315 for weighted average system lifetime of the various RE off-grid systems expected, scenario analysis and details see Section I of this Annex and Annex 7 - Economic Analysis). This takes into account savings and lifetimes for each system type against the baseline scenario, as well as appropriate reduction of total carbon benefits in light of rebound effects. For stand-alone systems, kerosene and candles are the main baseline (detailed data available from Digicel/iiDevelopment 2014 survey with N=1400), and Li-ion batteries with high quality LEDs have been assumed. Savings have been calculated in accordance with the latest CTF and World Bank guidelines[57] and the 2015 UNFCCC methodology for small-scale access via off-grid systems.[58] Savings for villages (from solar municipal/village grids Medium Type as per Tables in Economic Analysis) are estimated to be equal to 200 Wp SHS, as per said UNFCCC 2015 methodology.

34. *Key assumption and methodology used for estimating GHG Emissions Savings.* It is important to note that the BASE CASE scenario summarized in Table A10.4 above is only one of many possible scenarios - ultimately private sector and households will decide which system sizes will be sold most; and fuel switch behavior per household (HH) will differ with system type, baseline, income, etc. However, this Base Case is based on an extensive analysis of market scenarios performed for CTF and SREP preparation (15 market segments with several system sizes and sales models each). The Base Case estimate for GHG abated per CTF Base Case Segment (1-3 above) is conservative and relatively robust. The analysis was done through the following steps:

- First, the latest standard methodology of CTF, WBG and UNFCCC (2014 WB guidance and 2015 UNFCCC access methodology for small off-grid systems) were applied, together with the energy survey results from (Digicel/iiDevelopment 2014) to determine the typical range of annual fuel savings of dispersed HH (mainly kerosene) and municipal/village grid HH (treated as 200 Wp SHS for the carbon benefits, as per UNFCCCC 2015 – in reality a mix of kerosene and lighting, as most villages of the CTF target size have no or only rarely operational gen-sets today) for typical LA approved / high quality Pico kits, and high quality SHS and village grids (modeled with Homer by iiDevelopment and HOMER LLC themselves under a separate contract).
- Second, the probable lifetime for each system type and size was determined, to acquire lifetime carbon savings.
- To produce manageable total market estimates, the most probable "Base Case" market response to the proposed project was taken (that is, sold systems by system size in each segment, to calculate the weighted average of expected lifetime $CO_2$ savings per category) for each of the 4 main CTF Target Segments (numbered 1-4 in the table above).

35. Each segment is analyzed separately, because each has distinctive characteristics, which are relevant for market development (as described in the main CTF PAD text and Annex 2) but also for CO2 abatements (especially the “over the counter product” aspect and fixed lifetime w/o Opex and installation services of the 2-20 Wp "PicoPV 2.0" segment 1). The implications for carbon

[57] World Bank: Investment Project Financing: Economic Analysis Guidance Note, 2014, including World Bank : Social Value of Carbon in project appraisal; Guidance note to the World Bank Group staff; 2014
[58] http://cdm.unfccc.int/methodologies/DB/XJQ7APPRHQWLO6VSC3161I5Q8MCMNQ

savings calculations are: The low-cost PicoPV systems have an extremely short life (0.5-2 years) and low lumenhours. So only a minimal fuel switch occurs (Mills et al 2013; Tracy et al 2015). The other three stand-alone groups are the main driver of the Haiti CTF carbon savings. The first segment includes 2-20 Wp PV stand-alone systems ranging from Pico lanterns up to the new generation of Li-ion based small SHS and kits that are currently brought to the market by several suppliers. These have been aggregated in one segment because they are all "over-the-counter" products, imported as kits without local changes by importers to the system, no installation is required - thus no Opex accrue, but lifetimes range from 2-7 years (with latest generation Li-ion systems able to last over 10 years, but warranties are shorter). The next segments are solar home systems – SHS (Category 2), which are increasingly also becoming available as kits with Li-ion batteries, but a significant share is still provided as "classical" SHS with lead-acid batteries, local system integrator assembles; and lifetimes are usually taken as 20 years with significant Opex for Economic and Financial Analysis. Larger systems, such as mini-grids and systems for productive uses also assume 20 years life-time.

36. *Technology development status.* In recent years, renewable energy technologies, especially solar PV, have taken off as a new alternative for off-grid energy access. This reflects global trends, including falling costs of the solar PV technology, availability of more efficient LED lighting and other DC-powered energy efficient domestic appliances, and emergence of new business models aiming at serving the base of the pyramid customers. As a result, all these factors significantly contributed to dramatic reductions in the costs of energy services through mini-grids while improving their reliability. Meanwhile, widespread use of customer-owned distributed energy generation in developed countries have created a strong cohort of safe, field-tested technology options adaptable either for connecting to the main grid or integrating with mini-grids. Finally, recent policy changes leading to lower growth in renewable energy markets in OECD countries (particularly Europe) are providing the impetus for companies around the world to turn greater attention to markets in developing countries.

37. Not surprisingly, therefore, many of the new off-grid RE products and technologies are now beginning to appear in the Haitian market, although their penetration levels are still very low and entry barriers are still significant – e.g. consumer mistrust due to market spoilage from low quality products, fiscal and regulatory constraints creating uneven playing field with kerosene and diesel, lack of financing options, undeveloped supply chains and lack of skilled labor force.

38. The first two RE markets that have emerged in Haiti in post-earthquake years are those for (i) solar lanterns/pico-PV products, and (ii) larger rooftop solar PV systems for self-supply for (mostly urban) businesses and industries to reduce diesel spending (the "fuel-savers"). More innovative business models, such as pay-as-you-go (PAYG) solar kits and smart micro-grids are also now beginning to emerge, although all are still in the piloting stage. Annex 2 provides an overview of the emerging technologies and business models and specific Haitian-grown applications of these business models the project will build on.

39. Hence, the project will leverage the latest technology and business model developments and Haiti home-grown innovations to bring transformation to the Haitian rural energy markets.

**Cost-effectiveness**

40. *CTF investment per ton $CO_{2eq}$ reduced/avoided.* The cost effectiveness of both CTF $CO_2$ objectives and Access objectives is better than benchmark WB projects and are in line with comparable new generation off-grid projects (e.g. EnDev).

- CTF cost effectiveness [$\$_{CTF}/tCO_{2eq}$ avoided over lifetime of project systems]: 15 US$/t
- Total project cost effectiveness [$\$_{project}/tCO_{2eq}$ avoided over lifetime of project systems]: 60 US$/t

41. Assumptions are summarized in the Table A10.4 above, with details available in the Economic Analysis chapter (Annex 7).

42. *Marginal abatement cost.* In October 2013, the CTF Trust Fund Committee suggested providing information on the estimated marginal abatement cost (MAC) for projects for which the marginal abatement cost is likely to exceed US$100 per ton of $CO_{2eq}$. This decision draws from the CTF criteria which specifies that CTF co-financing will not be available for investments in which the marginal cost of reducing a ton of $CO_{2eq}$ exceeds US$200, which reflects the lower-end estimate of the incentive needed to achieve the objectives of the BLUE Map Scenario as indicated in the International Energy Agency's Energy Technology Perspectives 2008 Report.

43. Our calculations confirm that the MAC for the project will not exceed the aforementioned US$200 threshold value per ton of CO2eq. In fact, the MAC for the project should be lower than 60 US$ per ton of $CO_2$.

- $MAC = \frac{NPV}{LCO2}$, $MAC = \frac{NPV}{LCO2}$, where NPV stands for Net Present Value and $LCO_2$ stands for Lifetime $CO_2$ emissions savings.

44. *Expected cost reduction of technologies.* The main reduction of Capex is bound to be from the general projected global reductions in the costs of renewable off-grid technologies. However, as Haiti is one of the most innovative off-grid projects, funding the "new generation" of off-grid models across a broad range of well-defined promising business models, this is expected to impact the former. In addition, local good practices for business plans will have a transformational impact and reduce LCOE as explained in the PAD.

**Demonstration Potential at Scale**

45. *Scope for avoided annual GHG emissions through replication*. The purpose of the project is to transform rural energy markets from the current reliance on kerosene and diesel to a service-oriented, renewable energy-based business model. The project aims at jump-starting this development by addressing critical barriers that are currently constraining the development of this market (mainly regulatory and financing). The beneficiary companies are expected to continue growing even past the project's end date, investing in additional renewable off-grid systems for the remaining un-electrified population, and thereby continuing to support country's trajectory from fossil fuels to renewables, with additional GHG emissions reductions results. This will be ensured through the design of the Off-Grid Electricity Fund (OGEF), which will:

- Be set up as a 11-year facility, able to continue supporting the Haitian off-grid market development even after the CTF funds are all disbursed (re-investing proceeds from the initial investments).

- Support only sustainable business models, expected to be profitable at scale - therefore having a likelihood that these businesses will continue and expand operation post-CTF-funded operation.
- Leverage local investment expertise of FDI and engage a competent and experienced International Fund Manager to make sound business decisions and set up incentives structure supporting sustainable market development.

46. *Transformation potential.* The GOH estimates that 5 percent of rural households are anticipated to have access to adequate electricity through formal (legal) connections.[59] The rural off-grid market is estimated at around 1 million households (5 million people). The proposed CTF approach is estimated to result in providing sustainable off-grid energy services to estimated 117,000 households (585,000 people), corresponding to about 12 percent of the total off-grid market by year 6; and to about 400,000 households (2 million people), corresponding to 40 percent of the total off-grid market in 10 years, including the scale effects, and SREP synergies. This level of penetration of the high-quality, renewable-energy based off-grid electricity solutions should be sufficient to support further market development to reach universal access to electricity by 2030, in line with the SDG7 and SEforALL goal.

**Development Impact**

47. The project is expected to scale-up access to renewable energy-based off-grid electricity services for rural households, enterprises and institutions. As a result, the project is expected to have the following development impacts:

- at the household level: displacing the current expenditures on candles, kerosene, batteries or small diesel generators for lighting and other purposes and offering better electricity services at a lower cost per kWh.
- at the SME level on supply (provider) side: increasing rural business revenues by supporting an expansion of RE retail businesses and improvement of business practices; and on demand (client) side: higher energy quality at lower cost, leading to higher productivity and incomes.
- the related local and global environmental benefits.

48. Additional economic benefits from electrification are commonly recognized yet difficult to quantify. These include: improved health services and education; improved communications and connectivity; improved energy security, electric water pumping; better lifestyle and reduced gap in quality of life between city and rural dwellers; improved conditions of study for students; potentially more business and income-generating opportunities; more local jobs; improved public security; etc.

49. In general terms – linking development impact to the envisaged results framework, the CTF project will significantly contribute to:

- *Increased availability of power*. The project will support investments in diverse business models and renewable energy technologies, facilitating the increased access to modern

[59] The estimate based on the latest household survey is 17 percent electrification rate. The difference is likely due to informal connections and off-grid solutions. It is estimated that at the national level about two thirds of all connections are informal.

electricity services to 585,000 people short term (6 years) and 2 million medium term (10 years), increasing the penetration of off-grid renewable energy technologies in rural areas by at least 15 (and likely 20) MWp by 2024. The diverse off-grid technologies are expected to produce a total of at least 20 GWh of additional clean power annually (twice as much for optimistic project scenario). Note that the MW target is lower than the theoretically feasible maximum due to the active integration of energy efficient appliances and other energy efficient off-grid solutions, which significantly reduce the costs of off-grid energy for users – see next point.

- *Efficiency gains*. The project will specifically target energy efficient solutions. Given the decreasing price of renewable energy technologies, the convenience of "in the box solution" (like pico-PV) and improving energy efficiency, the ability to power an increasing number of domestic appliances such as TVs and fans, as well as machinery for productive uses (relevant in particular for micro- and mini-grids) is increasingly possible. In addition, the project will support innovations in balancing loads in village grids and the increased availability of energy efficient appliances.
- *Improved reliability and energy security*. The scale-up access to renewable energy-based off-grid electricity services will have significant benefits in terms of the reliability and security of electricity supply to Haitian consumers, which is a high development priority for the Government, especially considering the low reliability of the grid service in both urban and rural areas. Switching from imported oil products to locally available renewable energy will also enhance overall national energy security.
- *Development of local industry*. Scale-up of renewable energy development – through an enabling regulatory framework and the provision of funding and market development services to the private sector – will jump-start development of off-grid energy business models, supporting both existing companies and new entrants, and associated services (both imports and local manufacturing of renewable energy systems and their parts), resulting in increased jobs. Service provision models under the CTF project will cover a wide range of commercially scalable, low carbon technologies, including individual systems and village-based systems, adapted to the specific regional Haitian context.
- *Environmental benefits*. The generated power through renewable energy technology in rural Haiti is expected to replace candles, kerosene, batteries and small diesel generators. This will produce global environmental benefits (over the lifetime of all system types installed) of about US$30 million (Low Case Scenario for Carbon "Social Price" as per WBG 2014) to US$44 million (Base Case Scenario for Carbon "Social Price" as per WBG 2014) monetary "social" value of abated carbon (assuming a conservative market development scenario).[60] This quantification does not include additional local environmental benefits from reduction of local pollutants from diesel generation, kerosene, candles and batteries.
- *Gender*. The project is expected to have gender co-benefits. Targeted interventions are expected to ensure in particular that the benefits of the project impact women and girls. Access to modern energy services can create new economic opportunities for women, both as consumers and as suppliers of modern off-grid electricity services, in addition to other health, safety and socio-cultural benefits that access to electricity brings. The project will therefore

[60] World Bank: Social Value of Carbon in project appraisal; Guidance note to the World Bank Group staff; 2014

include several specific measures that will aim at enhancing positive gender impact -- see PAD's section VI. D for description of these measures. The project's Result Framework (Annex 1) includes indicators on female beneficiaries in general, and female employment and entrepreneurs specifically.

**Implementation Potential**

50. *Public policies and institutions that support deployment, diffusion and transfer of low carbon technologies.* The Government has recently undertaken a substantial effort to promote renewable energy. MTPTC, responsible for energy oversight, has created an "Energy Cell", which is now also in charge of promoting RE development and expanding energy access and is to be transformed into a Directorate of Energy in MTPTC in the medium run. The work force of experts on energy efficiency and renewable energy development at the Energy Cell has recently been strengthened, including with a specific coordinator for CTF and SREP interventions. The Government also launched the establishment of an adequate legal framework for on- and off-grid renewables to reduce investors' risk perceptions and attract new investment. Spearheading the multi-entity governmental Task-Force, the Energy Cell – on behalf of MTPTC – has further been the driving force behind Haiti's SREP Investment Plan that was approved by the SREP Sub-Committee members on May 13, 2015.

51. The CTF supported project is a direct response to the Government's high level commitments of Haiti becoming an emerging economy by 2030 – forming a central part of Haiti's SE4All strategy for increased energy access through the deployment, diffusion and transfer of low-carbon technologies to ensure a larger use of renewable energy resources together with long-term poverty reduction for the country. This vision is anchored in the overall Strategic Plan for the Development of Haiti (SPDH), and specified in the SREP-Haiti Investment Plan.

52. In addition, in April 2017, the new Government of Jovenel Moise has released the Roadmap for the Energy Sector, which prominently highlights the need to diversify the Haiti's energy generation mix with renewable energy, and to expand energy access through renewable off-grid energy interventions, including solar PV and smart micro-grids. The Roadmap also calls for further strengthening of the Energy Cell, especially in the area of clean energy, and it specifically mentions the implementation of the CTF and SREP projects as a priority for the new Government's engagement in the energy sector.

53. The commitment of Haiti to a low carbon growth is also evidenced in its INDC, which calls for expanding renewable energy share in the generation mix to 43 percent.

54. *Sustainability of transformation*. The sustainability of the off-grid market transformation is built into the project design, and includes in particular the following features:

- The project will invest only in businesses that are scalable and are expected to be profitable at scale – ensuring their operation and expansion after the CTF-funded operation closure.
- OGEF is set up for 11 years, allowing continued support to the off-grid market even after CTF funds are all disbursed (since funds can be re-invested up to Year 10).
- The project will increase penetration of high quality products on the market, removing high-risk perception of the users of unknown technologies, and therefore triggering future demand for similar products.

55. *Leveraging of co-financing*. The CTF financing is a key enabling factor for the scale-up of commercially viable off-grid electrification investments with a potential for replicability. The CTF project will leverage public and private sector resources. CTF's US$ 14.22 million will be available for OGEF's operation, investments and market development activities, complemented by US$1.43 million for setting up an enabling policy and regulatory framework. The Project will leverage private sector financing of at least US$48 million. In addition, the Project will further leverage additional US$8.62 million from SREP, and US$17 million from IDA (existing IDA PRELEN project was restructured in July 2017 to specifically support renewable energy and off-grid energy activities under CTF and SREP.

56. *IFI and Donor Coordination*: Given the importance of RE energy in Haiti's development agenda and its significance to mitigating climate change, a number of IFIs and donors are assisting the Government to implement its national vision regarding RE deployment. There is already considerable coordination as well as collaboration of these efforts – as summarized in the Haiti SREP IP.

57. *Leverage:* The CTF is leveraging an additional US$48 million from private sector. The financial leverage ratio is anticipated to be in the range of 1:3 – 1:4.

## G. CTF Additionality

58. Over the shorter time horizon, the CTF financing would enable an acceleration of the deployment of off-grid RE technologies in the country. Most importantly, it will enable the private sector to enter the Haitian off-grid market at faster speed that would otherwise be possible, and support the growth of the existing and new businesses from their current micro/small start-ups to medium/large companies.

59. Without the CTF concessional financing under the project, deployment and significant scale-up of the necessary RE service provision models for increased energy access in rural Haiti would be delayed by several years if not decades. This would push back the feasibility of reaching universal access to modern energy services beyond the 2030 target year.

60. In addition, in absence of the enabling regulatory and financing environment for the off-grid renewables, the business as usual in rural areas will consist of increasing reliance on diesel solutions. As of today, already over 500MW of individual diesel gen-sets are installed throughout the country (three times the total available generation capacity of the public utility EDH). In the "without the project scenario", the reliance on these diesel gen-sets in rural areas will grow. As rural incomes grow, many households would switch from kerosene lighting to diesel-based generation of electricity, further increasing GHG emissions. In addition, the currently prevailing low-cost, low-quality PicoPV products would further hamper demand for high-carbon saving solutions.

**61.** Thus, it can be estimated that by 2030, far more households would still rely on a combination of kerosene and diesel solutions.

## H. Implementation Readiness

62. The proposed CTF investments in RE technology in rural Haiti are ready for implementation. The Government's commitment and institutional set-up are ensured. The work force of experts on energy efficiency and renewable energy development at the Energy Cell in MTPTC has recently been strengthened. The Government also launched the development of an adequate fiscal and

regulatory framework for on- and off-grid renewables to reduce investors' risk perceptions and attract new investment. Further, MTPTC (via the Energy Cell) has already undertaken lending and TA projects with the World Bank Group, and so it has policies and procedures to ensure compliance with government and World Bank Group's environmental and social safeguards. The IDA PRELEN project has been restructured to provide more financing for renewable energy and access, including TA resources, to complement and enhance the impact of the CTF and SREP operations.

63. FDI has demonstrated its capacity to invest in local SMEs and to administer World Bank and other donor-funded projects. Its capacity for evaluating off-grid energy businesses will be further strengthened through the partnership with the International Fund Manager, which will be competitively selected under Component 3 of the Project. Several international financial institutions have expressed interest in serving as the international fund manager and the competitive process will be carried out in parallel to the project approval process.

**64.** The vibrant solar lantern markets and promising DESCO and mini-grid pilots ensure that the first wave of the investment pipeline (see Annex 2) will be ready by the time of the project approval.