

Cover Page for CTF Project/Program Approval Request ^[a]				
1. Country/Region	Colombia		2. CIF Project ID#	(CIF AU will assign ID.)
3. Investment Plan (IP) or Dedicated Private Sector Program (DPSP)	IP		4. Public or Private	Public <input checked="" type="checkbox"/>
	DPSP	<input checked="" type="checkbox"/>		Private <input type="checkbox"/>
5. Project/Program Title	Renewable Energy Financing Program for the Non Interconnected Zones (ZNIs)			
6. Is this a private sector program composed of sub-projects?				Yes <input type="checkbox"/>
				No <input checked="" type="checkbox"/>
7. Financial Products, Terms and Amounts				
Financial Product		USD (million)	EUR (million) ^[b]	
Grant		0.977		
Fee on grant		0.048		
MPIS (for private sector only)				
Public sector loan	Harder terms	9.265		
	Softer terms			
Senior loan				
Senior loans in local currency hedged				
Subordinated debt / mezzanine instruments with income participation				
Second loss guarantees				
Equity				
Subordinated debt/mezzanine instruments with convertible features				
Convertible grants and contingent recovery grants				
Contingent recovery loans				
First loss guarantees				
Other (please specify)				
Total		10.290		
8. Implementing MDB(s)	Inter-American Development Bank (IDB)			
9. National Implementing Agency	Bancóldex			
10. MDB Focal Point	Claudio Alatorre (calatorre@iadb.org)			
11. Brief Description of Project/Program (including objectives and expected outcomes) ^[c]				
<p>The objective of the proposed Program is to promote and increase private investments in RE generation in the non-interconnected zones (ZNIs) of Colombia, while reducing GHG emissions, and to demonstrate the feasibility of a model to finance and structure RE mini-grid projects in Latin America and the Caribbean.</p> <p>In Latin America and the Caribbean the electricity coverage is relatively high, but there are still approximately 32 million people without access to commercial electricity grids, often living in</p>				

remote areas with very low population density and where access to services is difficult and very costly. Given Colombia's favorable conditions to prove the feasibility of innovative finance models, and given its similarities to other countries in the region, it is expected that the financing and business model proposed by the Program, as well as the selected technologies (RE mini-grids with technologies such as hybrid solar-diesel, solar, small hydropower, and biomass), will have a high potential for replication.

This Program is aligned with the Colombian government's ongoing efforts to provide energy to the ZNIs. The government has undertaken a number of initiatives to promote private investment in renewable energies for these areas, including incentives to increase the share of RE and to improve the quality of energy supply, by enabling a framework for private investment in public services through concessions and "exclusive service areas" (ASE), and by drawing up a resolution, expected to be approved in a matter of months, to regulate tariffs and remuneration in order to encourage the use of RE for ZNIs. These initiatives are aligned with a recently approved law (1715 in 2014) aimed at promoting investments in energy efficiency and RE in Colombia. The law seeks to prioritize investment projects in RE in the ZNIs from non-conventional sources and its further regulation (expected to be enacted during 2016) should result in a number of additional incentives for private investments, such as tax exemptions.

The proposed Program will provide Bancóldex, Colombia's second tier public bank in charge of supporting entrepreneurial development, with additional finance to enhance access to long-term finance by private sector investors on terms and conditions needed to cover CAPEX and payback requirements of RE projects in the ZNIs. Bancóldex will on-lend to IFIs that should in turn provide sub-loans on adequate terms to investors.

The proposed Program is expected to pilot a financing and business model that, if successful, will complement the Government's ambitions to scale up private investments and increase the share of RE in the ZNIs. In addition to avoiding the emission of GHG, the Program will increase productivity in the targeted communities, by increasing the number of hours of electricity per day and by improving the quality of the service.

The goal of the Program would be achieved by providing long-term financing with adequate conditions to private investors. In addition CTF grant resources will be used (i) to promote business models and contractual practices that could reduce risk perception by private investors and IFIs, and (ii) to support the Ministry of Mines and Energy in the development of the regulatory framework and in capacity-building activities to foster sustainable private investment in RE in the underserved ZNI.

To facilitate implementation, ensure more favorable environmental impacts, and promote replication, the Program will target energy generation operators and technology providers that already have a credit history and experience with mini-grids and investments in off-grid areas. Furthermore, it is expected that the eligible projects would mainly replace both installed diesel capacity and planned increases in diesel capacity in areas with the highest concentration of users; and that the financing of RE mini-grids would focus on technologies with highest potential for replication. The Program will aim to support investments in the ASE and will seek to promote investments from existing operators and from energy technology providers that may participate in such investments, acting as operators themselves or jointly with existing operators.

This request for USD 10.29 million in CTF resources complements a previous request for USD 210,000 for a project preparation grant, which was approved by the CTF TFC on July 30th, 2015. The following table summarizes the four IDB operations that will be supported by this CTF

Program, including the PPG:					
Number	Division	Type	Amount	Amount incl. fees	Reference / status
CO-T1402	IFD/CMF	TC	200,000	210,000	See link (PPG approved by the TFC on July 30, 2015)
CO-L1161	IFD/CMF	Loan	9,265,000	9,265,000	See Part A
CO-T1409	IFD/CMF	TC	500,000	525,000	See Part B
CO-T1411	INE/ENE	TC	477,000	500,000	See Part C
TOTAL				10,500,000	
12. Consistency with CTF investment criteria^[c]					
(1) Potential GHG emissions savings			See Annex 1, p. 1		
(2) Cost-effectiveness			See Annex 1, p. 2		
(3) Demonstration potential at scale			See Annex 1, p. 2		
(4) Development impact			See Annex 1, p. 3		
(5) Implementation potential			See Annex 1, p. 4		
(6) Additional costs and risk premium			See Annex 1, p. 5		
Additional CTF investment criteria for private sector projects/ programs					
Although this is a public sector operation, it is targeting the private sector. We are therefore addressing the private sector investment criteria as well:					
(7) Financial sustainability			See Annex 1, p. 7		
(8) Effective utilization of concessional finance			See Annex 1, p. 8		
(9) Mitigation of market distortions			See Annex 1, p. 8		
(10) Risks			See Annex 1, p. 8		
13. For DPSP projects/programs in non-CTF countries, explain consistency with FIP, PPCR, or SREP Investment Criteria and/or national energy policy and strategy					
N/A					
14. Stakeholder Engagement^[c]					
See Annex 1, p. 9					
15. Gender Considerations^[c]					
See Annex 1, p. 9					
16. Indicators and Targets					
Project/Program Timeline					
Expected start date of implementation ^[d]				March 2016	
Expected end date of implementation ^[d]				March 2020	
Expected investment lifetime in years (for estimating lifetime targets)				25	

Core Indicators		Targets ^[e]
GHG emissions reduced or avoided over lifetime (tons of CO ₂ -eq)		1,070,000
Annual GHG emissions reduced or avoided (tons of CO ₂ -eq/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)	total average	42,700
Installed capacity of renewable energy (MW)		8.79
Number of additional passengers using low-carbon transport per day		
Energy savings cumulative over lifetime of investment (MWh)		
Annual energy savings (MWh/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)		
Identify relevant development impact indicator(s)		Targets
Average hours of electricity provided to localities served by RE plants (currently communities have an average of 13 hours of service)		15.2
17. Co-financing		
	Please specify as appropriate	Amount (in million USD)
MDB 1	IDB	10
MDB 2 (if any)		
Government		
Private Sector		8.7
Bilateral		
Others (please specify)		
Total		18.7
18. Expected Date of MDB Approval		
November 2015 (for CO-L1161)		

NOTES:

[a] This cover page is to be completed and submitted together with the MDB project/program proposal when requesting CTF funding approval by the Trust Fund Committee.

[b] For products denominated in EUR, please also provide USD equivalent in the column to the left

[c] Please provide the information in the cover page or indicate page/section numbers in the accompanying project/program proposal where such information can be found.

[d] Insert “not applicable” (N/A) if dates cannot be determined at the time of submission (e.g. private sector programs)

[e] Insert value N/A if indicator is not applicable to the project/program.

Version December 9, 2014

RENEWABLE ENERGY FINANCING PROGRAM FOR THE NON INTERCONNECTED ZONES (ZNIs)

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ACRONYMS AND ABBREVIATIONS	
ASE	<i>Áreas de Servicio Exclusivas</i> [Exclusive Service Areas]
Bancóldex	<i>Banco de Comercio Exterior de Colombia S.A.</i> [Bank of Foreign Trade]
BOMT	build, operate, maintain and transfer
CCLIP	Conditional Credit Line for Investment Projects
CTF	Clean Technology Fund
CONPES	<i>Consejo Nacional de Política Económica y Social</i> [National Council for Economic and Social Policy]
CO ₂ e	Carbon Dioxide Equivalent
CAPEX	capital expenditures
CREG	<i>Comisión de Regulación de Energía y Gas</i> [Energy and Gas Regulatory Commission]
DPSP	Dedicated Private Sector Programs (CTF)
EA	executing agency
ESMR	Environmental and Social Management Report
ESS	Environmental and Social Strategy
FAER	<i>Fondo de Apoyo Financiero para la Energización de las Zonas Rurales Interconectadas</i> [Rural Electrification Fund]
FAZNI	<i>Fondo de Apoyo Financiero para la Energización de las Zonas no Interconectadas</i> [Fund for Financial Support for Energy Access in the ZNIs]
GHG	greenhouse gases
GCI-9	Ninth General Increase in the Resources of the Inter-American Development Bank
ESMR	Environmental and Social Management Report
IDB	Inter-American Development Bank
IPSE	<i>Instituto de Planeación y Promoción de Soluciones Energéticas para las Zonas no Interconectadas</i> [Institute for Planning and Promotion of Energy Solutions for ZNIs]
IFIs	intermediary financial institutions
M	million
MME	<i>Ministerio de Minas y Energía</i> [Ministry of Mines and Energy]
NPV	net present value
OPEX	operating expenditures
PIEC	<i>Plan Indicativo de Expansión de Cobertura de Energía Eléctrica</i> [Indicative Plan for the Expansion of Electricity Coverage 2013-2017]
PPP	public private partnership
RE	renewable energy
SHP	small hydropower
SIN	<i>Sistema Interconectado Nacional</i> [National Interconnected System]
SME	small and medium-sized enterprise
SPF	Safeguard Policy Filter
SSPD	<i>Superintendencia de Servicios Públicos</i> [Superintendency of Public Utilities]
t	ton
TC	technical cooperation
TFC	Trust-Fund Committee (CTF)
UPME	<i>Unidad de Planeación Minero Energética</i> [Energy and Mining Planning Unit]
USD or US\$	Dollars of the United States of America
ZNIs	<i>Zonas No Interconectadas</i> [Non-Interconnected Zones]

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PART A
LOAN CO-L1161
PROJECT PROFILE

COLOMBIA

RENEWABLE ENERGY FINANCING PROGRAM FOR THE NON INTERCONNECTED ZONES

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

COLOMBIA

**RENEWABLE ENERGY FINANCING PROGRAM FOR THE
NON-INTERCONNECTED ZONES**

(CO-L1161)

PROJECT PROFILE

This document was prepared by the project team consisting of: Maria Netto, IFD/CMF, Team Leader; Jose Ramon Gomez, ENE/CCO, Alternate Team Leader; Javier Cuervo, INE/ENE, Jose Juan Gomes, Gloria Lugo, Maria Margarita Cabrera, Leticia Riquelme, Sebastian Vargas, Alejandro Tamola and Annabella Gaggero, IFD/CMF; Alvaro Concha, CMF/CCO; Claudio Alatorre and Veronica Valencia, INE/CCS; Colin McKee, VPS/ESG; Claudia Cardenas and Gabriele del Monte, FMP/CCO; and Escarlata Baza, LEG/SGO.

Under the Access to Information Policy, this document is subject to Public Disclosure.

PROJECT PROFILE

COLOMBIA

I. BASIC DATA

Project Name:	Renewable Energy Financing Program for the Non-Interconnected Zones		
Project Number:	CO-L1161		
Project Team:	Maria Netto, IFD/CMF, Team Leader; Jose Ramon Gomez, ENE/CCO, Alternate Team Leader; Javier Cuervo, INE/ENE, Jose Juan Gomes, Gloria Lugo, Maria Margarita Cabrera, Leticia Riquelme, Sebastian Vargas, Alejandro Tamola and Annabella Gaggero, IFD/CMF; Alvaro Concha, CMF/CCO; Claudio Alatorre and Veronica Valencia, INE/CCS; Colin McKee, VPS/ESG; Claudia Cardenas and Gabriele del Monte, FMP/CCO; and Escarlata Baza, LEG/SGO.		
Borrower:	Banco de Comercio Exterior de Colombia S.A. (BANCOLDEX)		
Guarantor	Republic of Colombia ¹		
Executing Agency:	BANCOLDEX		
Financial Plan:	IDB (Clean Technology Fund) ^{2,3} :	US\$	9.265 million
	Total:	US\$	9.265 million
Safeguards:	Policies triggered:	B.01, B.02, B.03, B.07, B.13 and B.17	
	Classification:	Not required (B.13)	

II. GENERAL JUSTIFICATION AND OBJECTIVES

- 2.1 **The Colombian Non-Interconnected Zones (ZNI)** represent two-thirds of the national territory with partial or no electricity coverage in which the limited energy services available are generated under a highly subsidized business model based on traditional, environmentally unfriendly technologies.
- 2.2 **ZNI: an opportunity to expand coverage and improve the quality of electricity services.** While Colombia has a high average electricity coverage index (96.1%⁴), the ZNIs are not served by the Interconnected System (SIN). The ZNIs comprise a population of 1.83 million inhabitants spread across 1,565

¹ The Republic of Colombia will only guarantee all financial obligations; therefore it is proposed that a partial waiver to the Bank's policy on "Guarantees required from Borrower" (OP-303) be approved by the Board of Executive Directors.

² This financing will be subject to prior approval by the Trust Fund Committee (TFC) of the Clean Technology Fund (CTF). Once obtained, the Bank will proceed with the approval of the program in accordance with its policies and procedures. The CTF has allocated under its Dedicated Private Sector Program (DPSP) US\$10 million to support private investments in RE minigrids in Colombia.

³ Individual RE investment projects to be funded with program resources will be complemented with financing of similar investment projects funded from resources (for up to US\$10 million) of the third loan operation (2949/OC-CO, US\$200 million) of an existing CCLIP (CO-X1007).

⁴ [Indicative Plan for the Expansion of Electricity Coverage 2013- 2017](#) (PIEC), Planning Unit on Mining and Energy (UPME).

localities, most of which are in rural areas (89%). Only 34% of the ZNI population has access to electricity services⁵, for an average of 9.2 hours in the capitals of departments and municipalities, and of 5.1 hours in smaller localities⁶ ([see Figure 1](#)).

- 2.3 **The current delivery of electricity services in the ZNIs: A subsidized business model.** The electricity service is provided by 94 operators⁷, of which half are private or mixed capital operators and the other half municipalities. Often, the same operators generate, distribute and commercialize electricity. Currently, these operators depend heavily on subsidies⁸, which cover the difference between the lower tariffs actually charged to end users in the ZNIs and the tariff paid by end-users of the same socio-economic conditions⁹ or productive activity in the SIN. Investments in generation and distribution are in most cases not commercially viable, with subsidies covering 30% to 80% of costs. The value of subsidies paid by the government in 2008-2012 is estimated at US\$381 million¹⁰.
- 2.4 **Energy generation technologies used in the ZNIs.** Despite its high operational costs and its negative environmental externalities, most of the installed electricity generation capacity in the ZNIs is based on diesel technology (96.3% - [see Figure 2](#)).
- 2.5 **Government initiatives to promote the expansion of private investments in Renewable Energy (RE) in ZNIs.** The government has undertaken a number of initiatives to promote private sector investments in RE generation in the ZNIs¹¹, including: (i) two exclusive service areas, under a concession model, to improve the quality and delivery of energy in the Department of San Andres, Providencia and Santa Catalina and Amazonas;¹² (ii) a public-private partnership law,¹³ as an enabling framework for private investments in public services; and (iii) fiscal incentives, under Law 1715, to encourage private firms or energy enterprises to scale up RE investments via Build, Operate, Maintain and Transfer (BOMT) schemes.¹⁴ Currently, the Regulatory Commission for Energy and Gas (CREG) is developing a resolution to regulate tariffs and remuneration and investment

⁵ According to the [PIEC](#) 0.49 million households do not have access to any electricity services.

⁶ The electricity generating capacity in the ZNIs is distributed among 373 facilities, serving 1,448 locations: 5 department capitals, 39 municipal capitals and 1,404 minor localities. [Superintendency of Domestic Public Services, 2014](#).

⁷ The [Regulatory Commission of Energy and Gas](#) (CREG).

⁸ The [CREG](#) determines costs of service delivery for the operators, taking into account specific localities, energy losses, capacity and availability of installed plants, energy demand, and minimum costs to cover customer needs.

⁹ The Government of Colombia distinguishes electricity tariffs for six different groups of users depending of their revenues.

¹⁰ Ministry of Energy and Mining, 2015. [Statistics Report 2008-2012](#).

¹¹ [CONPES 3108, April 2001](#).

¹² UPME. 2010. [PIEC. Annex I. Development of management schemes for ZNI](#).

¹³ DNP 2013. [Asociaciones Público Privadas - PPP](#).

¹⁴ Law 1715, May 2014. [Integración de las energías renovables no convencionales al sistema energético nacional](#).

requirements that would grant future RE investments similar conditions to current investments and BOMT schemes.¹⁵

- 2.6 These initiatives are part of a broader ongoing effort from the government to increase energy access in the ZNIs, reduce operational costs, and promote a cleaner energy generation. Institutionally, it has set up the Institute for Energy Solutions Planning (IPSE)¹⁶ to manage the development of infrastructure and service provision in the ZNIs. Further, the Mining and Energy Planning Unit (UPME) of the Ministry of Mines and Energy (MME) is assessing the opportunities and investment needs to expand energy access, mainly from RE technologies in the ZNI. Furthermore, the government established the Financial Support Fund¹⁷ for ZNIs ([FAZNI](#)) and the Rural Electrification Fund ([FAER](#)) to provide technical cooperation and financing for the expansion of generation infrastructure in those areas. These funds have supported most of the generating capacity in ZNIs and connections to the SIN, where possible, allocating US\$100 million a year to these activities.
- 2.7 **Topics to be addressed by the program.** In spite of government initiatives, private sector investments in mini-grids using RE generation in the ZNIs are very low (9.4%)¹⁸. The reason has to do with the differences on cash flow profiles between diesel and RE, and the financing conditions available in the Colombian markets. Diesel has much lower Capital Expenditures (CAPEX) than a corresponding RE. At the same time, the former presents much higher Operating Expenses (OPEX) than the latter¹⁹. If the financial market offered reasonable funding opportunities for long term projects, operators could be easily induced to switch from low upfront investment diesel into high RE investments. However, the actual conditions do not provide medium and long term financing at reasonable rates²⁰. This, summed to the still incipient regulatory environment for private sector investments in RE in ZNI, explains, in large part, operators' preference for diesel solutions. This problem is aggravated by the lack of familiarity with RE solutions by the financial intermediaries and the operators.
- 2.8 **Objectives.** The goal of the program is to promote and increase private investments in RE generation in the ZNIs while reducing Greenhouse Gas (GHG) emissions. This would be achieved through a pilot program providing long term financing with adequate conditions to private investors.

¹⁵ The CREG published Resolution 027 -2014, establishing the conditions for the remuneration of operators in the Exclusive Service Areas (ASEs, for its name in Spanish).

¹⁶ [Instituto de Planificación de Soluciones Energéticas](#).

¹⁷ Funded with resources from a fee on the power generated as well as power transmitted.

¹⁸ This percentage is the relation between private and public investments in the infrastructure of ZNIs during the period 2010-2013 (calculated based on data from FAZNI, 2015).

¹⁹ Electricity costs in the ZNIs are high (above US\$0.60 kw/hr) due mainly to operation costs (i.e. cost of diesel transportation). While these costs are greater than those of RE technologies (small hydropower, solar PV in a hybrid system with diesel generators, biomass and wind power)¹⁹, diesel technology remains more attractive to operators because of fuel subsidies. UPME, 2014. [Acciones y retos para la energización de las ZNI en Colombia](#).

²⁰ Currently, the local financial system does not offer investment finance at maturities of more than five years. The essential characteristics of the financing offered are: (i) from the point of view of bank liabilities, their average maturity is less than one year; and (ii) from the point of view of bank assets, the average maturity of local currency loans is around five years.

- 2.9 **Program beneficiaries** will be private sector operators offering and managing public electricity services and renewable technology providers who would be interested in investing in RE mini-grid generation. A market analysis is underway to assess the specific characteristics of the potential beneficiaries of the program, which will be described in more detail in the Proposal for Operation Development (POD).
- 2.10 **Eligible activities** will include medium and long term (more than two years) investments in renewable energy technologies. The market analysis mentioned before will characterize eligible technologies and projects in more detail to be reflected in the POD.
- 2.11 **Single component.** The program will consist of a Global Credit Loan, its' only component will be long-term funding to Bancoldex, Colombia's public bank in charge of supporting entrepreneurial development, for on-lending to eligible first tier local financial institutions (FIs) to provide sub-loans at adequate terms to eligible private sector firms interested in undertaking RE investment projects in the ZNIs.
- 2.12 **Expected impacts** of the program would be an increase in RE generation in the ZNIs and hence a reduction in GHG emissions. Its intermediate outcome would be the percentage increase in energy generation by beneficiary firms from RE sources vis-à-vis comparable, non-beneficiary firms. The outputs would be: an increase in the number of operators who access financing for RE projects; and an increase in the annual dollar amount of medium- and long-term loans granted by the program and its resulting investments in RE.

III. TECHNICAL ISSUES AND SECTOR KNOWLEDGE

- 3.1 The program design will consider the following information: (i) specific eligibility criteria, modalities and characteristics of the financing line; (ii) specific institutional and legal requirements to ensure the support and participation of key market players (e.g. FIs, private operators, insurance companies, etc.) in implementing the financing line; (iii) existing regulatory framework; and (iv) methodological approaches and protocols to monitor results/benefits of the financing line.

A. Program execution

- 3.2 Bancoldex has the necessary fiduciary and operational capacity for the successful execution of the program, as it is governed by the Financial System Act and is subject to oversight and monitoring by the Superintendency of Finance. Also, it operates as a second-tier bank that uses a network of FIs. In addition, Bancoldex has a track record of implementing operations funded by the IDB. Bancoldex is a solvent institution with exemplary risk management practices and the full backing of the government.

B. Program structure and approval process

- 3.3 Following the CTF requirements for co-financing, the single component for the financing of individual RE projects funded with the proposed program resources will be complemented with resources (of up to US\$10 million) from an existing IDB loan with Bancoldex ([2949/OC-CO](#)).²¹ Loan 2949/OC-CO's objectives of providing medium and long term financing for investment projects for technology innovation and modernization are aligned with those of the proposed program. The US\$10 million allocated from 2949/OC-CO for co-financing will correspond to financing for investments in RE technology innovation projects.
- 3.4 The program will be further complemented with a US\$500,000 non-reimbursable Technical Cooperation (TC) from the CTF to be presented jointly with the loan proposal to the CTF. The TC will support the program execution, promotion, monitoring and evaluation, and capacity building efforts with the local financial institutions and the program beneficiaries.

C. Alignment with national and IDB programs and strategies

- 3.5 The program is aligned with the IDB Country Strategy with Colombia 2012-2014 (GN-2648-1). It supports the promotion of lines of credit and the development of financial products (insurance, savings, microcredit, micro-franchises) and non-financial products (technical assistance for small-and medium-sized enterprises) through second-tier banks (see paragraph 3.11 of GN-2648-1).
- 3.6 It is also consistent with the lending target of the GCI-9 on climate change, renewable energy and environmental sustainability and with the IDB's priorities as set out in its strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy (see paragraphs 1.3, 2.9 and 3.14 of GN-2609-1) and will ensure consistency with IDB's Public Utility Policy (GN-2716-6).
- 3.7 The program is also aligned with a series of initiatives and policies from the Colombian Government. In particular, it will support commitments under the [National Development Plan 2014-2018](#) to: (i) consolidate national coverage, by providing 24-hour service in larger municipalities and localities of the ZNIs; (ii) boost schemes for power generation from non-conventional sources of energy and hybrid system; and (iii) implement economically efficient electricity generation systems in ZNIs and in areas of difficult access, according to the [Plan of Electrification of Non-Interconnected Zones](#).
- 3.8 The program will be coordinated with ongoing initiatives with Bancoldex, including loan 2949/OC-CO, and three TCs to support Bancoldex in developing and implementing green lines (ATN/SU-12012-CO; ATN/OC-12210-CO and ATN/OC-12718-RG; see Annex IV).

²¹ Third loan operation under execution by Bancoldex (2949/OC-CO, US\$200 million) of an existing CCLIP (CO-X1007).

IV. ENVIRONMENTAL SAFEGUARDS AND FIDUCIARY SCREENING

- 4.1 Since the promotion of RE confronts knowledge barriers and real or perceived risks among different market players, the proposed CTF TC will support Bancoldex overcome those barriers and risks and the program execution. Please refer to the Risk Assessment Matrix for information.
- 4.2 RE projects reduce GHG emission and hence are considered climate friendly. A framework to safeguard eligible projects and to ensure compliance with IDB's environmental and social policies will be defined. See the Annex III for more information.

V. OTHER ISSUES

- 5.1 While the government's efforts referred to in ¶2.5 should provide important incentives for private sector investments in RE, delays in their effective operationalization could reduce the attractiveness for operators to invest. To address these risks, the program will be developed in coordination with relevant national authorities, in particular MME, CREG, IPSE and UPME. The demand assessment for financing by private investors to be undertaken in preparation of the program will assume different regulatory scenarios.

VI. RESOURCES AND TIMETABLE

- 6.1 Preparation of the program will require administrative resources for US\$70,000. The distribution of the Proposal for Operation Development (POD) to the Quality and Risk Review (QRR) is scheduled for September 14, 2015 and consideration of the Loan Proposal (LP) by the Bank's Board of Executive Directors is scheduled for November 18, 2015. Dates are contingent upon the approval of the proposed operation by the CTF.

SAFEGUARD POLICY FILTER REPORT

PROJECT DETAILS	
IDB Sector	FINANCIAL MARKETS-FINANCING FOR ENVIRONMENTAL SUSTAINABILITY
Type of Operation	Financial Intermediation/Global Credit
Additional Operation Details	
Investment Checklist	Generic Checklist
Team Leader	Netto de A. C. Schneider, Maria E. (MNETTO@iadb.org)
Project Title	CTF Renewable Energy Financing Program for the Non-Interconnected Zones
Project Number	CO-L1161
Safeguard Screening Assessor(s)	Gaggero, Annabella (ANNABELLAG@iadb.org)
Assessment Date	2015-08-11

SAFEGUARD POLICY FILTER RESULTS		
Type of Operation	Loan Operation	
Safeguard Policy Items Identified (Yes)	The Bank will make available to the public the relevant Project documents.	(B.01) Access to Information Policy– OP-102
	The operation is in compliance with environmental, specific women’s rights, gender, and indigenous laws and regulations of the country where the operation is being implemented (including national obligations established under ratified Multilateral Environmental Agreements).	(B.02)
	The operation (including associated facilities) is screened and classified according to their potential environmental impacts.	(B.03)
	The Bank will monitor the executing agency/borrower’s compliance with all safeguard requirements stipulated in the loan agreement and project operating or credit regulations.	(B.07)
	Operation for which ex-ante impact classification may not be feasible. These loans are: Policy-based loans, Financial Intermediaries (FIs) or loans that are based on performance criteria, sector-based approaches, or conditional credit lines for investment projects.	(B.13)

	Suitable safeguard provisions for procurement of goods and services in Bank financed projects may be incorporated into project-specific loan agreements, operating regulations and bidding documents, as appropriate, to ensure environmentally responsible procurement.	(B.17)
Potential Safeguard Policy Items(?)	No potential issues identified	
Recommended Action:	Operation has triggered 1 or more Policy Directives; please refer to appropriate Directive(s), including B13, for guidance. No project classification required. Submit Report and PP (or equivalent) to ESR.	
Additional Comments:		

ASSESSOR DETAILS	
Name of person who completed screening:	Gaggero, Annabella (ANNABELLAG@iadb.org)
Title:	Sr. Operations Analyst
Date:	2015-08-11

COMMENTS
No Comments

ENVIRONMENTAL AND SOCIAL STRATEGY (ESS)

Project Name:	CTF Renewable Energy Financing Program for the Non-Interconnected Zones
Project Number:	CO-L1161
Project Team:	Maria Netto, IFD/CMF, Team Leader; Jose Ramon Gomez, ENE/CCO, Alternate Team Leader; Javier Cuervo, INE/ENE, Jose Juan Gomes, Gloria Lugo, Maria Margarita Cabrera, Leticia Riquelme, Sebastian Vargas, Alejandro Tamola and Annabella Gaggero, IFD/CMF; Alvaro Concha, CMF/CCO; Claudio Alatorre and Veronica Valencia, INE/CCS; Colin McKee, VPS/ESG; and Monica Lugo, LEG/SGO.
Borrower and Executing Agency:	<i>Banco de Comercio Exterior de Colombia S.A. (Bancóldex)</i>
Financial Plan¹:	IDB (Clean Technology Fund) ² : US\$ 9.265 million
Safeguards:	Policies triggered: B.13 Classification: Not required

I. OVERVIEW

1. While Colombia has a high average electricity coverage index (96.1%, with an average of 99.59% in urban areas and 84.84% in rural areas), two-thirds of the national territory are Non-interconnected Zones (ZNI) which are not served by the interconnected system (SIN). The ZNI are composed by a population of 1.83 million inhabitants spread across 1.565 localities, most of which (89%) in rural areas.
2. Only 34% of the ZNI population has electricity service and the available electricity services are provided only for an average of 9.2 hours per day in the capitals of departments and municipalities and for an average of 5.1 hours in smaller localities.
3. Most of the installed electricity capacity in ZNIs (165 MWe) is diesel generated (96,3%), followed by 2.8% by small hydropower and 0.9% by solar energy and other energy sources (see figure 3). Electricity generation costs in these areas are high (above US\$ 0.60 kw/hr) and greater than the costs of available renewable energy technologies in Colombia. However, the payback period for investing in non-convention renewable energy technologies to substitute diesel generation or for providing new generation capacity vary between 5 and 10 years and would require financing providing adequate grace and maturity periods and a rate of interest lower than the internal rate of return of these projects, which is currently not available.
4. In order to address the investments needs to increase access to energy, reduce costs and reliance on diesel generation and dependency on tariff subsidies, the Government of Colombia has been undertaking a number of initiatives³. And from

¹ This financing will be subject to its prior approval by the Trust Fund Committee (TFC) of the Clean Technology Fund (CTF). Once approved by the CTF/TFC, the Bank will proceed with the approval process of the program in accordance with its policies and procedures.

² The financing of renewable energy individual investment projects to be funded with program resources will be complemented with the financing of similar investment projects funded with resources (for up to USD 10 million) of the third loan operation (CO-L1132, USD 200 million) of an existing CCLIP (CO-X1007).

³ See Project Profile.

the regulatory point of view, the Law 1715 of May 2014 to promote the integration of non-conventional renewable energy sources in the Colombian energy matrix, also emphasizes the importance of promoting renewable energy in the ZNIs as part of Colombian sustainable development. Consistent with the law, the MME has established a target to increase the share of renewable energy in the ZNIs to 20% in 2015 and to 30% in 2020, which is estimated to need investments in the order of US\$ 240 million.

5. In spite of government initiatives, private sector investments in minigrids in renewable energy generation in the ZNI are very low. The program's goal is to support Colombia's efforts to enhance and modernize energy services in the ZNIs, while reducing GHG emissions. This would be achieved by pursuing two interconnected objectives: (i) increase private investments in renewable energy generation in the ZNIs; and (ii) build up the capacities of Bancoldex and other market actors on the structuring, financing, monitoring and evaluation of private sector-led, environmentally-friendly, investment projects in renewable energy in the ZNIs.
6. Main end beneficiaries of the program would be private sector operators offering and managing public electricity services and renewable technology providers who would be interested in invest in renewable energy minigrid generation either to substitute existing diesel generation or to provide for energy access in localities without any access to energy. Technologies available in Colombia are: small hydropower, solar PV in a hybrid system with diesel generators, biomass and wind power. It is expected that all projects will be below 20MW as the regulatory framework changes for projects above that threshold and that most projects be below 10MW.
7. The program's only loan component will be long-term dollar funding to Bancoldex, so that it can on lend those funds to eligible first tier local financial institutions for the provision of sub-loans at adequate terms to eligible private sector firms interested in financing renewable energy investment projects in the ZNIs.
8. The financing of renewable energy individual investment projects to be funded with program resources will be complemented with the financing of investment projects in innovation and mitigation of environmental impacts to be funded with resources (for up to US\$10 million) of an existing loan operation (CO-L1132).
9. To support the demand for investment financing, the program will be complemented with a US\$ 500,000 non-reimbursable technical cooperation (TC) from the CTF.

II. ENVIRONMENTAL AND SOCIAL IMPACTS

10. Renewable energy projects deliver long-term GHG emission reductions and are considered environmentally friendly projects as they entail cleaner energy production. However, some projects can entail adverse environmental or social impacts that can be significant and which need to be assessed and managed on a project by project basis. Based on early indicated, this line is preliminarily categorized as FI-2.
11. Environmental issues that may potentially occur include the following:
 - 11.1. Impact on biodiversity and especially on birds and bats mortality rates in the case of wind projects of larger scale.

- 11.2. Deterioration of the access to water (volume and/or quality) for the population in the case of hydro projects.
 - 11.3. Negative impact on primary forest areas or soil contamination in the case of biomass projects.
 - 11.4. Environmental issues caused by the associated infrastructure works if any (construction of roads, transmission lines, etc.).
 - 11.5. Environmental issues caused by the project geographic location in or near sensible areas (protected areas, etc.).
12. Social issues in renewable energy projects are potentially significant. They entail socio-cultural impacts related to land acquisition, land use, indigenous peoples, and cultural heritage.
13. Bancóldex has developed institutional capacity in the management of environmental and social risks and implemented a portfolio-wide Environmental and Social Management System. The system was developed with the technical assistance of the IDB (CO-T1198). Bancóldex has demonstrated strong capacity to manage environmental and social risks under previous IDB lines.

III. STATUS & COMPLIANCE

14. Given that this is a financial intermediary and based on Directive B.13 of the Environment and Safeguards Compliance Policy (OP-703), this transaction is not categorized. Based on early indication, and given the type and size of sub-projects (below 20MW with most projects below 10MW). And the average estimate at 5MW), this operation is estimated to be low to medium risk (FI-2). This classification and the associated risks and mitigation will be evaluated during due diligence. Of the renewable investment options available, the forecast pipeline is concentrated in solar and biomass. It is unlikely that hydro in excess of 10 MW will be financed.⁴

IV. STRATEGY FOR ENVIRONMENTAL AND SOCIAL DUE DILIGENCE

15. Bancóldex will execute the program as part of its current organizational structure. The operational rules governing the program and the eligibility criteria of individual projects will be established in the Operating Regulations document agreed between the IDB and Bancóldex, in accordance with the internal rules and policies of both counterparts, and laws and regulations in Colombia.
16. As per the IDB Environment and Safeguards Compliance Policy and Guidelines, and as part of its due diligence process, the Bank will further assess related E&S risks under this credit line, possible reputational risks, and capacity for environmental and social risk management. This will include:
- 16.1. A review of a proposed pipeline of projects to identify: (i) the location, size, scale, and type (solar, wind, hydro, etc.) of proposed investments, and their direct and indirect ESHS and labor impacts; and (ii) applicable

⁴ During due diligence, IDB will evaluate the role of hydro within the investment pipeline. The presence of hydro with capacity at or above 10 MW in addition to the site specific considerations may affect the final categorization.

environmental and social documentation, permits, and management plans to address their adherence to national laws and regulations and internationally recognized good practice standards.

- 16.2. The adequacy of Bancoldex's existing ESMS to manage the likely impacts under this credit line;
 - 16.3. A sample of similar projects financed by Bancoldex to evaluate the capacity for assessing, managing and monitoring renewable energy projects ranging in scale from 2MW to 20MW.
17. Based on this evaluation, the IDB will prepare an Environmental and Social Management Report (ESMR), which will detail the findings of the analysis and corresponding requirements defined in the Operating Regulations.
 18. The IDB will ensure that appropriate and feasible ESHS and labor requirements, in the form of an environmental and social risks management system (ESMS) applicable to the line, and other conditions as needed, tailored to the particular needs of the operation, are included in the Operating Regulations. The program Operating Regulations will include: (i) Colombian applicable law and regulations, standards, IDB environmental and social policies and safeguards and good practices applicable to the Program; (ii) the classification criteria based on risk and environmental impact of the specific operation; (iii) the process, roles and responsibilities for the evaluation, approval, management and socio- environmental monitoring of projects; and (iv) the specific requirements and procedures applicable by category of risk and environmental and social impact assigned.

ÍNDICE DE TRABAJO SECTORIAL REALIZADO Y PROPUESTO

Estudios	Descripción	Fecha	Referencias y enlaces a archivos técnicos
Opciones técnicas y de diseño	<p>Evaluación inicial del potencial de las energías renovables en Zonas No Interconectadas en Colombia.</p> <p>Evaluación legal de las alternativas de concesiones y acuerdos para Zonas No Interconectadas</p> <p>El sector de energía renovable en Zonas No Interconectadas.</p> <p>Evaluación de los instrumentos financieros adecuados para la promoción en inversión del sector privado en energías renovables para ZNI.</p> <p>Apoyo en el análisis de posibles soluciones tecnológicas (híbrida, minihidro, etc.)</p> <p>Análisis de riesgos y evaluación de posible impacto</p>	Agosto 2015	<p>Colombian Planning Unit on Mining and Energy (UPME) and its Indicative Plan for the Expansion of Electricity Coverage 2013- 2017 (PIEC)</p> <p>The regulatory Commission of Energy and Gas (CREG) determines costs of service delivery for the operators, taking into account specific localities, energy losses, capacity and availability of installed plants, energy demand, and minimum costs to cover customer needs</p> <p>Resolution 186 February 2012 from Ministry of Environment and Sustainable Development</p> <p>Law 1715, May 2014 “Integración de las energías renovables no convencionales al sistema energético nacional”</p> <p>CONPES 3108 Programa de energización para Zonas No Interconectadas</p>
Análisis de viabilidad económica	Evaluación económica del proyecto de la muestra Apoyo para análisis costo-beneficio de solución tecnológica.	Agosto 2015	<p>UPME, 2014. “Acciones y retos para la energización de las ZNI en Colombia”</p> <p>UPME, 2010. PIEC. Annex I. Development of management schemes for ZNI</p> <p>FEZNI, IPSE 2010</p> <p>FAZNI</p> <p>FAER</p> <p>Superintendencia de Servicios Públicos Domiciliarios. Base de datos SUI. www.sui.gov.co</p> <p>XM. Informe de Operación del SIN y Administración del Mercado. Recaudo de los fondos Fazni, Faer, Faes y</p>

			<p>Prone</p> <p>Unidad de Planeación Minero Energético – UPME. Análisis de la ley 1715.</p> <p>International Renewable Energy Agency – IRENA. Levelised Cost of Electricity</p> <p>Departamento Nacional de Planeación. Plan de Desarrollo 2006 – 2010. Estado Comunitario Desarrollo para Todos.</p> <p>SOPESA. Planta de incineración de residuos sólidos urbanos de San Andrés</p> <p>Determinación de Inversiones y Gastos de Administración, Operación y Mantenimiento para la Actividad de Generación en Zonas no Interconectadas Utilizando Recursos Renovables</p>
Capacidad Institucional	Análisis de condiciones crediticias y su impacto en el proyecto Identificación y propuesta de mitigadores de riesgos, implicaciones y actores involucrados	Octubre 2013	National Development Plan 2014-2018
Recolección de datos y análisis para reportar resultados	Matriz de resultados Plan de monitoreo y evaluación	Octubre 2013	Statistics Report 2008-2012 from the Ministry of Energy and Mining, 2015.
Salvaguardias ambientales y sociales	Análisis ambiental del programa Informe de Gestión Ambiental y Social del Programa (IGAS)	Agosto 2015	Project profile

Part B. Technical Cooperation ME-T1409

I. Basic Information of the technical Cooperation

▪ Country/Region:	Colombia
▪ TC Name:	Mitigation of Greenhouse Gas Emissions by Renewable Energy Projects in Non-Interconnected Zones (ZNIs). Operational support to program CO-L1161
▪ TC Number:	CO-T1409
▪ Team leader/Members	Maria Netto, IFD/CMF, Team Leader; Jose Ramon Gomez, ENE/CCO, Alternate Team Leader; Javier Cuervo, INE/ENE, Jose Juan Gomes, Gloria Lugo, Maria Margarita Cabrera, Leticia Riquelme, Sebastian Vargas, Alejandro Tamola, Annabella Gaggero, IFD/CMF; Alvaro Concha, CMF/CCO; Claudio Alatorre and Veronica Valencia, INE/CCS; Colin McKee, VPS/ESG; Claudia Mylenna Cardenas Garcia, Gabriele Maria del Monte, FMP/CCO; and Escarlata Baza Nuñez, LEG/SGO
▪ Associated Loan/Guarantee Name:	Renewable Energy Financing Program for the Non Interconnected Zones (NIZ)
▪ Loan name associated or guarantee	CO-L1161. Financing to leverage private invest in renewable energy in non-interconnected zones (ZNIs)
▪ Date of TC Abstract authorization:	N/A.
▪ Beneficiary (recipient countries or entities of technical assistance):	Banco de Comercio Exterior de Colombia (Bancóldex)
▪ Executing agency and contact name:	Bancóldex
▪ Donors providing funding:	Clean Technology Fund (CTF)
▪ IDB funding requested:	US\$500,000 from CTF
▪ Local counterpart funding (if any):	US\$100,000 (in-kind Bancóldex)
▪ Disbursement period:	48 months for execution and disbursement
▪ Required start date:	October 1 st 2015
▪ Types of consultants:	Firms and individuals
▪ Prepared by the Unit:	IFD/CMF
▪ Unit of Disbursement Responsibility:	IFD/CMF
▪ Included in Country Strategy:	Yes
▪ TC included in CPD:	Yes
▪ GCI-9 Sector Priority:	The operation of proposed technical cooperation is closely related to two institutional priorities of the IDB under the GCI-9: (i) institutions for growth and social welfare, and (ii) Protecting the Environment and Responding to Climate Change

II. Description of the Associated Loan/Guarantee:

- 2.1 This Technical Cooperation (TC)'s objective is to support the execution of the program CO-L1161, Renewable Energy Financing Program for the Non Interconnected Zones (ZNI).

III. Objectives and justification of the TC

- 3.1 This technical cooperation will support the loan transaction CO-L1161 "Renewable Energy Financing Program for the ZNI". The objective of the loan is to support Colombia's actions to improve access to energy in isolated zones and promote access to clean energy sources, to promote and increase private investment in renewable energy (RE) generation in the ZNIs while reducing Greenhouse Gas (GHG) emissions by testing an innovative financial model for RE projects in ZNI. The transaction will be financed with a loan of US\$10 million from the Clean Technology Fund (CTF) from the IDB. These resources will be complemented with resources (of up to US\$10 million) from an existing IDB loan with Bancóldex (2949/OC-CO).¹
- 3.2 Colombia is a country with a high average electricity coverage index. According to the Mining and Energy Planning Unit (UPME) and the Indicative Expansion Plan Coverage of Electric Power (PIEC),² the average coverage rate nationwide is 96.1% and in urban and rural areas disaggregated is 59% and 84.84% respectively. However, two-thirds of the country are not served by the Interconnected System (SIN) and are named as ZNI. In the ZNI they are approximately 1.83 million people who live in 1,565 localities, of which only 34% enjoy access to electrical energy supply. According to UPME PIEC there is in total 11.7 million homes in the country, of which 94.3% (11 million) are connected to the SIN and 1% (0.18 million) service are in ZNI. 4.2% (0.49 million households) do not have electricity service, of which 1.9% may be connected to the SIN and 2.3% are considered ZNI and should have a diesel or hybrid-based generation renewable solution. The service in these isolated zones is provided by 94 operators³ who mostly perform the activities of generation, distribution and marketing with low technical capacity, and financial management. The main aspects related to the provision of energy services in ZNI can be summarized as the following: (i) low quality of service delivery; (ii) schemes of electricity generation economically unsustainable high environmental impact in terms of climate change from the use of fossil fuels; (iii) low use of local renewable resources for electricity generation; (iv) high component of subsidies to cover the costs of providing the service are not covered by the fees paid by end-users; and (v) low private sector participation in the model due to the lack of a legal framework for a clearly return on investment. In 2014 the Colombian government enacted Law 1715 which creates a regulatory framework and incentives to accelerate investment in energy efficiency and renewable energy, with special emphasis on ZNI.
- 3.3 To support the government to overcome the above aspects and improve access to renewable energy in ZNI, the CO-L1161 program should be accompanied by measures to ensure alignment with the legal and institutional requirements of the

¹ Third loan operation under execution by Bancóldex (2949/OC-CO, US\$200 million) of an existing CCLIP (CO-X1007).

² [Indicative Expansion Plan Coverage of Electric Power \(PIEC\) - UPME, 2017-2017.](#)

³ [The Regulatory Commission of Energy and Gas \(CREG\).](#)

country to enable the participation of the key market players (financial institutions, private operators, insurance companies, etc.); the current regulatory framework; and methodologies and protocols to validate the expected results of the program.

- 3.4 This technical cooperation is aligned with the IDB Country Strategy for Colombia 2010-2014 (GN-2648-1). In particular, it is proposed to support the promotion of credit lines and developing financial and non-financial products (insurance, savings, microcredit and micro franchises) through second-tier banks (Bancóldex) (see paragraph 3.11 of the strategy).
- 3.5 This technical cooperation also keeps consistent with the goal of financing the Ninth Replenishment of the Bank to climate change, renewable energy and environmental sustainability, as well as the priorities set in the IDB Integrated Strategy for Mitigation and Adaptation to Change climate, and Sustainable and Renewable Energy, adopted in March 2011 (see paragraphs 1.3, 2.9 and 3.14 of the GN-2609-1).
- 3.6 This TC will integrate results from other studies and operations undertaken with Bancóldex technical cooperation, including technical cooperation CO-T1402 and CO-L1161.

IV. Description of activities/components and budget

- 4.1 It is expected that the credit line to be established with resources of the CO-L1161 program will consider the following information: (i) specific eligibility criteria, modalities and characteristics of the financing line; (ii) specific institutional and legal requirements to ensure the support and participation of key market players (e.g. FIs, private operators, insurance companies, etc.) in implementing the financing line; (iii) existing regulatory framework; and (iv) methodological approaches and protocols to monitor results/benefits of the financing line.
- 4.2 This technical cooperation is intended to support the implementation of the CO-L1161 operation through three main components, namely:
- 4.3 **Component 1.** Supporting the structuring of the demand side of the market promoting the financing line and by training local financial institutions and potential beneficiaries on: (i) the benefits than can be obtained through renewable energy investments in terms of improving the quality of service and / or energy savings and cost-reduction of GHG emissions; and (ii) on the real and perceived risks associated with this type of projects. As part of this component, a promotional strategy will be developed, including promotional materials and events. Requirements and basic guidelines for technical services will also be established (e.g. basic technical and financial information of a project proposal, contract type with risk mitigation measures, specifying technical requirements for eligible projects, etc.).
- 4.4 Two consulting (individuals and/or firms) will be hired to support the activities of the Component 1. One individual consultant will be required to support Bancóldex with specific technical capabilities and local coordination. A consultant or firm will also be hire to support the development of both workflows for the financing line operation as well as standards and examples of contracts and templates. The execution of this component will also include the cost of consultants and events required for dissemination, training, and consultation with relevant actors (such as local financial institutions, technical service providers and customers).
- 4.5 **Component 2:** This component will grant as investment spending, a benefit to the implementation of RE projects in ZNI resulting from the interaction in the market

between the operators and technical services or technology providers in a consistent decrease in the credit interest rate to the beneficiaries of the program to effectively implement the project. The resources of this component will be used to cover the difference between the initial interest rate of the loan and the new rate calculated by applying the reduction, for the remaining term of the loan.

- 4.6 **Component 3:** Designing and implementing a monitoring and evaluation registry for the continuous supervision of projects and the assessment of their results in terms of energy consumption/ savings and GHG emissions reduction. Monitoring of results is essential to demonstrate the improvement in the quality of the generation, energy consumption and GHG emissions reduction of the projects and the overall program. This component will include the design and implementation of a registry to monitor the quality of projects and ensure the proper reporting, monitoring and verification of the expected results of the projects and the program as a whole. Thus, this TC will support the design of the necessary templates as well as the development of a methodology to review projects and a registry or information system where Bancóldex can record all the activities undertaken within each subproject proposal as well as the monitoring of subprojects, safeguards requirements and the program results. In addition, this component will generate a report of lessons learned, to be shared with the CTF, which can demonstrate the potential for replication and transformation that the strategy of the program can achieve. Finally, this component will support an impact evaluation of the program towards the end of the execution period (including IDB Monitoring and Evaluation reports; Project Monitoring Report-PMR and Project Completion Report-PCR).
- 4.7 The implementation of this component also entails the cost of consultants or Firms and fees or travel costs.
- 4.8 To ensure proper execution of the proposed program, the project team will organize meetings and conference calls, mid-term and a final review with Bancóldex and the consultants for each of the phases of the design and implementation and the planned activities.

Indicative Results Matrix

Expected results	Unit	Baseline		Year 1		Years 2 / 4		Expected completion date	Data source
		Value	Year	Planned	Actual	Planned	Actual		
Outcome Comp. 1									
Component 1: Number of technical service providers that meet the requirements set out in the financing line.	#	0	2015	2		4		12/31/2016	IDB Systems and Bancóldex dedicated registry
Outputs Comp 1.									
Component 1: # of LFIs and clients reached through meetings, e-mail, calls, mailing and social media.	#	0	2015	100		150		12/31/2016	IDB Systems and Bancóldex dedicated registry
Component 1: # of visits to dedicated web page with information about the project.	#	0	2015	10		180		12/31/2016	Bancóldex virtual site for the program

Component 1: # of outreach and training events organized	#	0	2015	1		5		12/31/2017	IDB Systems and Bancórdex dedicated registry
Outcome /Output comp. 2 ⁴									
Component 2: # of projects supported by the credit line	#	0	2015	1		3		12/31/2017	IDB Systems and Bancórdex dedicated registry
Outcome comp. 3									
Component 3: Emissions Reduction of the Program	Ton CO2	0	2015			39,900		12/31/2020	IDB Systems and Bancórdex dedicated registry
Outputs comp 3									
Component 3: # of Monitoring and evaluation methodology and templates	#	0	2015	4		0		12/31/2016	IDB Systems and Bancórdex dedicated web site
Component 3: # Lessons Learned report	#	0	2015	1		1		12/31/2020	
Component 3: # Project Monitoring Report	#	0	2015	1		1		12/31/2016	Bancórdex dedicated registry
Component 3: # Project Completion Report	#	0	2015	0		1		12/31/2020	IDB Systems and Bancórdex dedicated web site

4.9 The total amount of this operation is US\$500,000 from CTF resources which will be used to hire the services of experts to implement the components 1, 2 and 3 above, as well as to pay for logistics of consultative events and travel expenses related to consultants. IDB execution would be carried out in accordance with GN-2629-1 and its Appendix 10. The Bank will contract individual consultants, consulting firms and non-consulting services in accordance with its current procurement policies and procedures. A request from the beneficiary for the IDB to execute this TC is enclosed.

⁴ This indicator is outcome/output level due further discussions required between the Beneficiary and IDB during the execution of the TC and Loan.

Indicative Budget (in US\$)

Activity/Component	Description	CTF	Counterpart Funding	Total Funding
Component 1	Development of standards and models of concessions and templates	40,000	10,000*	50,000
	Promotional materials	20,000	10,000*	30,000
	Dissemination and training events	70,000	30,000*	100,000
	Strengthening Institutional capacity Bancóldex	80,000	40,000*	120,000
Component 2	benefit to RE projects in ZNI /investment spending	150,000	n.a.	150,000
Component 3	Monitoring and tracking methodologies, Safeguards requirements and templates	30,000	n.a.	30,000
	Report Log monitoring and reporting of lessons learned	80,000	n.a.	90,000
	General impact assessment of the program	30,000	10,000*.	30,000
Total		500,000	100,000*	600,000

* * In-kind resources from Bancóldex: Counterpart resources will consist on staff time, facilities for the development of planned promotional workshops and events, and office space for the consultants supporting the design of the different products envisioned under this TC.

V. Executing agency and execution structure

- 5.1 The executing agency will be Bancóldex, with the fiduciary and operational capacities necessary for the successful execution of the program, as it is governed by the Financial System act and is subject to the supervision and monitoring by the Superintendence of Finance. In addition, Bancóldex has a long history of implementing operations funded by the IDB and CTF, and the government has chosen it as one of the entities that will support its GHG emissions reduction efforts.
- 5.2 For the purposes of this program, Bancóldex will be responsible for: (i) executing and supervising the appropriate use of the resources obtained through the proposed technical cooperation; (ii) providing in due time and form the necessary human, technological and budgetary resources required, and (iii) delivering to the Bank the required documentation to meet disbursements and other performance requirements for execution. As a condition prior to the first disbursement of the TC, the executing agency will provide evidence to the Bank's satisfaction of (i) the formal appointment of a program coordinator at Bancóldex; and (ii) project implementation will be based on the results matrix mentioned above and the products and indicators contained therein.
- 5.3 Bancóldex will submit to the IDB the following reports: (i) progress reports every six months, within sixty (60) days from the end of the six months; and (ii) a final report within six months from the end of last project activity executed. The contents of the reports shall be jointly agreed between IDB and Bancóldex.
- 5.4 The executor will also provide the Bank's financial statements of the project, within 90 days after the date stipulated for its last disbursement, which will be audited by an independent auditor firm selected and contracted resources from Bancóldex.

VI. Major Issues

- 6.1 In view of the high technical level of the proposed TC this work, there is a risk of not obtaining good quality results if appropriate follow the work of the consultants are not given. Therefore, the proposal considers ongoing monitoring activities and overall evaluation of the program. Peer reviewers to analyze the products produced may also be required.

VII. Exceptions to bank policy

- 7.1 No exceptions to Bank policy are envisioned.

VIII. Environmental and social strategy

- 8.1 Pursuant to filter environmental and social safeguards, the proposed technical cooperation was classified as Category C. No potential negative environmental or social impacts of technical cooperation were identified and therefore no mitigation strategy is needed.

Part C. Technical Cooperation CO-T1411

I. Basic Information

▪ Country/Region	Colombia
▪ Name of TC:	Public Policy to Address Barriers to Renewable Energy Solutions in ZNI
▪ TC Number	CO-T1411
▪ Team Leader/ Team Members	José Ramón Gómez (ENE/CCO), Team Leader; Jorge Mercado (ENE/CDR) Alternate Leader; Juan Paredes (INE/ENE); Haydemar Cova (INE/ENE); Wilkferg Vanegas (INE/ENE); Alvaro Concha (CMF/CCO); Juan Pablo Vallejo (CCS/CCO); Miguel Orellana (FMP/CCO); Gabriele del Monte (FMP/CCO); Maria Elisa Arango (LEG/SGO); y Andrea Giraldo (CAN/CCO)
▪ Taxonomy	Client Support
▪ Beneficiary	Republic of Colombia. Ministry of Mines and Energy (MME)
▪ Executing Agency	Inter-American Development Bank – Energy Division in Colombia (ENE/CCO)
▪ IDB Funding requested	US\$477,000
▪ Donor providing funding	Clean Technology Fund-CTF
▪ Local Counterpart	No
▪ Disbursement Period	36 months
▪ Execution Period	30 months
▪ Starting Date Required	November 2015
▪ Type of Consultancies	Individuals and Firms
▪ Preparation Unit	INE/ENE
▪ Unit of Responsibility for Disbursements:	ENE/CCO
▪ TC Included in Country Strategy	Yes
▪ TC Included in CPD	No
▪ GCI-9 Sector Priority	(i) Institutions for growth and social welfare, and (ii) Protecting the Environment, responding to Climate change and promoting renewable energy.

II. Objectives and Justification

- 2.1 **Objective.** The objective of this technical cooperation (TC) is to contribute to the reduction of Greenhouse Gas (GHG) emissions and the improvement in the quality of life of inhabitants of the non-interconnected Zones (ZNI) in Colombia. This objective is intended to be achieved by supporting the Ministry of Mines and Energy (MME) in the development of the regulatory framework and by strengthening the technical capacity needed to foster sustainable private investment in renewable energy (RE) in the underserved ZNI.
- 2.2 **Non-interconnected Zones.** ZNI are areas with no access to electricity from the National Interconnected System (SIN). They are characterized by their distance from urban and consumption centers; high indexes of unsatisfied basic needs; reduced ability to pay for services; high cost of electricity service provision due to heavy use of fossil fuels for generation; and high levels of electricity losses. ZNI cover about 66% of the country's territory, and are served by 92 operators, of which 47 are local governments, 34 are public utilities, and the rest are private operators such as community organizations and cooperatives.

- 2.3 The ZNI have 261 MW of installed generation capacity, of which only 3.5% corresponds to Non-Conventional Renewable Energy (NCRE) technologies. The remaining 96.5% is diesel-fired, despite the high operating costs and negative environmental impact of this technology. Required investments in generation and distribution in ZNI are in general commercially inviable, with high dependency on subsidies granted to fossil fuels by the Government of Colombia (GoC), and with a low ability to pay by users.
- 2.4 **Government's Strategy.** The GoC has set as a priority for the ZNI to advance in the promotion of sustainable energy solutions that reduce dependency from fossil fuels and firewood, and contribute to the reduction of GHG emissions. It has taken important strategic steps to improve its institutional, regulatory and operational framework, in order to bring the private sector along, while pushing the clean energy agenda in the country. The MME has the basic institutional capacity for policy formulation, for inter-institutional coordination within the public sector and with the private sector, and for planning, through its Mining and Energy Planning Unit (UPME). The Energy and Gas Regulatory Commission (CREG) is responsible for regulating the activities of users and operators. The State is present in the ZNI through the Institute for Planning and Promotion of Energy Solutions in Non-Interconnected Zones (IPSE), responsible for supporting sustainable energy projects aimed at expanding access to electricity in ZNI. Furthermore, Law 1715, approved in May 2014, seeks to stimulate the development and use of NCRE, by integrating them into the national energy system, and by increasing their share in ZNI, as a key element for sustainable economic development, reduction of GHG, and security of energy supply. Another initiative taken by the GoC is the creation of the Financial Support Fund for ZNI Energization (FAZNI), which offers technical and financial support for the expansion of electricity infrastructure in ZNI.
- 2.5 Among the steps taken to promote private investment in RE in ZNI, the GoC created the "Exclusive Service Areas" (ASE), which provide incentives to private operators under a service provision concession-like model in ZNI, initially set in the Departments of San Andrés, Vichada and Amazonas. Moreover, the Law of Public-Private Partnership, approved in 2012, provides incentives to private participation in public services. Law 1725 from 2014 offers incentives to attract private firms for expanding investments in RE. Currently the GoC is introducing financing initiatives and technical support for RE solutions in ZNI through Bancóldex, a second-tier national development bank, which in turns channels the support through the commercial banking system.¹
- 2.6 **Justification.** Policies and initiatives put in place by the GoC have not produced the expected impact in terms of a significant increase in the share of private investment in RE solutions in ZNI, currently estimated at around 9%. The main barrier to achieve the proposed goal is the high initial investment requirements of RE solutions, when compared with diesel-based solutions. A further barrier is the subsidies to diesel. This framework creates strong incentives to the use of GHG-emitting technologies, with the resulting adverse environmental impact. Gaps in the regulatory framework and in the planning and sector operation process have been identified, that prevent the establishment of a business

¹ See the "Renewable Energy Financing Program for the ZNI" (CO-L1161), which is submitted for CTF approval simultaneously with this TC.

climate with adequate commercial and political incentives conducive to sustainable investments in RE at the expected scale. This TC aims at strengthening the MME and relevant agencies, to ensure that the country puts in place a regulatory and operational framework and acquires the technical capacity to stimulate private intervention.

- 2.7 **Strategic Alignment.** This TC is consistent with the financing goal of the Ninth Replenishment of the Bank: (i) Institutions for growth and social welfare, and (ii) Protecting the environment, responding to climate change and promoting renewable energy and environmental sustainability, as well as the priorities set in the IDB Integrated Strategy for Mitigation and Adaptation to Climate Change, and Sustainable and Renewable Energy, adopted in March 2011 (GN 2609-1).
- 2.8 This TC is aligned with the IDB Country Strategy for Colombia, 2012-2014 (GN-2648), which includes Renewable Energy as one of the areas of support to dialogue and knowledge.

III. Description of Activities and Results

- 2.9 This TC consists of two components:
- 2.10 **Component 1. Support for the development of a regulatory framework to promote private investments in RE in ZNI.** This component will finance consultancy services for: (i) identification of the main technical, environmental, socio-economic, financial and regulatory barriers that dis-incentivize private investment in RE in the ZNI; and (ii) specific policy and regulatory recommendations that promote RE private investments in the ZNI. The following issues will be examined: available technologies, tariff structures, financing mechanisms, operating and environmental license granting; contract models for electricity generation and distribution, stakeholder involvement, social and cultural aspects, as well as definition of responsibilities. Workshops and consultations will be held with the participation of MME, UPME, IPSE, network operators, local authorities of the ZNI, nongovernmental and civil society organizations, providers of RE technologies for isolated systems, potential investors, financial institutions, and regulatory entities.
- 2.11 **Component 2. Institutional and capacity strengthening of the MME and other entities.** This component will finance consultancy services and training activities aimed at supporting the capacity of MME, UPME and IPSE to carry out planning and monitoring activities, and to promote and expand private investments in affordable state of the art RE generation and storage technologies appropriate for ZNI. This support will include: (i) updating the socio-demographic data, ability to pay, electricity service coverage, natural resource and climate data in ZNI, needed for making decisions related to coverage expansion, types of solutions, and RE private investment plans; (ii) review of coverage and GHG emissions reduction targets for the ZNI; (iii) training on the design of policies and regulations to promote private investments in RE; (iv) analysis of electricity generation alternatives for the communities of the ZNI; (v) methodologies for consultation and community participation aimed at creating awareness on climate change, the use of NCRE, and financial sustainability of RE solutions; and (v) definition of indicators and other monitoring tools that will enable the verification of the achievement of targets.

- 2.12 **Results:** The main expected results of this TC are: identification of the main barriers that act as disincentives or limit private investments in RE in the ZNI of Colombia; better access to information that fosters private investments in RE from a policy and regulatory perspective; and improvement of MME capacities for planning and monitoring the sector in the ZNI.

Table IV-1 Results Matrix

Results	Outputs	Baseline 2015	Target 2018	Means of Verification
Component 1. Support development of a regulatory framework to promote private investments in ER in ZNI				
The main barriers for investments in RE in the ZNI of Colombia have been identified.	Assessment report on main barriers to private investments in RE in the ZNI	0	1	Consultancy report submitted to the IDB and MME
Better access to and quality of information that promotes private investments in RE in ZNI from a policy and regulatory perspective; and improvement of MME capacity for planning and monitoring the sector in the ZNI.	Workshops and consultations with network operators and local authorities,	0	3	Agendas and participants lists
Better access to information that promotes private investments in RE in ZNI from a policy and regulatory perspective	Report with recommended standards and regulations that foster private investment in RE in ZNI	0	1	Consultancy report submitted to the IDB
Component 2. Institutional strengthening and capacity building for MME				
Improvement of MME capacities for planning and monitoring the sector in the ZNI.	MME's staff training events	0	2	Participants lists
	MME needs assessment report for planning and monitoring the sector in the ZNI.	0	1	Consultancy report submitted to the IDB and MME

3 Indicative Budget

- 3.1 The total amount of this operation is US\$477,000 from CTF resources, which will be used to hire the services of experts to implement Components 1 and 2 as shown on Table IV-1.

Table IV-1. Indicative Budget (in US\$)

Activity/ Component Description	BID (CTF)	Total
Component 1. Support the development of a regulatory framework that promotes private investments in ER in ZNI of Colombia.	200,000	200,000
Component 2. Institutional and capacity strengthening of the MME and others entities	177,000	177,000
Monitoring and supervision	50,000	50,000
Total	477,000	477,000

4 Executing Agency and Execution Structure

- 4.1 Per GoC’s request, the IDB will execute this TC through its Energy Division in Colombia (ENE/CCO) given that the MME’s 2016 budget does not include this TC. The IDB execution would be carried out in accordance with GN-2629-1. The Bank will contract individual consultants, consulting firms and non-consulting services in accordance with its current procurement policies and procedures (GN-2350-9 and updates). All products will be jointly reviewed by IDB and MME, with participation from UPME and IPSE.

5 Relevant Risks

- 5.1 Lack of interest from local network operators and municipalities and communities of ZNI has been identified as a risk for the execution of the TC. Workshops and consultations to be carried out under Component I will contribute to minimizing this risk. In addition, IPSE and UPME will be involved in the execution of this TC since both institutions have significant experience and knowledge of the energy sector in the ZNI.

6 Environmental Safeguards

- 6.1 Pursuant to Bank’s environmental and social safeguards, the proposed TC was classified as Category C. No potential negative environmental or social impacts were identified and therefore no mitigation strategy is needed.

Annex 1. Fit with CTF Investment Criteria

RENEWABLE ENERGY FINANCING PROGRAM FOR THE NON INTERCONNECTED ZONES CO-L1161; CO-T1409; CO-T1411

Program Fit with Colombia's Investment Plan and Dedicated Private Sector Program - Phase II

In 2010, the CTF Trust-Fund Committee (TFC) endorsed an IP for Colombia that outlines the strategy, sectors, and objectives to be implemented by the IDB, the World Bank and the IFC in leveraging additional resources to support climate change mitigation measures in the country. The non-conventional renewable energy (RE) sector was presented in the original CTF IP as a priority sector for a possible second phase of the IP. In 2013, the original IP was revised, adding a Non-conventional RE Program with an indicative CTF allocation of USD 10 million for implementation by IDB, even though the total indicative allocation after the revisions remained at USD 150 million in CTF funding (funds from the Energy Efficiency Program in the original plan were reallocated, decreasing from USD 50 million in the original plan to USD 39 million in the revised plan). The CTF TFC endorsed these revisions (see [Revised CTF IP for Colombia](#)).

In October 2013, the TFC endorsed a [proposal](#) for funding to be deployed for Dedicated Private Sector Programs (DPSP). A [proposal for a Phase II of the DPSP](#), endorsed in June 2014, includes a RE Mini-Grids and Distributed Power Generation Program, which aims to leverage private investment to fill financing gaps and to promote the widespread development of RE mini-grids to serve rural and underserved off-grid communities. The proposed IDB Program, "RE Financing Program for the Non Interconnected Zones" (ZNIs by its acronym in Spanish) was presented as part of the proposal for Phase II.¹

The objective of the proposed Program is to promote and increase private investments in RE generation in the ZNIs of Colombia, while reducing GHG emissions. RE investment projects to be funded with CTF resources will be complemented by financing of similar investment projects funded with IDB resources (up to USD 10 million) from the third loan operation (2949/OC-CO, USD 200 million) of an existing Conditional Credit Line for Investment Projects (CCLIP) with Bancóldex.

The Program's long-term financing would be complemented with technical cooperation activities to address non-financial barriers to the investments and to provide regulatory support.

The Program will be also accompanied by monitoring and evaluation components, seeking not only to assess the Program's impact but also its replicability. In addition, it will include a system to ensure continuous environmental and social (E&S) risk management, including avoidance of GHG leakage.

1. Potential for GHG Emissions Savings

The Program is expected to finance about 12 projects with an average capacity of 735 kW each, for a total RE installed capacity of 8.79 MW. This should result in total emissions reduction of about **42,700 tons of CO₂e per year**,² or about 1.07 M tCO₂e over the lifetime of the projects (around 25 years), from approximately 16.08 million liters of diesel displaced per year, and reducing the cost of electricity by an annual average of 52%³.

¹ The DPSP document proposes an allocation of USD 10 million for Colombia, and an additional allocation of USD 0.5 million for technical assistance activities with a regional focus. However, the IDB is proposing using the full amount (USD 10.5 million) for Colombia.

² The emission factor applied for diesel is 2.68 Kg CO₂/l, based on the *Emission factors for Colombian fuels (Factores de Emisión para Combustibles Colombianos FECOC)*. The reduction in black carbon emissions (a short-lived climate pollutant with impacts on glaciers, ecosystems and health) has not been accounted for.

³ Based on the difference between diesel generation cost of 0.22USD /kWh and average RE generation cost of 0.103 USD /kWh.

The average potential savings of fuel and GHG emissions by each project to be supported by the Program is 1.34 million liter of diesel/project/year (approx. 3,561 tCO₂e/project/year).

Emission reductions were estimated based on savings on liquid fuel (diesel) from specific scenarios of technological changes, potential number of projects to benefit from a USD 19.265 million credit line and an estimated leverage of 30% in financing from intermediary financial institutions (IFIs) and private equity.

Replication potential. Even though the magnitude of the resources for the proposed program limits its scope, if successful the Program could be replicated in more than 100 projects of more than 500KW (an estimate based on the Colombian Government's ambition to increase the share of RE in the ZNIs to 30%; see below section 4, Demonstration Potential at Scale). This would represent a total of 1.31 million liters of fuel savings, GHG emissions reductions of 130,000 tCO₂ per year and 3.5 M tCO₂e over 25 years.

2. Cost Effectiveness

Based on GHG emission reductions of 1.07 M tCO₂e for 25 years, the unit abatement cost of the Program is estimated at: (i) **USD 9.81 per ton of CO₂e** considering only CTF financing (USD 10.5 million); and (ii) **USD 27.3 per ton of CO₂e**, when total project investment costs are considered (USD 10.5 million from CTF + USD 10 million co-finance by IDB/Bancóldex + USD 8.7 M in equity from private investors).

A Cost Benefit Analysis (CBA) undertaken for this Program indicates that the expected Net Present Value (NPV) is USD 33.27 million. The sensitivity analysis performed on key variables (participation of different types of renewable energies, increase in O&M costs) indicates that the Program's NPV remains positive for a wide range of scenarios, based on a discount rate of 12%.

3. Demonstration Potential at Scale

It is expected that the financing and business model proposed by the Program, as well as the selected technologies, could remove some important barriers to investment in RE projects in the ZNIs in Colombia, particularly in terms of increasing the attractiveness (reduced risk and efficient returns) of projects to engage private investors, reducing the risk perception of IFIs, and promoting good contractual practices and schemes.

The business models developed under the Program present a great opportunity to demonstrate the commercial viability of financing and structuring RE mini-grid projects, allowing for Colombian IFIs and potential private investors to reduce their investment risk perceptions and engage further in investing in RE solutions in the ZNIs in the long term. If the model is successful, it could be scaled up to support more RE generation projects for the ZNIs in Colombia. Moreover, the program has high potential for replication in other countries and regions, especially in Latin America and the Caribbean. This is so because the characteristics of the communities not connected to the grid in Colombia are very similar to others in the rest of Latin America and the Caribbean, where around 32 million people have no access to commercial electricity grids⁴, often living in remote areas with very low population density and where access to services is difficult and very costly.

Given the Colombian Government's ambition to increase the share of RE in the ZNIs to 30%, the Program could be replicated to more than 100 projects (more than 500KW) and achieve a total of 1.31 million liters of fuel savings and GHG emissions reductions of 3.5 M tCO₂e.

Transformation Potential. The proposed actions of the Program are expected to have a transformational impact as they would help overcoming some barriers such as lack of appropriate financing, lack of regulatory visibility and a better understanding of the business opportunity with RE in the ZNIs. The availability of appropriate financing will improve the RE project economics and in turn this would raise

⁴ Improving access to water and energy in poor communities in Latin America with mobile technology. <http://bit.ly/acclAmob>.

interest from additional private investors and technology suppliers^{5, 6}. (Figure 1 at the end of this document illustrates the evolution of projected emissions for a scenario with and without the program, considering the potential impact of a transformation effect on RE investments by the CTF program, while Figure 2 shows the program's potential to reduce the operational cost of generation).

The application of the proposed innovative financing model for RE investments should have important transformational impacts on the technology that is being used in ZNIs, as well as on subsidies, and hence on additional emissions reductions over the long term. Out of the 261.5 MW of installed electrical capacity in the ZNIs, 96.5% is provided by diesel technology, and only 3.5% from renewable energy technologies.⁷

Finally, the Program may have a high potential for replication in other countries in the Latin American region where barriers to mini-grids and RE distributed generation in rural areas are similar, i.e. difficulty of access, little participation of IFIs due to high risk perceptions, and inadequate regulatory and risk management frameworks and instruments.

4. Development Impact

In addition to reducing GHG emissions, the development impact of the CTF RE Financing Program for ZNIs will be reflected not only in reductions in energy costs that have a direct impact on the subsidies provided by the government, but also in increasing productivity in the targeted communities given that the quality of electricity service will improve and the number of daily hours of electricity will rise⁸. In addition, it would attract new companies and create new jobs in the design, installation, and maintenance of these systems.

Contribution to the Sustainable Development Goals (SDGs). The project aims to contribute to the following SDGs: (i) *SDG 1: End poverty in all forms everywhere*: Most (84%) of the users of the energy services in the ZNIs are classified by the statistics office of the Government of Colombia⁹ as living in the lowest socio-economic conditions (stratum 1), referring to the physical conditions of households and their productive capacity. Furthermore, within the ZNIs in Colombia, the percentage of unsatisfied basic needs (NBI) is 71%, whereas for the rest of the country it is 28%¹⁰. The proposed Program is expected to enhance the quality of energy service provided by increasing the reliability of the system and enhancing daily-hours of electricity. This is expected to increase productivity and economic benefits, as local businesses would be able to operate longer hours and connect new equipment to increase production and improve the living conditions of the highly diverse communities in the ZNIs, with approximately 840,000 indigenous people of different ethnic groups¹¹ and 950,000 Afro-Colombians¹². (ii) *SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all*: In the case of 1,118 communities in the ZNIs, 96% have low efficiency, expensive to operate diesel generators to cover their electricity needs. The energy use and GHG emissions are likely to contribute to a further deterioration of the environment unless low-carbon technologies are adopted. A challenge remains with respect to introducing new technologies to the grid. Generator service provider companies lack knowledge of the economic benefits of RE systems and perceive that RE investments are expensive (direct costs) and may not have the returns in the very short term of other alternative investments (opportunity costs).

⁵ UNDESA, 2012. Synthesis of energy-related issues highlighted in national reports of Rio+20 [online]. Rio de Janeiro: UN-Energy.

⁶ BASE and POCH 2012. Diagnóstico, análisis de modelos de financiamiento y recomendaciones de coberturas y/o instrumentos de mitigación de riesgo para las energías renovables no convencionales (ERNCC) en Chile. Chile: Ministerio de Energía.

⁷ UPME, "[Acciones y retos para la energización de las ZNIs en Colombia](#)", 2014.

⁸ The average electricity service in the ZNIs communities is around 13 hours per day (some communities have just 4 hours of electricity per day).

⁹ [DANE, Dirección Geoestadística, Grupo de Estratificación Socioeconómica](#). See also: <http://www.dane.gov.co/index.php/estratificacion-socioeconomica/generalidades>.

¹⁰ [E.E. Gaona n, C.L. Trujillo, J.A. Guacaneme. 2015. Rural microgrids and its potential application in Colombia](#)

¹¹ Distributed in the regions of Vaupés, Guainía, Amazonas, Vichada, Putumayo, Guajira, Cauca and Chocó.

¹² Distributed in the regions of Chocó, Archipelago of San Andrés, Providencia and Santa Catalina, Valle, Bolívar and Cauca.

Environmental co-benefits. In addition to GHG emissions reductions, by replacing the use of diesel, the project is expected to result in several other environmental benefits, such as (i) reduction in the risk of oil leakages and spills during transport of diesel to remote areas and operation of generators¹³; (ii) reduction in emissions of local pollutants such as particulates (NOx, SOx)¹⁴; (iii) in the case of waste to energy biomass projects, significant gains in terms of correct waste disposal, reducing soil, surface and ground water pollution (especially from animal manure)¹⁵, and (iv) in the case of solar projects, significant reduction in noise¹⁶.

The generation cost of electricity per unit from RE is estimated to be 53% lower than the generation cost from the existing diesel generators, which would mean lower electricity costs. This is particularly important for the Colombian government given the level of subsidies to diesel generation to provide affordable electricity prices to the end-users, who normally pay the same fee as a user at the same social level that is connected to the grid¹⁷.

5. Implementation Potential

Country and sector strategies. The proposed Program is aligned with a series of initiatives and policies from the Colombian Government. In particular, it will support commitments under the [National Development Plan 2014-2018 \(PND\)](#) to (i) consolidate national coverage, by providing 24-hour service in larger municipalities and localities of the ZNIs; (ii) boost schemes for power generation from non-conventional sources of energy and hybrid systems; and (iii) implement economically efficient electricity generation systems in the ZNIs and in areas of difficult access, according to the [ZNIs Electrification Plan](#). The PND creates an independent fund for the Pacific Region¹⁸, named “Fund for the Development of the Plan *Todos Somos Pacífico*”. The Program is aligned with this Government’s initiative to increase access to energy, water and sanitation infrastructure in the Pacific Area of Colombia, and should complement efforts underway by the IDB’s Energy and Water Divisions. The proposed Program goals are also aligned with the Colombian government’s overall ambition to increase the share of RE in the ZNIs by 30%¹⁹.

As explained in detail in the loan proposal (section 1.20), the Colombian government has undertaken a number of initiatives to promote private investment in renewable energies for the ZNIs^{20,21} and has

¹³ World Bank. 2007. [Environmental, Health and Safety Guidelines. Industry Sector Guidelines: Thermal Power Plants - Hazardous Materials and Oil](#).

¹⁴ World Bank. 2007. [Environmental, Health and Safety Guidelines. General Guidelines: Environmental – Air Emissions and Air Quality](#) and [Environmental, Health and Safety Guidelines. Industry Sector Guidelines: Thermal Power Plants – Air Emissions](#).

¹⁵ US Environmental Protection Agency. 2013. [Oil and Non-Hydroelectric Renewable Energy](#).

¹⁶ World Bank. 2007. Environmental, Health and Safety Guidelines. Industry Sector Guidelines: Thermal Power Plants – Noise and World Bank. 1994. [Solar Energy: Lessons from the Pacific Island Experience](#).

¹⁷ The proposed model requires the government to continue paying the subsidy to the generator temporarily, so that they can recover the RE investment within a reasonable period. This is aligned with the remuneration resolution proposed by the government. For example, operating a 500KW diesel plant 12 hours per day costs an estimated USD 144,540 per year. On the other hand, an RE plant generating the same energy should cost USD 68,081, implying a reduction of USD 76,458 per year per plant. This also represents the savings on subsidies for the government once the RE plant has achieved its return on investment.

¹⁸ [El Artículo 178 del Plan Nacional de Desarrollo 2014-2018 Crea un Patrimonio Autónomo para la Región del Pacífico](#).

¹⁹ Ministry of Mines and Energy, [Program for Rational and Efficient Energy Use and Non-Conventional Energy Sources in Colombia](#) (PROURE), 2010.

²⁰ UPME, [“Acciones y retos para la energización de las ZNIs en Colombia”](#), 2014.

²¹ Which include: incentives to improve the share of RE and energy quality for the ZNIs, enabling a framework for private investment in public services through concessions and “exclusive service areas (ESA)” (exclusive private concessions); and most recently, a resolution that regulates tariffs and remuneration to encourage the use of renewable energies for the ZNIs, which is expected to be approved in the coming months. These initiatives are aligned with a recently approved law (1715 in 2014) that aims at promoting investments in energy efficiency and RE in Colombia and increasing their share in the energy matrix. The law seeks to prioritize investment projects in RE from non-conventional sources in the ZNIs and its further regulation (expected to take place during 2016) should result in a number of additional incentives for private investments, such as tax exemptions.

established the Institute for Planning and Promotion of Energy Solutions in ZNIs (IPSE) as responsible for identifying, promoting, developing and implementing energy solutions via organizational arrangements that would bring electricity to the ZNIs in an efficient and sustainable manner²².

Institutional and implementation arrangements. The Program will be executed and coordinated by Bancóldex, Colombia's public bank in charge of supporting entrepreneurial development. Bancóldex has a long track record of implementing IDB operations, and the government has chosen it as one of the entities that will support its GHG emissions reduction efforts. Bancóldex is a solvent institution with exemplary risk management practices.

Bancóldex will implement the Program under its current organizational structure, and will be responsible, among others, for supervising the adequate use of Program financial resources and of the timely provision of human and technical resources necessary for its implementation. Also, it will apply its existing Environmental and Social Management System (ESMS) to identify, analyze, manage and monitor potential E&S risks. The ESMS will be enhanced to address particular E&S risks in the context of the sub-loans to private investors. In particular, it will require Bancóldex to (i) screen against the IDB's List of Excluded Activities for Non-Sovereign Guaranteed Operations, (ii) comply with applicable Colombian environmental, social, health and safety, and labor regulatory requirements, (iii) develop, with IDB support, and apply a sector-specific checklist, and require a management plan in instances of high risk, (iv) implement a disposal protocol to avoid GHG emissions leakage, (v) exclude Category A sub-projects, and (vi) present an annual Environmental and Social Compliance Report (ESCR), among others.

Through the technical cooperation activities, Bancóldex will also support complementary activities to address non-financial barriers and perceived risks from private investors and IFIs, such as: (i) identification and promotion of business and contractual models that could ensure payments for the energy generated are sufficient to promote investment returns and address eventual investment risks; (ii) capacity building efforts with the local financial institutions and the Program beneficiaries around opportunities relating to eligible RE technologies; (iii) monitoring and evaluation of the project results and impacts; and (iv) ensuring that any E&R risks associated with financed activities are addressed.

Technology Development Status. The selected technologies to be promoted under the Program are commercially available in Colombia and have a high potential for replication across not only the ZNIs but also in the national interconnected zones.

6. Additional Cost and Risk Premium

In spite of the Government initiatives, most of the installed energy generation capacity in the ZNIs remains based on diesel. While some of the business models to promote private sector engagement in investing in the ZNIs, such as the "exclusive service areas" (ESA), are promising, private sector investments in the ZNIs, particularly in RE generation, are still very low (9.4% of total investments in energy generation in the ZNIs)²³. The reason has to do with the differences in cash flow profiles between diesel and renewable technologies and the financing conditions available in the Colombian markets.

RE technologies provide a competitive generation cost compared with the conventional diesel solution, but the initial capital investment is higher, which makes it necessary to put in place special financing conditions for these kinds of projects, such as long term loans and concessional interest rates that allow

²² The Government has also. Towards this end, IPSE carries out directives from the MME by working closely with public service providers in the ZNIs. IPSE also facilitates the use of two dedicated funds, the Financial Support Fund for ZNIs (FAZNIs) and a Rural Electrification Fund (FAER), aimed at providing technical cooperation and financing for the expansion of new generation infrastructure, particularly for the population of the ZNIs with no access to energy. These funds have supported most of the generating capacity in ZNIs and connections to the SIN, allocating USD 100 million a year to these activities.

²³ This percentage is the relation between private and public investments in the infrastructure of the ZNIs during the period 2010-2013 (calculated based on data from FAZNIs, 2015).

the technology to be more competitive and attractive than diesel generation. While diesel has much lower CAPEX than a corresponding RE technology, the former presents much higher OPEX than the latter²⁴.

If the financial market offered reasonable funding opportunities for long term projects, operators could be induced to switch from low upfront investment diesel into high upfront RE investments. However, the actual conditions do not provide medium and long term financing at reasonable rates²⁵. This financial constraint, together with the still incipient regulatory environment for private sector investments in RE in the ZNIs, explains in large part the operators' preference for diesel solutions. This problem is aggravated by the lack of familiarity and absence of contractual arrangements that could ensure financial return from RE solutions by the IFIs and the operators.

The proposed Program aims at addressing these barriers through a combination of technical support and financing measures, providing financing under adequate conditions to facilitate investments and the structuring of RE systems in the ZNIs in Colombia. This will contribute to strengthen the development of a business model that uses the framework and incentives established by the Colombian government.

The combination of (i) long term finance (to address payback and CAPEX barriers) with (ii) technical cooperation activities to address non-financial barriers; and (iii) government initiatives underway (in particular, those aimed at developing a methodology of tariff payment), should make it financially viable for operators and technology providers to invest in RE in the ZNIs²⁶.

Without the government support through subsidies and concessional financing, it would be quite unlikely that RE projects in ZNIs would achieve competitive returns on the investment, and this will continue to keep away investors. CTF funding will be a complementary mechanism in helping the Colombian government with enabling conditions to increase private sector investment in RE in the ZNIs.

Some experiences in developing countries have shown the need for non-reimbursable funds varying from 40% to 60%²⁷ of the initial investment to financially sustain the project and achieve a reasonable payback period. As shown in Table 1 at the end of this Annex, a number of existing case studies have also produced evidence to suggest that RE technologies in isolated localities that are not connected can provide cost-competitive forms of electrification (per unit, calculated over the system's lifetime) and can offer a 24-hour enhanced service to power a wide range of appliances. Several studies support that RE systems can result in energy cost reductions compared with costs of conventional diesel generation, the energy source most used to provide electricity in rural communities not connected to the grid. Furthermore, the studies describe similar barriers and risks associated with investing in RE technology solutions, such as lack of appropriate regulation and policy, high upfront cost and long pay back periods, reliability of technologies, access to capital, financing cost and projects liquidity to undertake investments,

²⁴ As mentioned in the Program project document, the new tariff methodology to be applied by CREG to the ZNIs should make the RE projects more attractive as they would benefit from similar conditions as diesel projects. The main difference with regards to costs would however still be CAPEX. See UPME, 2014. [Acciones y retos para la energización de las ZNIs en Colombia](#).

²⁵ Currently, the local Colombian financial system does not offer investment finance at maturities greater than 5 years. Specifically (i) for bank liabilities, average maturity is less than one year; and (ii) for bank assets, the average maturity of local currency loans is around 5 years. In addition, Intermediary Financial Institutions (IFIs) lack capacity to market, analyze and structure RE deals, are uncertain about their returns and losses, and often require guarantees of debt repayment.

²⁶ The new regulatory framework is expected to establish a clear and transparent remuneration structure for RE investments in the ZNIs. The framework will provide a remuneration structure to attract private investors. Although this framework aims to stimulate private investment, it would be necessary to complement it with the Program, which will facilitate access to appropriate financial characteristics.

²⁷ (1) Raach, J., 2014. Stratified Energy access in Niger [online]; Niger: Raach Solar; (2) BID, 2013. Evaluación financiera y económica del proyecto electrificación rural con energía renovable. Cochabamba: Inter-American Development Bank; (3) Bhattacharyya, S. C. and Palit, D., 2014. Mini-grids for rural electrification of developing countries. 1st edition. Switzerland: Springer International. (4) JRC, 2008. A New Scheme for the Promotion of Renewable Energies in Developing Countries. Ispra: European Commission.

among others^{28, 29}. In the case of Colombia there have been also some pilot RE projects demonstrating the viability of RE technologies compared with diesel generation plants.³⁰ Some case studies highlight experiences in Latin American countries with similar conditions as Colombia, as is the case with Peru³¹, Bolivia³² and Ecuador³³.

7. Financial sustainability

In addition to the solid basis under which the Program is being developed, its sustainability is expected to come from the increasing awareness of relevant market players on the risks and returns of RE projects, as well as the strengthening of their capacities to structure and finance effective RE technology projects.

First, the Program will provide financial support through on-lending to IFIs. This is expected to result in IFIs becoming more familiar with these types of technologies, hence reducing their risk perception and, over time, increasing their supply of financing for RE.

Secondly, given the key role that Bancóldex can play in the market as a public institution with in-depth knowledge of private sector investors and local capital markets, and with the additional support of technical cooperation resources, the long-term financing line will be accompanied by a series of activities covering other (non-financial) risks, such as lack of knowledge of the risks and returns of RE technologies and the lack of appropriate contractual and concessional arrangements providing adequate return on investments. In particular, this would be achieved through promoting good practices regarding contractual agreements to stimulate private investments; capacity building of key players to engage in these types of investments (IFIs, operators and technology providers) and monitoring and evaluation of results.

There are a number of potential contractual arrangements that could be promoted to create new windows of opportunities for private investors interested in the ZNIs. For instance, in addition to stimulating and replicating RE investments among the existing operators in the ZNIs, some models would allow for third party investors to engage through PPP contracts with existing operators and with technology service providers (EPCs - Engineering, Procurement and Construction). To the extent that these models could be piloted and be successful, they could result in powerful replication and transformational potential, which would make these business sustainable in the long term.

Finally, the program would be part of a broader, long-term initiative from the Colombian Government to incentivize investments in RE, through its [PND 2014-2018](#) and its [Plan of Electrification of ZNIs](#), its initiative *Todos Somos Pazífico*, as well as various regulations³⁴. Promotion of the current Program is expected to be undertaken in close collaboration with Colombian Government authorities.

8. Effective utilization of concessional finance

²⁸ [Léna, G., 2013. Rural Electrification with PV hybrid Systems: Overview and recommendations for further development. IEA International Energy Agency.](#)

²⁹ OFID, 2014. The mini-grid option: Lessons learned and factors of success. Vienna: Sustainable Energy For All.

³⁰ Examples of RE generation where considered in detail under the [Determinación de inversiones y gastos de administración, operación, y mantenimiento para la actividad de generación en ZNIs usando recursos renovables CREG 2012.](#)

³¹ [Solar-diesel Hybrid Options for the Peruvian Amazon Lessons Learned from Padre Cocha . ESMAP 2007.](#) This study shows how providing an RE mini-grid system in a small community in has positive impacts on the quality and reliability of power supply to isolated villages and communities in developing countries.

³² [Evaluación Financiera y Económica del Proyecto Electrificación Rural con Energía Renovable., IDB 2013.](#) This evaluation shows how an array of alternative RE technologies is more cost effective than diesel in areas not connected to the grid.

³³ [A New Scheme for the Promotion of Renewable Energies in Developing Countries. Case study Ecuador. EU Commission PV Technology Platform, 2008.](#) This scheme analyses incentive mechanisms to leverage private sector investments, including conditions relating to a regulated purchase tariff (subsidized price) financial scheme, similar to the conditions currently being developed by the CREG in Colombia.

³⁴ Including law 1715 of 2014 that regulates the integration of non-conventional renewable energies into the national system and decree 1623 of 2015 and GREC resolution 004 from 2014 to revise the methodology of tariffs for RE in the ZNIs.

The proposed Program is expected to test a business model and strengthen the Government's efforts to scale up private investments and increase the share of RE in the ZNIs. It is designed to complement the policy framework and incentives that the government has put in place to mobilize private investments in RE generation in the ZNIs; and in order to maximize leverage from other sources. On top of the USD 10 million in IDB/Bancóldex lending that will be mobilized as co-financing of CTF resources (USD 9.265 million), it is estimated that the Program would result on a leverage of USD 8.7 million, which correspond to approximately 30% in financing from IFIs and equity from private investment.

Furthermore, as the Program is expected to pilot a model that can later be expanded to other ZNIs, the Program would be mobilizing additional private sector resources as IFIs and other relevant private sector actors become more knowledgeable about the risk and returns of RE investments in ZNIs.

It is estimated that most of the communities have average capacity plant of 750kW, equivalent to USD 2.39 million in investment. Projects between 500kW and 10MW of capacity (USD 1.50 million to USD 32 million) will be eligible for credit evaluation, but for bigger projects the co-financing shall be much smaller than that to support to small scale investments in order to reach the target of at least 12 financed projects.

9. Mitigation of market distortions

There is currently no active RE market in ZNIs of Colombia, so no potential distortions are foreseen. The program is expected to crowd in private investment, as well as to develop tools to overcome current barriers for competitive institutional framework for RE to be strengthened.

10. Risks

There are minor to moderate Environmental and Social Risks, related to small-scale construction, land use change, occupational health and safety, and GHG emission leakage. Bancóldex will apply an existing ESMS to identify, analyze, manage and monitor potential risks. The ESMS will be enhanced to address particular E&S risks in the context of these sub-loans. Fiduciary risks in financial and procurement management are low.

While there is sufficient demand for financing by private firms to invest in RE under this program, if the government's efforts to provide further incentives for private investments are delayed they could impact the replication potential of the program, as this could reduce the attractiveness for operators to invest in RE in the ZNIs. To address this risk, the program will be developed in coordination with relevant national authorities, in particular the Ministry for Mines and Energy (MME), the Energy and Gas Regulatory Commission (CREG), IPSE and the MME's Mining and Energy Planning Unit (UPME). The replication of the Program's pilot model could also be smaller than expected because of lack of knowledge of service providers in ZNIs or other potential private investors on the costs and returns of RE technologies. In order to ensure replicability and long term sustainability of the pilot model proposed by the program, it will be complemented by a technical cooperation to support knowledge gaps from firms and IFIs and promote contractual arrangements and other good practices to structure demand for credit with a pipeline of bankable projects. A second technical cooperation activity will be focused on regulatory support.

Stakeholder engagement

The effective implementation of the Program relies on the fact that the proposal and its implementation are being developed in close consultation and collaboration with a number of key actors in Colombia, including the MME, UPME, CREG, IPSE, local technology providers, operators, local investors and those IFIs that are more active in green finance.

Bancóldex has a strong mandate by the Government to support the implementation of its national low carbon development priorities. In fact as a second tier development bank, it is in a unique position to promote Programs such as the one being proposed, as it can easily establish contacts with all of the relevant public and private sector actors that need to be involved in the promotion and financing of climate change mitigation projects.

Gender issues

Improved electricity access offers opportunities for gender-inclusiveness and increased productivity of women in isolated communities, particularly low income communities with family-based businesses. The International Network on Gender and Sustainable Energy³⁵ has shown there are a number of gender-related benefits from improving energy services quality and access in isolated communities.

First, small RE projects in developing countries revealed that households bought appliances to improve living conditions and save time and provide more work options, particularly for women. Second, modern energy services are important for the empowerment of women, because they improve women's health and make their lives easier so they can participate more fully in development. For instance, more access to appliances such as television and radio was shown to provide language instruction and information on commodity prices, weather, and new farming methods and practices, increasing women's knowledge through the media, which helped women negotiate their strategic needs both in the household and the community. Electricity and lighting quality can also facilitate home study and organization of evening classes for girls and women who are often housebound due to traditional family responsibilities. Third, affordable and reliable energy options can broaden the scope for women's enterprises, thereby fostering employment and income generation among women.

The impacts of the Program on women will be assessed by quantifying at the end of Program execution the number of beneficiaries (in communities where the number of hours of supply has increased) disaggregated by sex.

³⁵ Cecelski E. 2000. Enabling equitable access to rural electrification: current thinking and major activities in energy, poverty and gender. Proc. Brainstorming on Poverty Alleviation Women, Jan. 26–27, Washington, DC, World Bank. <http://www.energja.org> and Richter M, Meunier B. 1997. Accelerating Rural Electrification in Inner Mongolia with the Use of Wind and Solar Energy. Eschborn, Ger.: GTZ

Table 1: Case studies on mini-grid models

Literature	Location	Description	Reference
Raach Solar 2014	Niger	The study analyses the current situation in Niger with PV systems and creates a financial model that includes the risks involved in project financing and execution.	Raach, J., 2014. Stratified Energy access in Niger [online]. Niger: Raach Solar.
ESMAP 2007a	Peru	Lessons learned from Padre Cocha hybrid project in Peru.	ESMAP, 2007a. Solar-diesel Hybrid Options for the Peruvian Amazon: Lessons Learned from Padre Cocha. Washington, DC: The International Bank for Reconstruction and Development/The World Bank. Report 111/07.
Lau et al. 2010	Malaysia	The report analyses the performance of a hybrid stand-alone system under Malaysian conditions. The document highlights the importance of a hybrid technology as reliable and with low dependence on fuel cost changes.	Lau, K.Y., Yousof, M.F.M., Arshad, S.N.M., Anwari, M. and Yatim, A.H.M., 2010. Performance analysis of hybrid photovoltaic/diesel energy system under Malaysian conditions. Elsevier, Energy [online], 35, 3245-3255
Bhattacharyya 2014	Bangladesh	Techno-economic analysis which shows different scenarios of energy consumption	Bhattacharyya, S. C. and Palit, D., 2014. Mini-grids for rural electrification of developing countries. 1st edition. Switzerland: Springer International.
BID 2013	Bolivia	Cost - benefit evaluation of different off-grid technologies to support the development of sustainable energy in Bolivia.	BID, 2013. Evaluación financiera y económica del proyecto electrificación rural con energía renovable. Cochabamba: Inter-American Development Bank.
Léna 2013	Africa	Guidance to enable sound decision making when considering solar PV hybrid systems to address rural electrification needs. Presents the main issues to address – from the design, technical and implementation perspectives	Léna, G., 2013. Rural Electrification with PV hybrid Systems: Overview and recommendations for further development [online]. IEA International Energy Agency
Thirumurthy et al. 2012	India	The document, executed by the National Renewable Energy Agency, informs about the potential of solar mini-grid technologies in India. It has a business case and project economics and an assessment of macro-environmental elements including political, economic, environmental, social and technological.	Thirumurthy, N., Harrington, L., Martin, D., Thomas, L., Takpa, J. and Gergan, R., 2012. Opportunities and Challenges for Solar Minigrid Development in Rural India. Oak Ridge: National Renewable Energy Laboratory. Report NREL/TP-7A40-55562
ESMAP 2007	World	Technical and economic assessment of off-grid, mini-grid and grid electrification technologies, which includes LCOE for all sources of power generation technologies	ESMAP, 2007. Technical and Economic Assessment of Off-grid, Mini-grid and Grid Electrification Technologies. Washington, DC: The International Bank for Reconstruction and Development/The World Bank. Report 121/07.
IED 2013	World	Identifies the gaps and builds the evidence base on mini-grids in a compilation of eight documents that review mini-grids around the world, executes a cost benefit analysis of different mini-grid technologies, offer some examples of good practices in implementation and operational management and highlight policies and regulatory frameworks for mini-grids	IED, 2013. Identifying the gaps and building the evidence base on low carbon mini-grids. London: Department for International Development.
JRC 2008	Ecuador, Mauritania and Gambia	Cost analysis and financial assessment of hybrid and photovoltaic projects executed in Ecuador, Mauritania and Gambia.	JRC, 2008. A New Scheme for the Promotion of Renewable Energies in Developing Countries. Ispra: European Commission.
Szabo et al. 2011	Africa	The study uses a spatial electricity cost model to determine whether diesel generators, photovoltaic systems or extension of the grid are the least-cost option in off-grid areas	Szabo, S., Bodis, K., Huld, T. and Moner-Girona, M., 2011. Energy solutions in rural Africa: mapping electrification costs of distributed solar and diesel generation versus grid extension [online]. Paris: IOP Publishing Ltd.

Figure 1. GHG emission reduction resulted from the proposed CTF Program

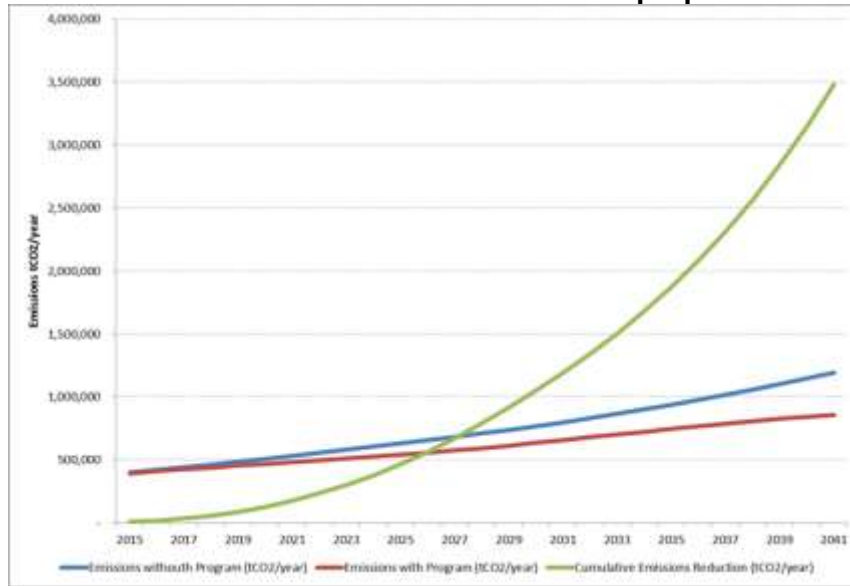


Figure 1 illustrates the evolution of projected emissions for a scenario with and without the program, considering the potential impact of a transformation effect on RE investments by the CTF program. The emissions projections without the program indicate an exponential increase in emissions from 400,000 tCO₂e in 2015 to 1.15 Million tCO₂e by 2040, based not only on continued fuel consumption but also on an increase in energy coverage in the ZNIs. In contrast, in a scenario where the RE investments develop following the lead of the CTF Program model, emissions behave in a linear fashion, starting from the same point (shown by the blue line) in 2015 and rising to 840,000 tCO₂e in 2040. The difference between the two scenarios presents a gap at the end of the Program of 300,000 tCO₂e/year. This is a conservative estimation that does not consider the emissions created from transporting diesel to the ZNIs. It also assumes only a partial replacement of current diesel generation, implying further reductions in emissions if projects converted their technology mix towards RE.

Figure 2 illustrates the program's potential to reduce operational cost of generation. We observe that a scenario with the CTF program and a replication effect on future investments could lead to a cumulative cost savings of USD 890 million by 2041 from an approximate 50% difference in unit generation cost in the ZNIs between a diesel plant and a (weighted) average RE plant. The application of the proposed innovative financing model for RE investments should have important transformational impacts on the technology that is being used in ZNIs, and on subsidies, and hence on additional emissions reductions over the long term.

Figure 2. Operational cost reduction resulting from the proposed CTF Program.

