

IDB-KIAT Collaboration Project Proposal

Project Overview

Project Title	Fostering Colombia's transition from existing diesel-powered mini-grids to low-carbon mini-grids in remote and rural off-grid areas of the country		
Sector (sub-topics)	<i>Energy Storage System (ESS)</i> <i>Micro-grid (MG)</i> <i>Small scale hybrid power plant (Solar PV and or SHP)</i>		
Country	Colombia	Location	Department of Chocó
Project Duration	3-6 months feasibility studies 2 years implementation	Budget	USD 50.000 per each feasibility study USD 10.000.000 (max. value per each implemented project)
Association with Other Projects	Yes		

Submitter's Information

IDB (country office)	
Name	
Position	(details to be provided when selected)
E-mail	
Telephone	

Partner Country's Implementing Organization(s)

Partner Country Contact 1 (ministerial level)	
Name	(details to be provided when selected)
Position	(details to be provided when selected)
Organization	Ministry of Mines and Energy of Colombia
E-mail	
Partner Country Contact 2 (regional level or implementing agency)	
Name	(details to be provided when selected)
Position	(details to be provided when selected)
Organization	IPSE (Instituto de Planificación y Promoción de Soluciones Energéticas para Zonas No Interconectadas)
E-mail	

1. Project Background

Current Situation

- 52% of the Colombian territory is not interconnected to the National Interconnected System (SIN in Spanish). These areas are referred to as Non-Interconnected zones or ZNI (its acronym in Spanish) and comprise about 1777 localities within the country (as of July 2021).
- Historically, the energy provision in the off-grid areas of Colombia (ZNI in Spanish) has depended on fossil fuels. Nearly 88% or 255.677 kW of the installed capacity in these areas comes from diesel-powered plants, requiring about 2.8 million gallons per month (gl/month) to serve a total of 158.251 families (as of December 2021) (IPSE, 2021b). San Andrés and Providencia, Chocó and Nariño, correspond to the three departments with the highest installed capacity on diesel (See Fig.1).

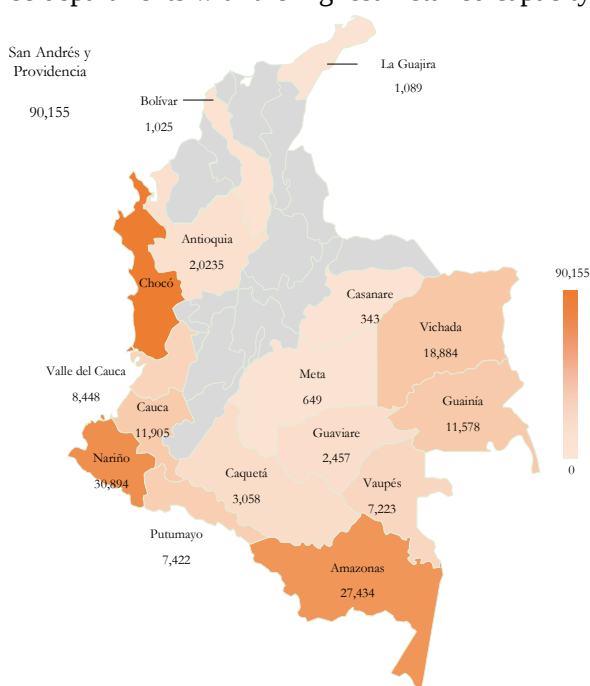


Figure 1. Installed capacity with diesel generation (kW). Source: Adapted from (IPSE, 2021b).

- As of June 2021, nearly 98% of the off-grid localities in the ZNI were attended with diesel-powered plants (See Table 1).

Table 1. Distribution of localities by type of minigrids installed in the ZNI of Colombia (as of July 2021)

Technology	No. of localities
Diesel and Municipal solid waste (MSW) plants	1
Solar PV	1
Solar PV and Diesel	19
Biomass and Diesel	2
Small hydropower	4
Small hydropower and Diesel	15
Diesel	1735
Total	1777

- During the last decade, the GoC has set different policies to foster the transition from its existing diesel-powered mini-grids to low-carbon mini-grids in remote and rural off-grid areas of the country. In 2014, the MME set a national policy (Art. 9 of Law 1715-2014) aimed at implementing a program that progressively substitutes diesel generation in the ZNI with more efficient energy systems. In addition, in 2015, during the United Nations Framework Convention on Climate Change (COP 21), the Colombian government ratified its commitment to the fight against climate change and set the compromise to reducing national GHG in 20% by 2030. Then, in 2020, under the energy transition of the current government, this commitment was modified to reduce 51% of the national GHG by 2030 (Ministerio de Ambiente, 2020).
- Within this context, off-grid RE-based systems are a promising alternative not only to diversify the energy matrix of the ZNI, but also to reducing greenhouse gas (GHG) emissions from the use of fossil fuels, to lower the electricity service costs, to increase energy efficiency, and to improve the quality of the electricity provision in these areas (IPSE, 2022). However, as public resources scarce, investments from the private sector and/or international donors are essential to scale up and strengthen rural electrification initiatives in Colombia.
- This proposal requests support from the KIAT to accelerate the uptake of low-carbon mini-grids in the off-grid electrification sector of Colombia and thus, to promote the implementation of renewable energy-based systems, while contributing to reducing GHG emissions.

Relevant National Development Plans, Policies, and Strategies

- At the national level, Colombia has made progress in climate change management through the National Climate Change Policy and its national strategies: Colombian Low-Carbon Development Strategy, National Climate Change Adaptation Plan, Integrated Strategy for Deforestation Control and Forest Management, National Plan for Disaster Risk Management, Strategy for Financial Protection from Disasters, and the National Climate Financing Strategy. Gradually, climate change has become an essential component in development planning and has been in the latest years included as a key topic in national development plans. Colombia has also adopted a National Climate Finance Strategy as a tool to consolidate the strategies and plans that make climate change management possible at the territorial and sectoral levels.
- To complement previous efforts, in 2018, Colombia approved the Climate Change Law (Law 1931 of 2018), which establishes the guidelines for climate change management in the country. This law seeks to take advantage of synergies and leverage the regulatory framework and existing systems and uses the National Climate Change System (SISCLIMA) as the primary axis for institutionalizing and internalizing climate change among actors and instruments. Leveraging existing tools and taking advantage of synergies is especially important considering the health and economic crisis caused by COVID-19, given that the country's economic reactivation will require efficient use of resources and the integration of the climate change agenda into ongoing processes to guarantee its implementation in a context of limited resources.
- Recently, Colombia developed a process to update the NDC which was led by the Ministry of Environment and Sustainable Development with the support of the Ministry of Mines and Energy, Ministry of Transport, Ministry of Industry, Trade and Tourism, Ministry of Agriculture and Rural Development, Ministry of Housing, City and Territory, Ministry of Finance and Public Credit, Ministry of Foreign Affairs, Ministry of Health and Social Protection, Ministry of Education, Ministry of Science, Technology and Innovation, the National Planning Department, the National

Environmental Licensing Authority, Colombia's National Natural Parks, the Institute of Hydrology, Meteorology and Environmental Studies, the Mining and Energy Planning Unit, the National Disaster Risk Management Unit and the Adaptation Fund within the framework of SISCLIMA, as well as with the Regional Climate Change Nodes.

- In 2014, the MME set a national policy (Art. 9 of Law 1715-2014) aimed at implementing a program that progressively substitutes diesel generation in the ZNI with more efficient energy systems. Also, article 34 of Law 1715 of 2014 indicates that the Ministry of Mines and Energy will promote the development of hybrid solutions that combine local sources of electricity generation, especially those from Non-conventional Energy Sources (FNCE) for the provision of energy service for ZNI.
- More recently, the Congress of the Republic issued Law 2099 of 2021, namely the “Energy Transition Law”. In its article 45, it sets that the Institute for Planning and Promotion of Energy Solutions for Non-Interconnected Areas (IPSE), "shall be entitled to structure, present and make viable public funds that make investments in the electricity sector, such as FENOGE, FONENERGIA, among others, plans, programmes and projects in the SIN and ZNI, aimed at promoting, developing, implementing or executing Non-conventional Sources of Energy and Efficient Energy Management (...), as well substitution mechanisms for FNCE and cleaner fuels".
- In addition, Article 8 of Law 2128 of 2021 indicates that the National Government will prioritize projects to replace diesel with fuel gas and that IPSE "shall initiate an implementation plan for diesel fuel replacement projects with criteria of economic efficiency, within twelve (12) months from the date of entry into force of this Law".
- These public policies initiatives are aligned with the government compromise towards reducing the national GHG emissions. In 2015, during the United Nations Framework Convention on Climate Change (COP 21), the Colombian government ratified its commitment to the fight against climate change and set the compromise to reducing national GHG in 20% by 2030. Then, in 2020, this commitment was modified to reduce 51% of the national GHG by 2030 (Ministerio de Ambiente, 2020).

Table 2. Main Policy framework at national and ministerial level

Category	Policy Framework	Priority areas
Country Strategies & Policies	National Development Plan 2018~2022 (Plan por Desarrollo Nacional 2018~2022)	- The National Development Plan has been effective May 2019. Under the Plan, project-related objectives are as below. - Pact VIII. (Pacto por la calidad y eficiencia de servicios publicos: agua y energía para promover la competitividad y el bienestar de todos) suggests improving public services and efficiency. It has sub-objectives to modernize electricity market and expand power supply rate. - Pact IX. (Pacto por los recursos mineroenergéticos para el crecimiento sostenible y la expansión de oportunidades) suggests developing renewable energy resources and expanding opportunities for international cooperation. It has sub-objectives to diversify energy sources and ensure energy security.
	Plan Energético Nacional 2050 (National Energy Plan 2050)	- There are five policy objectives towards energy transition; i)Securing energy supply stability and diversifying the energy supply mix, ii)Strengthening energy demand management, iii) Expanding energy supply rate iv) Facilitating energy international cooperation, v)Creating energy value-added. - The 3rd objective is to expand energy supply rate achieving 100% power supply using renewable energy sources and reducing power subsidies. In order to provide sustainable rural energy, diesel power generation in ZNI will be replaced with renewable energy, to increase the share of renewable energy to 30% by 2020. Also, installation of smart metering system is encouraged to eradicate illegal energy use such as electricity theft.
	Misión para la transformación energética (Mission for Energy Transition)	- President of Colombia, Iván Duque Márquez, stressed energy supply mix to respond to climate change and launched the Misión para la transformación energética, which is a special organization with 20 domestic and international energy experts, to create and present energy transition roadmap for Colombia. The organization announced five key agendas i) energy market reform, ii)role of natural gas for energy transition, iii)distributed power generation, digitization and demand management, iv) energy subsidy reform and v)energy system and regulatory reforms.
Ministry level policy & Law	Renewable Energy Law (Law 1715)	- The government enacted the Renewable Energy Law (Law 171) to promote integrating non-conventional renewable energy in the electricity market - Tax-free benefits for imports of renewable energy-related equipment such as solar panels, wind turbine generators, and income tax reduction for renewable energy operators (up to 50%), VAT exemption on machinery.

- The proposed project is fully aligned with the objectives of the National Development Plan and National Energy Plan 2050 of Republic of Colombia and with the Green New Deal ODA in Korea which supports partner countries to leapfrog carbon-intensive development paths. It is also aligned with the Sustainable Development Goals as well as with the UN's Sustainable Energy for All.

Association with Other Projects/Programs

Table 3. Related projects funded by Korean government

Project Name	Type
Green energy electrification project for ETCR (Regional Unit of Territorial Spaces of Training and Reincorporation) peacekeeping in Pandores, Colombia	Grant
Solar Power Plant in Departamento del Vichada	Grant
Establishment of hybrid power supply for Bogota USME area	Grant

In addition, this proposal is also related to the proposal “Scaling-up Universal access in off-grid areas of Colombia”, which also is intended to be implemented in the department of Chocó, but with a different focus. This one is focused on expanding energy access for user who do not currently have access to the electricity service, and the one presented in this proposal is focused on improving the electricity service provision with cleaner energy systems.

2. Project Objectives

The objectives of the proposed Project are to:

- Diversify the energy generation matrix in off-grid areas of Colombia by integrating renewable energy-based solutions.
- Reduce greenhouse gas (GHG) emissions resulting from the current use of diesel-powered plants.
- Improve the communities' living conditions and the energy service supply in rural and remote off-grid areas of the country.

3. Project Components

The proposed Project will have the following components.

- **Component 1: Feasibility study.** Techno-Economic feasibility study of implementing low-carbon minigrids in selected off-grid areas of Colombia where there is a high dependency on diesel-powered plants, maximizing the use of renewable energies and minimizing the use of fossil fuels. It includes geospatial analysis, and other techno-economic analysis, namely the selection of the best energy technology to be implemented (FNCER or more efficient fuels) and the project finance.
- **Component 2: Construction of selected projects within the ZNI of Colombia.** This phase includes the design, supply, and installation of X low-carbon minigrids. In particular: (a) construction of

electricity generation infrastructure; (b) distribution infrastructure, including expansion of the distribution lines and distribution transformers. It is expected that the proposed low-carbon minigrids will allow target settlements to have an average of 24 hours of electricity service per day.

- **Component 3: Capacity Building.** This phase includes providing and implementing a capacity building program by selecting trainees to operate the hybrid minigrid systems and thus, on-site training will be provided.

4. Project Location, Period, and Estimated Cost

- **Location**

The Ministry of Mines and Energy (MME) and the Institute for Planning and Promotion of Energy Solutions for Non-Interconnected Areas (IPSE) have been working in a prioritisation methodology to identifying the most critical localities where it is crucial to replace diesel-powered plants with non-conventional renewable energy sources (FNCER in Spanish) and/or fuel gas.

However, in order to close energy access gaps in the ZNI, more intervention is required in the localities of Chocó. Chocó corresponds to the department with one of the highest deficits in infrastructure improvement. Of the 1769 localities of the ZNI, 554 are in this department. Additionally, 97% of users in these locations only receive electricity service for 4 to 8 hours (CNM Report-Feb22). Therefore, there is a high deficit in infrastructure improvement and, therefore, a high need to improve the provision of electricity service, with more efficient, reliable, and sustainable generation systems. Also, according to the Indicative National plan for the electricity expansion in Colombia (PIEC 2019-2023), Chocó is the fourth department with the highest number of households lacking access to electricity, nearly about 29,558 households (as of December 2018). As a result, the preliminary Project locations are described in Table 4.

Table 4 Potential project locations in the Department of Chocó

No.	Municipality	Sub-region (community)	Potential Beneficiaries	Total Installed Capacity (kW)- Diesel powered plants
1	BOJAYÁ	NAPIPI	230	91
2	UNGUÍA	BALBOA	357	330
3	BAJO BAUDO	BUENAVISTA	290	88
4	BAJO BAUDO	PILIZA - BELLAVISTA - VILLA LUZ	265	140
5	NUQUÍ	PUERTO JAGUA	156	80
6	EL LITORAL DEL SAN JUAN	TOGOROMA PLAYA	153	41,8
7	EL LITORAL DEL SAN JUAN	CUCURRUPI	154	125
8	MEDIO ATRATO	SAN ROQUE	208	60,48
9	ACANDI	CAPURGANA	1.591	1.868
10	QUIBDÓ	TAGACHI	221	136
11	NUQUÍ	COMUNIDAD INDIGENA DE PANGUI - (EL YUCAL)	88	32
12	BOJAYÁ	LA LOMA DE BOJAYA	167	120
13	BOJAYÁ	PUERTO CONTO	210	100
14	BAUDO	CIUDAD BAUDO - PIE DE PATO	447	500
15	NUQUÍ	ARUSI	132	110

Note: The exact locations would be defined based on the results of the feasibility studies.

• Period and Estimated Cost

Each project will require approximately up to \$10 million to cover detailed engineering, construction, equipment procurement, and related activities such as consultancy service, knowledge dissemination, etc., in the form of grant ODA. The selected project(s) can serve as a demonstration to be replicated and/or to be scaled up to other regions.

Component	Total expected duration	Amount (US\$)
• Feasibility Study	3-6 months	\$50,000 per project
• Engineering and Construction	Project to start in January 2024	Up to \$10,000,000 per project
• Capacity building (for technicians, policymakers, etc.)	2-3 months	\$100,000

5. Project Implementing Organization

- IPSE (Instituto de Planificación y Promoción de Soluciones Energéticas para Zonas No Interconectadas)

6. Required Coordination at National/Regional Level

- N/A

7. Risks and Opportunities

Risk identification and mitigation measures

- Controlling the provision of equipment will be of the utmost importance. Quality control of procurement processes and suppliers of scientific devices and equipment will be essential.
- A moderate level of risk associated with high maintenance requirements is expected as devices and equipment parts will not be available locally when needed for replacement. Thus, high-quality project management is required to ensure well-timed implementation of planned activities.
- Progress control for the project implementation is essential. Therefore, well-designed administrative procedure and condition check must be set in advance.
- The sequencing between provision and availability of the real-time remote stack monitoring system inclusive of equipment, devices, and software and deployment of technical experts for training purposes.
- High maintenance cost due to replacement of expendable supplies and others after the completion of the project.

Opportunities

- Availability of high-quality project management support from local institutions.
- Government's support in selecting government staff to be trained, and their availability during the training sessions and exchange training visits to Korea.