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COLOMBIA (REI) INVESTMENT PLAN



FUNDS

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PROPOSED DECISION

(To be added)



GOBIERNO DE COLOMBIA

Bogotá D.C., November 11th, 2022

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Manager

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It is a great pleasure that I submit the Colombia's Investment Plan (IP) to support the decarbonization by accelerating its going clean and inclusive energy transition. The Government of Colombia appreciates all the support provided by the Climate Investment Funds - CIF - the Inter American Development Bank (IADB) and The World Bank to develop this IP.

This Plan was led by the Ministry of Mines and Energy as technical coordinator, with contributions from the National Planning Department and the Ministry of Finance and Public Credit. As a result, this IP is conceived as a tool to move towards a productive economy, accelerating the shift towards clean energy use and democratization of electricity production.

The resources will be executed by two Colombian Development Banks, Bancoldex and Financiera de Desarrollo Nacional (FDN). Both are financial corporations specialized in promoting business growth. The first one by mainly offering entrepreneurs financial services and the second one by financing and structuring infrastructure projects.

Bancoldex and the FDN will prioritize projects within the following categories: scaling up renewable energy technologies, enhancing infrastructure to be renewable energy-ready, supporting renewable energy innovation, enhancing system design and operation and democratization of the market and promoting a just energy transition.

The expected project's portfolio will tackle the main challenges Colombia is facing in the modernization of its energy sector such as deficient infrastructure, high cost of providing electricity to Non Interconnected Zones and insufficient participation of the energy demand in energy price and grid operations.

The Colombian Government is grateful for the opportunity to take part of the Renewable Energy Integration Program and the support of SREP for this Investment Plan. We look forward to work with CIF, the IADB and our local partners to successfully implement the project's portfolio.

Yours sincerely,

José Roberto Acosta

Director of Credit and National Treasury
Ministry of Finance and Public Credit

CLIMATE INVESTMENT FUNDS
RENEWABLE ENERGY INTEGRATION PROGRAM
INVESTMENT PLAN FOR COLOMBIA

October 2022

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Acronyms and Abbreviations

AMI:	Advanced Metering Infrastructure
BAU:	Business as Usual
CCUS:	Carbon Capture, Use and Storage
CDM:	Clean Development Mechanism
CIF:	Climate Investment Funds
CREG:	Energy and Gas Regulatory Commission (<i>Comisión de Regulación de Energía y Gas</i>)
DER:	Distributed Energy Resources
DFACTS:	Distributed Flexible AC Transmission Systems
DNP:	National Planning Department (<i>Departamento Nacional de Planeación</i>)
EV:	Electric Vehicle
FACTS:	Flexible AC Transmission Systems
FENOGE:	Fund for Non-Conventional Energy and Energy Management (<i>Fondo de Energías No Convencionales y Gestión Eficiente de la Energía</i>)
FEO:	Firm Energy Obligations
GDP:	Gross Domestic Product
GH2:	Green Hydrogen
GHG:	Greenhouse Gas
GoC:	Government of Colombia
H2:	Hydrogen
HVDC:	High Voltage Direct Current
IDB:	Inter-American Development Bank
IDBG:	Inter-American Development Bank Group
IE:	Implementing Entity
IFC:	International Finance Corporation
IP:	Investment Plan
IPSE:	Institute for the planning and promotion of Off-Grid energy solutions (<i>Instituto de Planificación y Promoción de Soluciones Energéticas para Zonas No Interconectadas</i>)
IRENA:	International Renewable Energy Agency
IRF:	Integrated Results Framework
LAC:	Latin America and the Caribbean
MADS:	Ministry of Environment and Sustainable Development (<i>Ministerio de Ambiente y Desarrollo Sostenible</i>)
MDB:	Multilateral Development Bank

MHCP:	Ministry of Finance (<i>Ministerio de Hacienda y Crédito Público</i>)
MME:	Ministry of Mines and Energy (<i>Ministerio de Minas y Energía</i>)
NAMA:	National Appropriated Mitigation Action
NCRE:	Non-Conventional Renewable Energy
NCRES:	Non-Conventional Renewable Energy Sources (<i>FNCER</i> in Spanish)
NDB:	National Development Bank
NIS:	National Interconnected System (<i>SIN</i> in Spanish)
NIZ:	Not Interconnected Zones or Off-Grid Areas (<i>ZNI</i> in Spanish)
NSP:	NAMA Support Project
OECD:	Organization for Economic Cooperation and Development
PV:	Photovoltaic
RC:	Reliability Charge
RE:	Renewable Energy
REI	Renewable Energy Integration
SDG:	Sustainable Development Goal
SIEPAC:	Central America's Electric Interconnection System (<i>Sistema de Interconexión Eléctrica de los Países de América Central</i>)
SINEA:	Andean Electric Interconnection System (<i>Sistema de Interconexión Eléctrica Andina</i>)
STATCOM:	Static synchronous compensator
TA:	Technical Assistance
UN:	United Nations
UNFCCC:	United Nations Framework Convention on Climate Change
UPME:	Mining and Energy Planning Unit (<i>Unidad de Planeación Minero Energética</i>)
WB:	World Bank
WBG:	World Bank Group

I. Proposal Summary

Introduction

Colombia's Investment Plan (IP) for the Climate Investment Funds (CIF) Renewable Energy Integration (REI) Program was prepared under the lead of the Ministry of Mines and Energy (MME), with contributions from the National Planning Department (DNP) and the Ministry of Finance (MHCP), plus support from the Interamerican Development Bank (IDB) Group, the World Bank (WB) and the International Finance Corporation (IFC). As a result, the CIF-REI program's IP is conceived as a tool which will assist the Government of Colombia (GoC) in carrying out deep transformations required for confronting the current global climate crisis and its impacts over society, ecosystems and biodiversity. This plan is intended to help the country move towards a productive economy which is based on its respect for nature and increasing climate resiliency, accelerating the shift towards clean energy use and democratization of electricity production, as dependence on extractivism is left behind.

Objectives

The objective of Colombia's IP is to support the decarbonization of the country's economy by accelerating its ongoing clean and inclusive energy transition. This will be achieved by (i) reducing operational and technical barriers to the integration of renewable energy generation into the power grid, (ii) scaling up finance for renewable energy integration infrastructure, and (iii) building related public and private sector capacities. Specifically, the IP will support: i) the development of energy communities ¹ in connection with the Government's solar outburst ² project and popular and community-led associative schemes, promoting rural electrification with Non-Conventional Renewable Energies (NCRE), enabling the rise and integration of popular economies ³ in the territories and reducing diesel-based electricity generation in Non-Interconnected Zones (NIZ); ii) the reinforcement or expansion of transmission networks for integrating NCRE capacities, plus deployment of advanced metering infrastructure (AMI) as a democratization enabler for the electricity sector, as well as battery storage and other technologies that increase the overall flexibility of the grid; iii) the electrification of transport allowing equitable access to clean and efficient public transport systems, the deployment of public or private freight and passenger fleets,

¹ Defined as social groups that will be able to generate their own electricity with renewable energy sources and sell it to the system, thus promoting the democratization of the electricity sector beyond corporations or private companies, to reach communities and popular economies in the territories. Schemes of cooperatives, social organizations, supportive communities, networks and families that produce goods and services, and organize the work of their community promoting equality, solidarity and social development with care for the environment, are forms that will seek to be fostered in the framework of access to energy and its productive use, protected by a solar outburst concept that will allow users massive access to this abundant source of clean energy.

² Ambitious governmental initiative to support the development of PV systems, referred to in Spanish as "estallido solar".

³ Popular economies comprise the set of jobs carried out by people to guarantee the social and biological reproduction of their homes and communities, through the generation of income derived from activities of production, distribution and commercialization of goods and services, mainly in local markets, as well as and through historically organized community processes. The majority of workers in the popular economy are self-employed, in small-scale production units (family units, micro-businesses or micro-enterprises), with various labor relations and organizational forms (associations, cooperatives, mutuals, community organizations, companies, corporations). The popular economy participates in all sectors of the economy, in rural and urban areas, and the majority of workers in the country resort to it. The workers who are part of these economies are mostly not wage earners nor are they recognized by the State as workers, therefore, they lack social and economic rights associated with work and are therefore excluded from the social contract (Chena, 2017; Gago, 2021, Giraldo, 2017).

and the deployment of the required infrastructure (such as rapid charging stations) and iv) the deployment of new NCRE technologies, such as those associated with green hydrogen (GH2) for indirect electrification and decarbonization of industry and transport, offshore wind and ocean energy technologies to support diversification of the country's renewable based generation matrix.

Colombia's CIF-REI budget of US\$70 million is expected to mobilize at least US\$280 million (with a ratio of 1:4) from multilateral development banks (MDBs), national development banks (Bancoldex and FDN), the carbon finance markets, and the public and private sectors. CIF-REI support will play a pivotal role in accelerating Colombia's energy transition and the energy sector's share to achieving commitments under the updated Nationally Determined Contribution (NDC), which aims to reduce Greenhouse Gas (GHG) Emissions by 51 %, with respect to the business-as-usual (BAU) scenario in 2030, and to increase adaptation to climate change in key sectors of the economy, such as the energy sector.

Expected outcomes

CIF-REI financing and technical assistance will provide low-cost financing for technologies and business models that facilitate the penetration of NCRE and that are not yet commercially viable or widely deployed in Colombia and will allow the leverage of important additional resources from the public and private sectors. Most part of CIF-REI funds (US\$68 m) will be channeled through two national development banks (NDBs) that will finance eligible projects under the CIF-REI program, in areas prioritized by the Government of Colombia (GoC), with the following expected outcomes³:

- **Increasing reliable access to clean and modern electricity services** for over 19,560 households⁴, through more than 13.6 MW of NCRE based generation to be installed in off-grid areas (NonInterconnected Zones – NIZ), fostering a solar outburst through energy communities and the development and inclusion of popular economies in the territories.
- **Achieving emission reductions** in the order of 110 kt CO₂eq/year and 1.6 Mt CO₂eq throughout projects lifetime.
- **Supporting the integration of climate risk management in energy sector decisions**, in order to reduce the impacts generated by climate variability and climate change in the energy industry.
- **Enabling energy users to assume an active role in the energy market**, and facilitate demand response programs that allow for more flexible operation of the system in response to integration of variable sources like wind and solar.
- **Accelerating total electric system cost reductions** to be achieved from the deployment of AMI, estimated in approx. US\$ 42 million savings by year 2030 if 75% of NIS users are reached. This IP is expected to reach some 326,000 from a total 12.3 million users.
- **Additionally, other system cost reductions shall be expected from transmission, energy storage and overall grid flexibility capacities** to be obtained from grid support infrastructure development.

³ These outcomes have been identified based on a tentative division of financial resources among the priority areas identified by the GoC. The final outcomes achieved could vary depending on the pipeline of projects of the NDBs, and the allocation of CIF-REI funds. For example, Bancoldex can allocate 50% of the CIF-REI funds for a NIZ FNCE project and the other 50% for a GH2.

⁴ Out of which, initially, some 7824 households (40% of total) may be expected to be presided by women

- **Scaling up transport electrification** by deploying rapid and fast charging stations⁵, co-financing the deployment of EV fleets to contribute to the country's target of 600,000 EVs by 2030, supporting electric massive urban transport systems, same as electric intermunicipal and interdepartmental public transport.
- **Increasing green hydrogen production capacities**, with an investment grant of US\$2 million to FENOGE, which will mobilize additional non-reimbursable resources of at least US\$1.12 million to support both project pre-feasibility and feasibility studies, as well as the development of pilots in GH2 on the transport and industrial sectors with concessional financing.
- **Mobilizing at least US\$280 m. in public and private capital** to finance investments eligible under this IP.

Program criteria, priorities, and budget

The IP prioritizes projects included within one or more of the following categories from the CIF-REI Program⁶, assessed and defined by the Government of Colombia (GoC) with the assistance and support of MDBs in the following way:

- **Scaling up renewable energy enabling technologies**: promoting the massification of advanced metering infrastructure (AMI), facilitating the rise of prosumers and/or the deployment of battery energy storage systems, and investing in other technologies that enhance the electricity system flexibility. Scaling up technologies for the electrification of transport through deployment of EV charging infrastructure and/or acquisition of EVs, including cars, trucks, buses, trains, trams, subways or elevated railway systems. Also, support the production, storage and use of green hydrogen (GH2) and derived e-fuels⁷ in the transport sector and in diverse thermal applications, contributing to the absorption of electricity sourced from variable sources such as wind and solar.
- **Enhancing infrastructure to be renewable energy-ready**: developing required transmission infrastructure or supporting upgrades for transmission power transfer capabilities to allow the incorporation of new NCRE generating capacities, and bolstering grid interconnection projects reducing needs for curtailment of these sources while enlarging balancing areas.
- **Supporting renewable energy innovation**: supporting innovative schemes that enable reliable energy supply through NCRE in off-grid or non-interconnected areas (NIZ), involving the participation of the private sector as well as from project beneficiaries, through the implementation of new business models. Such models will promote popular-associative schemes where communities will play an active role in project development and implementation, and can benefit not only from energy access, such as obtaining or increasing an income from energy productive uses.

⁵ Article 9 of Law 1964 of 2019 on EVs promotion requires for municipalities of special category to install at least 5 rapid charging EV stations by 2022, and at least 202 such charging stations in Bogota, of which, as of May 2022, only 7 have been deployed (5 in Bogota and 2 in Medellin). Such stations must be open for use of the general public.

⁶ CIF-REI Brief. Table 1.

⁷ E-fuels, also referred to as synthetic fuels, are zero-emission fuels produced from electricity generated from renewable energy sources and the electrolysis process to produce green hydrogen that can later be converted into ammonia, methanol or other compounds, making use, for example, of CO2 captured from the environment or some industrial process.

-
- **Enhancing system design and operation and democratization of the market:** fostering participation of experienced companies in the development and operation of solutions ensuring access to electricity service through efficient subsidy allocation, low cost to users and acceptable quality and reliability. Also, supporting projects that enable the entry of new market players into the energy sector, especially in the generation segment. This category of intervention does not represent a stand-alone category but a complementary one for projects mostly associated with NIZ energy supply solutions, and projects scaling up renewable energy enabling technologies.
 - **Promoting a just energy transition:** Contributing to the democratization of electricity generation, distribution and commercialization, seeking to support communities and business in generating and distributing their own energy, especially in the most remote regions, and improving coverage, quality and price conditions. Likewise, self-generation and energy efficiency in both households and industry is expected to allow for energy to be perceived as a common good, with priority of supply to vulnerable regions and communities.

Eligible projects will need to: (i) justify the need for concessional resources, (ii) demonstrate contributions to the reduction of GHG emissions and the achievement of a just and inclusive energy transition in terms of gender equality and vulnerable communities (iii) demonstrate the integration of climate risk assessment to ensure resilient infrastructure; (iv) show the potential to generate transformational change through the incorporation of NCRE in Colombia's generation matrix; and (iv) comply with the environmental and social standards of the MDBs.

The proposed IP requires a CIF-REI budget of US\$70 million, US\$66.5 million of concessional finance and US\$3.5 million grant of non-reimbursable technical assistance (TA). CIF-REI cofinancing resources will be channeled through the IDB and implemented by two national development banks (NDBs), which will in most cases lend directly to public or private developers for projects meeting CIF-REI eligibility criteria. Non-reimbursable TA will be used mainly for covering currency conversion risk mitigation, inclusive and just transition support to projects accessing the program's concessional financing, and funding of the +H2 Colombia program executed by FENOGE by providing non-reimbursable co-financing for the pre-feasibility and feasibility studies of GH2 pilot projects.

II. Country Context

In the last 20 years, Colombia has shown economic and social progress, becoming an upper middle-income economy and a member of the Organization for Economic Cooperation and Development (OECD), despite setbacks produced by the COVID-19 pandemic. Colombia's gross domestic product (GDP) grew 12.7% percent from 2010 to 2019 and poverty decreased from 46.2% to 35-7%. Inflation rates were kept in one digit lows, converging towards a 3% target in 2020, and financing maintained healthy levels through direct foreign investment. However, the outbreak of COVID-19 had a strong economic and social impact, leading to a reduction in consumer spending and an increase in the unemployment rate. GDP contracted 6.8% in 2020, the worst decline in the country's history. Poverty increased from 35.7% in 2019 to 42.5% in 2020, while extreme poverty rose from 9.6% to 15.1%. The fiscal deficit that year increased to 7.8% of GDP and debt rose to 64.8%

of GDP. The reopening of the economy and progress in the vaccination scheme (more than 70%⁸ of the population has been fully vaccinated) has contributed to economic recovery. In 2021, the economy grew 10.6%⁹ and unemployment was reduced to 13.7% (recovering more than 90% of jobs lost during the pandemic). The fiscal deficit in 2021 was 7.1% of GDP and gross debt was 63.8% of GDP. Nonetheless, the recovery affected the inflation rate, which reached 8.53% in February 2022, exceeding the 3% target, and triggering continued increases of monetary policy rates.

The Government of Colombia's (GoC) "Policy for Economic Reactivation and Sustainable and Inclusive Growth" (CONPES 4023/21) identifies comprehensive set of measures and investment programs aimed, in the short-term, at supporting the economic recovery of the country to its preCOVID-19 growth level, while transitioning to a more sustainable and resilient long-term growth. The measures identified have an estimated cost of COP\$135,000 billion (US\$33.6 billion)¹⁰ in investments (12.5% of GDP) from 2021-2026 in partnership with the private sector. These investments are expected to create 2 million jobs and support vulnerable households and enterprises in a sustainable and inclusive way. One critical element of this plan is the ambitious agenda for infrastructure development in the energy and transport sectors, which will contribute to accelerating the country's transition to a low-carbon growth path, including a green energy transition and de-carbonization of the transport sector with investments estimated at US\$4.7 billion.

The new Government is committed to developing a fair energy transition, not only based on a technological transformation, but on a change in the social and economic relations of energy production and consumption. Under this scheme, the development of energy communities is proposed, in terms of social groups which shall be able to generate their own renewable energy and sell it to the system, or store it to increase their hours of service, thus promoting the democratization of the electricity sector beyond corporations, to reach popular sector stakeholders. Schemes of cooperatives, social organizations, supportive communities, networks and families that produce goods and services, and organize the work of their community promoting equality, solidarity and social development with protection of the environment, are forms that will seek to be fostered in the framework of access to energy and its productive use. Such dynamics are expected to be promoted along a solar outburst (massive deployment of PV technology access) which will allow increasing the use of this abundant source of energy.

Socio-economic context linked to women and other diversity groups

Colombia has made important progress regarding education indicators for both women and men. In fact, in the education category there is a small gap in favor of women. Net primary school enrollment rate declined slightly between 2000 and 2017 (in 2000 this was 94% for women and 95% for men, and in 2017 it fell to 91% for both genders), but the completion rate also increased for both. In 2017, net secondary school enrollment rate was 82% for women and 76% for men, and gross tertiary school enrollment ratio (% of relevant age group) was 65% for women and 56% for men. Tertiary education has also been expanding in the last two decades; in 2020, 34% of 25–34-

⁸ Figures taken from *Our World in Data* and in accordance with the Colombian Ministry of Health and Protection available at: <https://vacunacoronavirus.canalinstitucional.tv/l>.

⁹ Producto Interno Bruto (PIB), [DANE](#).

¹⁰ Using an exchange rate of 4,019 COP/US\$, as hereafter used, corresponding to the average exchange rate for May 2022.

year-old women in Colombia had a tertiary education degree compared to 26% of their male peers. Gender differences in the distribution of tertiary entrants across fields of study are significant. Women tend to be under-represented in certain fields of science, technology, engineering, and mathematics (STEM). In 2019, women represented 31% of new entrants in engineering, manufacturing and construction programs and 20% in information and communication technologies, compared to the education field where they represented 62% of new entrants.

Despite improvements in educational achievement, Colombian women do not have the same access to economic opportunities as men do. In 2019, only 56% of women participated in the labor force compared to 80% of men. In addition, unemployment rate has been higher for women than for men and the covid-19 pandemic has widened these gaps. At the end of 2020, unemployment rate reached 18.7% for women and 10.2% for men¹¹. A major contributing factor for women's low participation in the labor market is the disproportionate responsibility they have for household tasks and care work. On average, women working in non-remunerated domestic and care tasks spend 34.1 hours per week, compared to 18.4 hours among men¹². This has a social-economic impact, as these women are overloaded in work and unable to earn a greater income¹³. Moreover, when women do participate in the workforce, their jobs tend to be of low quality and poorly paid. Importantly, Indigenous and Afro descendant women often face the greatest disadvantages, weighed upon by the double constraints of ethnicity, race, and gender.

In addition to the gender gaps described above, there is a challenge related to occupational segregation. The International Labor Organization (ILO) estimates that female labor force participation is significantly lower than male in the transport, storage and communication sectors (of the total of people employed in these sectors, 86% are men and only 14% are women), and in mining and quarrying, electricity, gas and water supply (of the total of people employed in these sectors, 83% are men and only 17% are women). This is also reflected in a low participation of women in business ownership in these sectors.

Access to energy in Colombia is lower in rural areas compared to urban areas. While in main cities access to electricity service covers 99.2% of the population, in the peripheries it decreases to 96%, and to 80.3% in dispersed rural areas. Departments with the lowest levels of access to electricity are Vichada (35.4%), Vaupés (41.7%) and La Guajira (58.5%); these departments have a high proportion of indigenous population in their territories: such being 58%, 75% and 48%, respectively. In terms of gender, women have a higher level of access to electricity than men, which can be explained in part by their predominance in urban areas. However, this difference is very slight: 96.4% of women vs 95.7% of men¹⁴. According to the latest survey on quality of life (2021), almost 90% of the country's population that has access to electricity pay for the service directly or indirectly and only 7.5% have access to electricity without paying for it. On average, households pay 66,157 Colombian pesos per month (equivalent to US\$ 14) for the electricity service.

¹¹ ILO, 2021.

¹² Based on information from the National Census, 2018.

¹³ Defensoria del Pueblo, 2019.

¹⁴ Estimated based on information from CNPV 2018.

Ethnic groups, especially indigenous people, do not have equal access to energy. Although access to electricity for ethnic groups is superior to other services such as access to water and sewerage systems in peripheral areas where these groups are mainly located, there is a gap of 16 percentage

points compared to people who do not self-identify with any ethnic group (81.6% vs. 98%¹⁵). This gap is especially wide in the case of indigenous people whose access to electricity is 34 percentage points lower (64%) than those who do not self-identify with any ethnic group.

Only 2.2% of the country's population uses electricity for cooking while most of the population (66.6%) uses the natural gas connected to the public network. However, differences are observed between ethnic groups. More than 55% of households whose head self-identifies as indigenous people use firewood or wood as fuel for cooking, which results in high level of air pollution and impacts on deforestation and climate change. Meanwhile, afro-descendant-headed households use natural gas (49.6%) and propane gas (36.2%) for cooking food and more than 70% of households whose head does not self-identify with any ethnic group use natural gas. Recent studies¹⁶ have shown that using natural gas for cooking also has a negative impact on climate and people's health by generating carbon dioxide and leaking unburned methane into the air.

More women than men apply different ways to reduce the consumption of electrical energy. Approximately 78% of female-headed households use energy-saving light bulbs, five percentage points higher than male-headed households. In addition, turning off the lights is a practice carried out by 78% of women heads of household (vs. 73% of men). Another saving practice to reduce electricity consumption that is carried out by more women than men is to disconnect electronic devices (62% vs. 57%).

More than 3 million people with disabilities live in Colombia, representing more than 7.2% of the country's total population. At the national level, more than 71% of the population with disabilities are poor or extremely poor. Additionally, 4.3% of this population does not have electricity and 2.9% do not have access to any public service¹⁷. This population experiences multiple educational and labor market gaps. At the educational level, 41% of people with disabilities are out of school and 65% refer to disability as a reason for not studying. Moreover, persons with disabilities are significantly unrepresented at labor market, and the effects of climate change further exacerbate their exclusion, while their access to new green jobs is limited. In Colombia, almost two thirds of the population with disabilities have no income and, among the people who work, 80% do not have a formal job.

Current state of electricity generation and transmission systems

Colombia's installed generation capacity in January 2022 was 17,761 MW, of which 67.3% are hydro plants, 30.7% fossil fuel-based plants (mainly natural gas, followed by coal and liquid fuels), 1.2% biomass, 0.8% solar, and 0.1% wind.¹⁸ Electricity generation in 2021 was 74,116.91 GWh,

¹⁵ Based on information from the National Census, 2018 (DANE).

¹⁶ Stanford Woods Institute for the Environment, 2022.

¹⁷ Ministry of Health and Social Protection, 2018.

¹⁸ Based on figures updated up to the 31st of January 2022 in XM's PARATEC platform:

<http://paratec.xm.com.co/paratec/SitePages/generacion.aspx?q=capacidad>

representing an increase of 5.51% since 2020. In the period 2012 – 2021, hydropower supplied an average of 76% of the country’s generation, followed by fossil fuel-based with 23%, and NCRE 1%.

Colombia's overall electricity market comprises 96 generation companies, 16 transmission companies, 137 registered retail electricity providers, and 28 active distribution companies.¹⁹

Colombia’s National Interconnected System (NIS) provides electricity access to 96 percent of the population, while the NIZ serves an additional 229,000 households. However, the NIZ is where more than 400,000 users without access to electricity services live. **Error! Reference source not found.** presents the distribution of NIS and NIZ areas within the country’s territory.

The NIS has 28,448 kms of transmission lines that interconnect 229 electricity generation facilities with final users through distribution networks. This infrastructure is split into the National Transmission System (*Sistema de Transmisión Nacional – STN*) that includes all lines from 220 kV tension levels and up, and the Regional Transmission System (*Sistema de Transmisión Regional – STR*) that includes lines between 57.5 and 220 kV tension. The NIS was designed to transport energy from traditional generation plants (hydro and fossil fuels), which are located mainly in the central and north-western regions of the country.

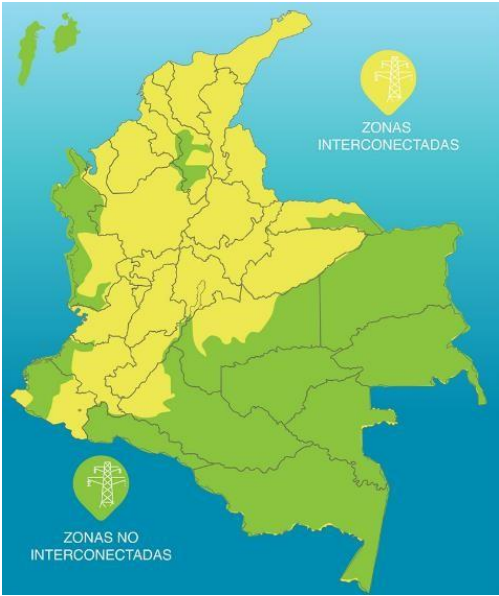


Figure 1. NIS and NIZ areas in Colombia

The NIZ have approximately 229,000 users, who are served by centralized diesel mini-grids, with a total capacity of 269 MW, and in other cases through 20 MW of PV and 5 MW of other renewable-based capacity such as small hydro, biomass and municipal solid waste power plants

¹⁹ Figures as of the 31st of January 2022 in XM's PARATEC platform: <http://paratec.xm.com.co/paratec/SitePages/caracteristicas.aspx?q=numero>

(approx. 25,000 users).^{20,21} A key priority in Colombia's energy transition policy is to achieve universal access to electricity by 2030, in alignment with the UN's Sustainable Development Goal (SDG) 7. To support this goal, Colombia seeks to promote community empowerment models around the production and productive use of energy generated from NCRE.

National and international climate strategies and plans, including status of NDC

Colombia's GHG reduction target is considered to be one of the most ambitious in the Latin America and Caribbean region.²² Its updated NDC was submitted in 2020 and sets the objective to reduce domestic GHG emissions by 51% by 2030, compared to the BAU baseline. This is an overall reduction of 176.5 Mt CO₂²⁴. Colombia has also committed to reach carbon neutrality and climate resilience by 2050, following the submission of its Long-Term Climate Strategy (LTS) to meet the long-term goals of the Paris Agreement Commitments, the so-called E2050²³.

Colombia's climate change adaptation policy started gaining relevance by 2010 in response to rising awareness and the devastating effects suffered due to heavy rain and floodings in 2010 (La Niña cycle)²⁴. The government has formulated a National Climate Change Adaptation Plan with a toolkit of methodologies to promote the inclusion of adaptation in sectoral planning. In the last years, Colombia has enhanced its climate policy and its regulatory framework to ensure compliance with national and international objectives through the enactment of:

- **A National Policy on Climate Change (PNCC by its acronym in Spanish, 2017).** The PNCC, adopted in 2017, laid out a roadmap to include climate change management in public and private sector decision-making. The PNCC has five strategic areas: i) rural development; ii) urban development; iii) mining and energy; iv) strategic infrastructure; and v) ecosystem management and conservation. The policy identifies mitigation and adaptation actions for each strategic area to foster technological development and enhance production processes that are low in GHG and/or adapted to the effects of climate change.
- **The Climate Change Act (CCA or Act 1931 of 2018) creates an institutional framework for decision-making and guidelines for climate change comprehensive planning and management.** For example, it establishes institutional principles and areas of authority at the national and subnational levels, as well as participatory bodies (National Council on Climate Change); it creates Regional and Sector-specific Comprehensive Plans for Climate Change (including one for the energy sector); and it mandates the creation of a National Climate Change Information System.

²⁰ Source: La Republica <https://www.larepublica.co/economia/demanda-de-energia-electrica-en-zonas-nointerconectadas-ha-incrementado-25-9-3227491>

²¹ Source: Portafolio 2021 <https://www.portafolio.co/economia/infraestructura/miles-de-hogares-en-zonas-remotas-decolombia-ya-tienen-energia-558590>

²² Climate and Clean Air Coalition <https://www.ccacoalition.org/en/news/colombia%E2%80%99s-ndc-increases-its-2030climate-change-ambition-and-integrates-new-targets> ²⁴ The initial NDC had a target of 20% reductions by 2030.

²³ See: https://unfccc.int/sites/default/files/resource/COL_LTS_Nov2021.pdf

²⁴ La Niña is an oceanic and atmospheric phenomenon causing extensive effects on the weather across the globe, affecting with heavy rains and flooding in central Andes region in South America.

- **Strategy for the implementation of Colombia’s Sustainable Development Agenda (CONPES 3918/18).** The CONPES established the basis for the development of strategic frameworks at the national and subnational levels, such as the Green Growth Policy (2018), the Regional Development Plans (2020-2024), and the National Development Plan (NDP) 2018-2022. This document has also become a long-term government policy. It identifies priority areas for meeting SDGs by 2030 and establishes 156 indicators, specific targets, and responsible institutions. Over a 15-year horizon, it establishes targets for achieving universal access; increasing the number of electric vehicles from 1,695 to 600,000; increasing the number of protected land areas by 28%; narrowing the monthly income gap between men and women by 2.6%; and increasing the recycling rate by 9%.

- **Colombia’s Green Growth Policy guides the actions related to sustainable growth (CONPES 3934/18).** Its objective is to increase productivity and economic competitiveness through the sustainable use of the natural capital. It identifies the need to: i) create conditions that will foster new economic opportunities based on Colombia’s wealth of natural capital; ii) strengthen mechanisms to optimize the use of natural capital and energy in production and consumption; iii) promote green growth by strengthening the capacity of science, technology, and innovation; and iv) enhance interagency coordination, information management, and financing to implement monitoring systems for achievement of the policy.
- **The PND 2018-2022 “Pact for Sustainability: Produce by Conserving, Conserve by Producing.”** It seeks a balance between productive development and environmental conservation to fuel new economic opportunities and safeguard natural resources for future generations. Its main targets were to cut GHG emissions by 36 Mt CO₂e, reduce deforestation by 30%, double the land area with systems for sustainable production to 1.4 million hectares, increase the rate of women’s participation in agricultural extension services to 30%, transition to sustainable transportation, and implement the National Strategy on the Circular Economy. A PND 2022-2026 is planned to be issued by the new Government Administration by the first semester of 2023.
- **Comprehensive management plan for climate change in the energy and mining sector 2050 (Resolution 40350 of 2021).** The MME was the first ministry in Colombia to adopt a comprehensive sector climate change plan. This is a sectoral plan that aims to define the priorities of the energy and mining sectors in terms of mitigation, adaptation, as well as governance aspects. In the mitigation component, it develops the strategies and actions to generate the appropriate conditions to promote the reduction of emissions and carbon neutrality in a cost-effective manner. In terms of adaptation, it incorporates climate risk management at decision-making levels in the sector, to reduce the impacts generated by climate change and climate variability.

Other relevant achievements aligned with NDC compliance actions correspond with those presented in Table 1:

Table 1. Other relevant achievements towards NDC compliance

Achievement	Comment
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Law 2169 of 2021 on Climate Action Law (December 2021)	Adopted climate change mitigation targets as a law mandate, including NDC 51% GHG emissions reductions by 2030, black carbon emission reductions of 40% by that same year against 2014 levels, reducing natural forest deforestation to 0 Ha / year by 2030, establishing 2020-2030 carbon budgets by no later than 2023, and reaching carbon neutrality by 2050. Based on defined actions and responsibilities within such law, a short-term action plan for the National Climate Finance Strategy should be formulated and implemented by 2025, and Carbon Markets shall be further analyzed and strengthened, continuing to develop an Emissions Trading System (ETS) which should be fully implemented by 2030.
Long Term Climate Strategy to meet Paris Agreement commitments E2050 (November 2021)	Correspond to Colombia's LTS to the Paris Agreement which was submitted during COP26. It defines 9 core objectives, including the diversification of the energy matrix to achieve carbon neutrality and climate resilience by 2050. It also lists 50 transformational sectoral options, within which those related to the energy sector include self-generation with renewable energies, the electrification of the economy, improvement of energy efficiency, the promotion of distributed energy resources (DER), smart grids and clean energies in the transportation sector. The other 8 central objectives include the generation of knowledge related to climate, the integral management of biodiversity, sustainable production and consumption, the just transition of the labor force, rural, marine and coastal development, city-regions with comprehensive urban development, sustainable mobility infrastructure and increased adaptability of the population and the health system.
Colombian Carbon Neutral Strategy - ECCN (April 2021)	Initiative led by the Ministry of Environment and Sustainable Development (MADS), promotes climate action empowerment and involvement from the private sectors, voluntarily assuming emission reduction commitments to contribute to 2030 NDC targets. More than 600 private and public companies have joined the initiative and presented specific commitments aligned with domestic climate policies.

The current status and expected contribution from the energy sector to the NDC target. Monitoring of progressive emission reductions since the adoption of the Paris Agreement is performed through biennial update reports submitted to the United Nations Framework Convention of Climate Change (UNFCCC), the last of which was issued in March of 2022 presenting 2018 emission figures (Colombia's BUR 3²⁵). According to the report, the energy sector in Colombia is responsible for approximately 33.29% of total domestic GHG emissions (approx. 92.9 Mt CO₂eq as of 2018), while sectoral plans aim for a reduction of 11.2 Mt CO₂eq by 2030. This reduction target represents approximately 9% against the business as usual (BAU) emissions scenario for the energy sector in that year. The highest contribution to achieving such reduction objectives is expected to come from electricity generation (7.73 Mt CO₂eq/year reductions vs. 8.3 Mt CO₂eq/year produced in 2018). Additional emission reductions will be achieved from fugitive sources (1.71 Mt CO₂eq), energy efficiency (1.44 Mt CO₂eq), and demand-side management (0.32 Mt CO₂eq).

²⁵ Government of Colombia (2022).

Decarbonization of the electricity generation matrix therefore becomes crucial to meeting emission reduction objectives, and the Energy Transition plays a key role in achieving such goal.

Gap/barrier analysis; needs assessment

Both, the Energy Transformation Mission conducted in 2019-2020 with support from MDBs and the participation of more than 30 national and international experts providing recommendations for the modernization of the Colombian energy sector, and analyses conducted for the preparation and approval of the Energy Transition Policy CONPES 4075/22, provide a thorough assessment of barriers faced by the country in order to increase penetration of variable electricity generation sources. While many recommendations have been addressed by governmental institutions, some of these still remain, as described and categorized within the following five major categories.

i. Deficient Infrastructure:

Within the NIS, high non-technical losses and insufficient investment in the maintenance and development of new grid distribution infrastructure constitute a major problem in regions such as the Caribbean Coast. In that region, important investments are required to improve the network, but low revenues in association with low payment capacity by users represent a barrier to providing infrastructure and technological upgrades that will allow the grid to incorporate large amounts of distributed generation.

The limited existing infrastructure, and high cost of providing electricity services to NIZ users does not allow for these to receive a high quality and reliable service with serviced times throughout the regions varying between 4 and up to 22 hours per day, mostly through diesel plants. At the same time out of more than 567.000 households estimated to live in NIZ areas where the NIS cannot be extended, only some 229.000 have access to electricity, with more than 338.000 households remaining to be serviced, for which investments in the order of US\$ 2 billion are required, compared to up to approx. US\$ 0.8 billion which government estimates to be able to invest from 2022 to 2030 towards the goal of increasing such access to energy.

Besides this, other estimated 157.000 households within areas where the NIS can be extended, remain to be connected, requiring investments for close to US\$ 200 million more, which may need to come from progressive NIS energy cost increments in tariffs which are already high for users, mainly after pandemic events in which different conjunctural factors have led to tariff increments which the Government administration is aiming to contain.

Despite ambitions targets having been established back in 2019 for the adoption and massification of AMI infrastructure in order to reach 75% of NIS users by 2030, as of 2022 little progress has been made, mainly due to pending regulation to be established in order to govern how investments will be remunerated for such infrastructure to be deployed. In this sense, the Colombian Energy and Gas Regulatory Commission (CREG) is expected to enact such regulation no later than 2023 (see ANNEX VI). Investments in the order of US\$1 billion will be required to achieve the AMI target by 2030.

In the case of NIZ, the lack of appropriate monitoring and follow-up infrastructure result on poor or non-existent information on service quality and general statistics on its provision. This is compounded by the difficulties in collecting information due to the remoteness of many areas which have no internet access services or mobile phone connectivity for information sharing. The

installation of AMI, or remote monitoring capabilities, is therefore essential to adequately manage the electricity service in NIZ.

Existing transmission infrastructure is insufficient to transport energy from NCRE projects in La Guajira and the Caribbean region to the areas of greatest demand. UPME has identified the need for a new HVDC transmission line, which is expected to be procured in 2023. UPME has also identified the need for Flexible Alternating Current Transmission Systems (FACTS) and Static Synchronous Series Compensators (SSSC) to enhance and increase the power transfer capability and controllability of the power system, as specific wind electricity generation plants are expected to be commissioned in la Guajira.

Limited existing rapid public charging infrastructure undermines the country's ambitious goals in terms of transport electrification though EV deployment, which is expected to grow from a current 8,000 EVs in mid-2022 to more than 100,000 units by 2024 and 600,000 by 2030. Beyond existing 225 rapid and fast charging points distributed across main cities in the country, it is estimated that some 5579 points shall be required by 2025 and 18,274 by 2030 in order to enable meeting such goal²⁶.

Insufficient participation of the energy demand in energy price formation and grid operation, limits the flexibility of the system, increasing the requirement for transmission expansion and thus acting as a cost barrier to additional variable generation.

ii. Permits, legal framework and regulation:

As identified by the experts of the Energy Transformation Mission, regulation in the electricity sector does not promote an active demand participation and adoption of energy efficiency measures. The Energy and Gas Regulatory Commission (CREG) is expected to define a new flexible tariff design that promotes participation from the demand side and to provide signals for the participation of generation with distributed energy resources (DER), as was implemented by CREG's resolution 1742021.

Furthermore, for facilitating the participation of variable generation and its interaction with flexible generation, experts issued short-term market design recommendations, including the implementation of a nodal prices scheme incorporating efficient energy payments for congestion charges and losses, together with a binding dispatch and intraday market, and enhancement of existing ancillary services market. In line with these recommendations, CREG has carried out various studies and external consultant work leading to planned market reforms which are yet to be implemented²⁹.

Colombia has a complex regulatory system for the energy sector, which may to some extent limit the appetite for banks and financial institutions to finance projects in this field, considering the knowledge and due diligence that is required for proper project execution. However, the dynamic activity of project promoters in search for financing alternatives has somehow started to remove

²⁶ Considering the predominance of apartment buildings in cities like Bogota and Medellin, where "home" charging is cumbersome, and the need to travel long distances between cities, public rapid and fast charging stations are necessary. It is expected that up to 30% of EVs will regularly use such infrastructure (compared with a 10% expectation in countries where most people have access to "home" charging). Concessional financing would play a key role in the development of private or public-private based models leading to the construction of EV charging infrastructure. ²⁹ Within these expected market reforms, no use of nodal prices is expected for the moment.

this barrier with commercial and development banks gaining interest and developing experience in NCRE based energy projects.

Some of the complexities or major challenges which can also be to some extent regarded as barriers in the development of NCRE integration lie within the **obtention of environmental licensing permits and social consultation processes with communities, which can lead to long project preparation timelines, delays and costs**. Furthermore, in the case of new technologies such as offshore wind developments, aspects such as legal stability that the State may offer for expected project lifetime concessions of at least 30 years and other long-term agreements with instances such as port facilities add complexity and increase the risks and challenges for project developers.

In the case of hydrogen and off-shore wind technologies, regulatory and technical guidelines still need to be adopted to promote their development. Various bilateral and multilateral donors are supporting the development of these guidelines.

iii. Knowledge, skills and capacities

As CONPES 4075/22 establishes, **digitization, data analysis, and knowledge management are still capacities which require to be extensively developed in Colombia** in order to achieve desired efficiency in the adoption and integration of new technologies in the energy sector. Supply of professional and technical personnel to lead such integration in the case of technologies such as GH2, offshore wind, HVDC lines and other related technologies is therefore insufficient at this stage. Specialized know-how and training is required to fill in this gap making necessary to receive knowledge transfer support from experienced firms and countries.

In the case of NIZ, in association with a lack of infrastructure as earlier indicated, **the lack of information managerial capacities at a national level is also evident and shall be one of the points to be addressed together with the provision of new energy access solutions based on NCRE** generating technology which offers the possibility for decentralized, reliable information management, to the extent in which this information can be shared through different type of connectivity platforms.

Facing **a challenge of rural communities** in relation to their **cooking practices, eliminating inefficient use of biomass in such areas becomes a priority**, given the health effects of emissions produced from incomplete combustion processes, which fall primarily on women and children. In this sense, despite the fact that electricity based solutions derived from the use of NCRE such as solar are not a fit solution, **the use of biomass efficient stoves, same as solar based thermal technologies where direct radiation is representative, and other modern use of biomass shall can regarded as viable solutions** to overcome this problem. However these knowledge and skills are yet to be developed and well spread along rural communities facing the problematic.

In the case of NIZ electricity access solution provision through NCRE such as solar PV, there is also a **barrier in the development of proper maintenance and service capacities** given the wide geographical spread of these systems and difficult access, added to the **challenge of building up local productive uses of energy which users may implement to provide live improvement conditions and make these solutions sustainable and scalable**.

iv. Markets – models / schemes

In the electric sector, the medium-term market lacks proper creditor security, guarantees, and risk distribution, which may affect all market players, and especially new agents. With the last Long Term Energy Contract auction celebrated back in 2021 (see III Renewable Energy Integration Context on Overview of energy/power sector), many contracts with small energy purchasers yet remain pending to be subscribed based on commitments there established and associated counterparty guarantees high risk and costs.

Allocation of grid connection permits and electricity transportation rights is also an important concern to be addressed by agents developing new NCRE based projects (e.g. considering current grid connection requests in the order of 58 GW for the whole NIS, out of which 9 to 10.5 GW plan to be assigned by the end of 2022 – for a system currently holding 17.7 GW of generating capacity).

As previously identified, gaps in the strengthening and planning of energy markets are still evidenced in the currently operating market, but **CREG is well advanced into the planning and expected application of market reforms in the near future.**

The current Colombian economy heavily relies on fossil fuels for both its domestic supply for segments in transport and industry, same as its exports-imports commercial balance, greatly challenging the decarbonization possibilities for these sectors. In the transport sector, with 96% of energy consumption being based on liquid fuels derived from petroleum ²⁷, such sector is responsible for 12.5% of total domestic GHG emissions, additionally impacting air quality through the production of particulate matter (PM). It is important for the electrification of transport to be accompanied by the penetration and use of NCRE based generation. In this sense, business schemes that ensure the demand for electricity in public transport comes from NCRE shall be promoted (through competitive purchasing mechanisms).

The relatively low cost of fossil fuels, and the lack of a carbon market and emissions trading system (yet in development)²⁸ represent economic barriers to reach a fast adoption of novel e-fuel alternatives such as GH2, with this lying at a distance from becoming competitive. GH2 development shall require technical cooperation, grant funding and concessional resources to be able to demonstrate achievable benefits and encourage private participation at a growing scale which may allow competitive production, distribution and use in the medium term. A carbon market and emissions trading system is already in the planning but not expected to be operative before 2030 (See Table 1).

v. Financing

As outlined by CONPES 4075/22, **limited financing to operate massive public passenger transport systems has made it difficult to replace the existing fleets and incorporate new high-cost technologies** (i.e. EVs and electric trains, subway and tram systems).

The use of hydrogen as an energy carrier for transport, industry use, and future back-up for the variability of renewable energy, is still in an early stage of development, and investment costs and

²⁷ UPME, 2021.

²⁸ A carbon market and emissions trading system is already being planned, but is not expected to be operational before 2030 (see Table 1).

associated risks are relatively high. High CAPEX and lack of local know-how in GH2 technology present a challenge for accelerating its deployment.

Lack of local track-record and expertise in the financing of these type of new technology projects (same as for offshore wind) makes it difficult for financial entities, and especially commercial banks, to be willing to be the first to provide financing. Therefore, **NDBs can play an important role in overcoming the lack of adequate financing options.**

Business risk perceptions also extend even to more common technologies such as EV deployment, both from the financial institutions and businesses which could benefit from this technology shift, thus limiting or difficulting in many cases their access to credit. Difficulties in access to preferred interest rates and subsidies to cover high capital costs also plays a role as a barrier which could be surpassed by concessional loans.

III. Renewable Energy Integration Context

Overview of energy/power sector

The institutional organization and operation of the Colombian electricity market is based on the vertical separation of the activities of the chain (production/generation, transmission/transport, distribution, and marketing), developed by public, private, and mixed capital companies. The sector development is based on Law 142 of 1994 (Domiciliary Public Services Law) and Law 143 of 1994 (Electricity Law). The Ministry of Mines and Energy (MME), the National Planning Department (DNP), and the Energy Mining Planning Unit (UPME), attached to the MME, define the policies of the sector and its indicative expansion planning. The Energy and Gas Regulation Commission (CREG) is responsible for economic and technical regulation and establishes tariffs considering efficient costs. The Superintendence of Residential Public Services oversees the supervision and control of the service provision. For Non-Interconnected Zones (NIZ), the Institute for Planning and Promotion of Energy Solutions (IPSE) is responsible for identifying, developing, promoting, and making energy access projects viable.

The National Interconnected System (NISNIS) is organized around a Wholesale Energy Market (MEM for its acronym in Spanish) where the different generation technologies compete to supply demand. In this MEM of marginal prices, the equilibrium price in each hour is set by the plant with the highest price required to supply the respective demand. The formation of prices in the market is based on the prices offered by generators that reflect their variable costs, including fuel or the opportunity cost of water, the Reliability Charge, and their perception of risk associated with dispatch.

Currently, generation activity is mainly private and highly concentrated, with only a handful of players having large market shares. Four companies own around 65% of the generation: EMGESA (20%), EPM (20%), ISAGEN (17%) and CELSIA (8%). Furthermore, 7 new international companies have entered the Colombian generation market as a result of 2019 and 2021 long-term auctions for NCRE.

The Reliability Charge (RC) is the fundamental mechanism for expanding system capacity. Through an auction, the RC assigns Firm Energy Obligations (FEO) to new and ongoing projects to compensate for the availability of plants to generate energy at the most critical hydrological moment,

guaranteeing the reliability of the service. The model has allowed bidders to receive a stable income, rendering the operation financially viable and strengthening the supply by providing a backup sufficient to overcome periods of water shortages. Based on the methodology used to calculate FEO for each technology, resources such as solar and wind do not contribute significantly to reliability due to their variability and intermittency.

In 2019, a new mechanism was designed to incentivize the installation of NCRE projects, by allowing them to sell their energy by means of long-term contracts considering the generation curve of each technology. Thus, the long-term contract auction values the benefits of renewable sources for the system and allow them to attain financial viability. The auction was innovative because of its two-sided design, i.e., both, generators and buyers participated with offers for quantities and prices, making it the first auction of its kind in the world. In addition, the contracts were organized according to time slots for the delivery of energy, matching the times when there is more solar radiation or more wind, allowing the demand to acquire energy at different prices for each one.

The transmission infrastructure is developed and operated by private and public-private companies. There are sixteen national and seven regional transmission companies operating in the NISNIS. UPME is responsible for updating the Transmission Expansion Plan, which serves to expand the system. UPME issues calls for proposals for the construction and operation of new transmission lines, the best offers (minimum investment and AOM cost) are granted the right to build and operate them, and the investors bear all the risks. Remuneration of the existing investment follows regulations issued by CREG.

In the distribution network there are 28 active grid operators, which are responsible for the operation and expansion of their grid systems. Two companies have 56% of the distribution market: EPM (34%) and CODENSA (22%). The regulation requires grid operators to prepare and present 5-year expansion plans, which are reviewed and approved by CREG. CREG must approve their expansion plans for 5-years periods, and the assets are remunerated based on regulated tariffs. As of 2018, there were 562.882 km of distribution networks, including 581,592 transformers, across 4 different levels of tension, as illustrated in Figure 2.

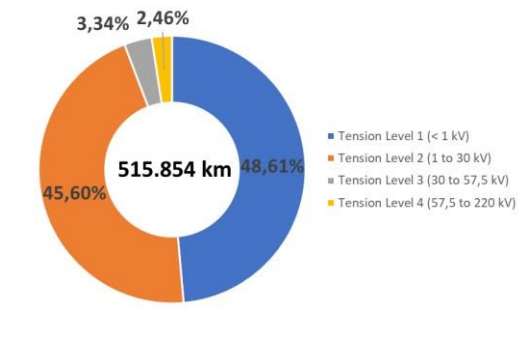


Figure 2. Colombia’s distribution networks by tension level (based on 2010-2018 figures reported by Asocodis²⁹)

²⁹ https://www.asocodis.org.co/administrator/components/com_archivos/docs/49fee671f49d7b81eada348cb505046c-INFORME-ASOCODIS-VER7NOV2019-impresion-compressed.pdf

Electricity retailers are in charge of buying electricity in the wholesale market and selling it to users. The users are classified as regulated and non-regulated consumers (with a minimum demand of 55 MWh/month, or 0.1 MW power consumption). Non-regulated users can choose their retailers and negotiate generation and retail prices through bilateral contracts with electricity retailers. Regulated users have the possibility to choose a retailer of their choice but are regularly served by the incumbent distribution company, due to infrastructure related higher transactional costs associated to other retailers³⁰. They pay a regulated tariff set by CREG, based on cost-efficient CAPEX and OPEX remuneration for generation, transmission, distribution, and retail activities. Thanks to Law 1715 of 2014 and its subsequent regulatory acts, any user who meets the required

technical conditions is entitled to becoming a self-generator and delivering any energy surplus into the grid and being duly remunerated³¹.

In-depth analysis of country's renewable generation portfolio

While Colombia's electricity matrix is more dependent on hydropower generation than thermoelectric generation based on fossil fuels (coal, natural gas and fuel oil), the electric system has faced critical situations during drought periods caused by El Niño events which jeopardized the continuity of service several times over the last 30 years. In those cases, thermoelectric plants must assume a greater generation role despite their higher costs and greater pollution.

In 2020, fossil fuels used for electricity generation were responsible for 8.3 Mt CO₂eq, leading to a NIS attributed operational emission factor of 0.203 tCO₂eq/MWh. However, if the total lifecycle of conventional energy projects is considered, an emission factor of 0.662 tCO₂eq/MWh is obtained³².

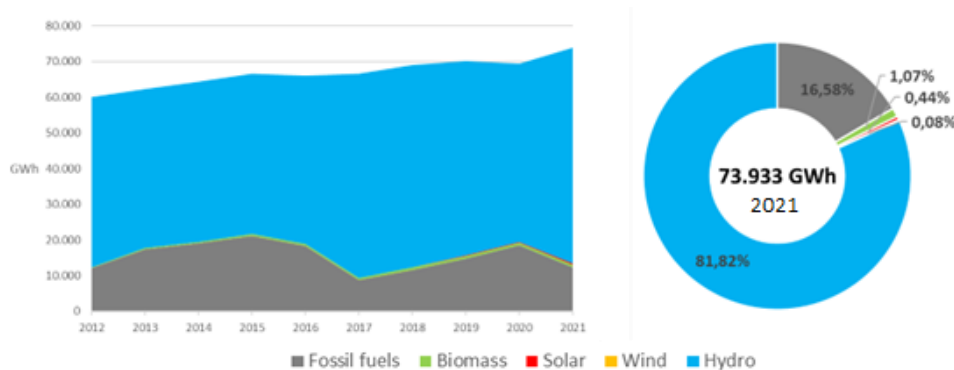


Figure 3 Colombia's NIS electricity generation 2012-2021 (Based on XM,2022 reported figures)

Until 2018, the installed capacity of NCRE accounted for 1.7% of the total capacity, mainly from biomass. However, 2019 was a tipping point for NCRE projects in Colombia: i) FEO's auctions: NCRE

³⁰ Something which will change once AMI begins to be implemented massively, considering it will now be the responsibility of the Grid Operator to install such infrastructure, with the user thus being able to change its retailer company without needing to change the meter.

³¹ Establishing simplified and preferential conditions, in terms of connecting procedures and surplus remuneration, for users with self-generation capacities below 100 kW, as established by CREG Resolution 174 of 2021.

³² Based on values established by UPME as per resolution 382 of Nov 2, 2021; Available at: <https://www1.upme.gov.co/siame/Paginas/calculo-factor-de-emision-de-Co2-del-SIN.aspx>

participated for the first time, competing directly with traditional energy sources (hydro, gas, coal and liquid fuels). The auction allocated 164.33 GWh/day, equivalent to an additional net effective capacity of 4,010 MW, of which 1,160 MW are wind and 238 MW are solar; **ii) Long term NCRE auctions:** They were held for the first time and awarded contracts to 23 buyers representing regulated demand and nine renewable energy generators: six wind generators totaling 1,084 MW and three solar generators totaling 289 MW.

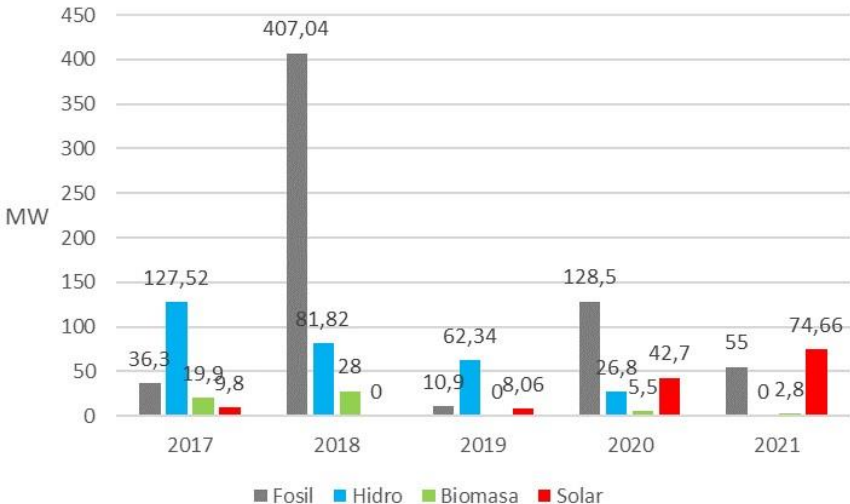


Figure 4. Colombia’s NIS generating capacity year by year additions 2017-2021 (Based on XM,2022 reported figures)

2021 saw a record high in NCREs incorporation with 74.66 MW of PV generation, equivalent to 58% of the new capacity that year. PV installations have seen a rapid acceleration, with a total installed capacity of 135 MW as of 2021, or 30808 MW if including projects in operation but not yet registered by XM, such as *El Paso* with 86 MW, *Canal del Dique* with 5.6 MW, *Castilla* with 20.4 MW, and *San Fernando* with 61 MW. Moreover, in the next three to four years, projects adding up to 1,322 MW of PV and 2,309 MW of wind capacity are expected to be in operation based on Long-Term Contracts and Firm Energy obligations (Table 2).

Table 2. Wind and solar project capacities with Auction obligations / assignments or transmission project guarantees

		Solar (MW)	Wind (MW)	Total (MW)
RE Auctions	October 2019	288.0	1,077.0	1,365,0
	October 2021	796.3	0.0	796,3

	Total	1,084.3	1,077.0	2,161.3
Firm Energy Auctions Feb 2019 with no RE Auction assignment		238,0	491.6	729.6
No Auction obligations / assignments; with Guarantee in place towards <i>Colectora</i> project			495.0	495.0
No Auction obligations / assignments; but with Guarantee in place towards other connection projects (as of December 2021)			246.0	246.0
	TOTAL	1,322,3	2,309.6	3,631.9

Entry of NCRE projects face important challenges: (i) Projects with Long Term Contract assignments from the first Auction in October 2019, which closed at an average price of 95.65 COP/kWh (26 US\$/MWh), face a challenging situation compared to those assigned after the pandemic due to increased CAPEX. They are now affected by inflation, local currency devaluation, high shipping and raw materials costs. Therefore, the three PV projects (288 MW) expected to start operation in 2022 are now delayed until at least 2023; (ii) The other six wind projects (1077 MW) originally expected for 2023 will likely be delayed until 2024 and 2025³³ due to delays in the construction of the *Colectora* transmission line that will evacuate the generated electricity; (iii) PV projects from the 2021 auction (796.3 MW) which were expected for the end of 2022 are now planned for 2023. Further PV projects with firm energy obligations and no RE Auction assignments, like *La Loma*, are expected to enter into operation by the end of 2022, while 741 MW of wind projects with transmission expansion guarantees in place are expected for 2025.

System flexibility is a priority. In 2021, UPME commissioned the first large-scale battery-based energy storage system (45 MWh), which is expected to be completed by June 2023. This facility will provide ancillary services to the Caribbean region's transmission and distribution networks. UPME also announced Colombia's first HVDC transmission line to add flexibility to the transmission network and ensure the incorporation of NCRE installed in the country's northwest region. The project will call for proposals in 2023 and the line will connect the *Colectora* substation in La Guajira's to the *Cerromatoso* or *Primavera* substations in the central area of the system. In addition, UPME is expected to call for proposals in 2023 for new synchronous compensation systems, such as Flexible AC Transmission Systems (FACTS) and Static synchronous compensator (STATCOM), which shall provide further grid flexibility capabilities to the system.

National low or zero carbon energy strategies

Colombia's commitment to the Paris Agreement under its NDC seeks to reduce GHG by 51% in 2030 with respect to the BAU scenario. The energy sector is at the forefront of implementing a comprehensive climate change management plan by reducing an equivalent of 11.2 Mt CO₂ by 2030. The transportation sector was also prioritized with the aim to optimize logistics and transportation operations, and to develop electromobility, which can yield a reduction of 44 Mt CO₂ eq.

³³ Connections with Assigned Capacity by UPME as of the 14th June 2022: <http://www.siel.gov.co/Inicio/Generaci%C3%B3n/SeguimientoaproyectosdeGeneraci%C3%B3n/tabid/112/Default.aspx>

³⁷ Such Strategy was developed and issued by the Government of Colombia, with the support of IDB, PNUD, AFD, WRI, and the German government back in May 2021.

Colombia's net-zero emissions plan by 2050 is outlined in the Long-Term Climate Strategy to meet Paris Agreement commitments E2050³⁷. At the sector level, the Comprehensive Climate Change Management Plan for the Mining and Energy Sector (PIGCCme)³⁴ sets specific action lines to achieve such a goal. The main action lines for achieving the targeted emission reductions include energy efficiency, clean electricity generation, demand management, fugitive emissions control, electrification of demand, and substitution of most carbon-intensive energy carriers.

The most ambitious scenario under Colombia's 2020-2050 National Energy Plan, adopted by the PIGCCme, will reduce emissions by 31.6 Mt CO₂e. The action lines include implementation of disruptive technologies as carbon capture and utilization (CCU) together with the massification of electric train transportation, the use of low emissions hydrogen in transport, the adoption of blockchain transactions, autonomous control centers, artificial intelligence (AI), and the use of

intelligent conductors and materials. However, the energy sector would still produce 8.4 Mt CO₂eq, therefore making necessary for other strategies to offset these emissions.

One special contributor to the achievement of a net-zero emissions scenario by 2050 will be low-emissions Hydrogen³⁵, which requires the deployment of up to 4 GW of dedicated power installed capacity to enable the production of 70 kt of green H₂ by 2030. The plan includes the incorporation of 2,000 light-duty vehicles and 1,500 heavy-duty vehicles and up to 100 hydrogen fueling stations. Such a scenario represents up to US\$5.5 billion in investments, generating 15,000 jobs and up to 3 Mt CO₂eq cumulative reductions by 2030 (0.7 Mt CO₂eq/year).

Climate Change Adaptation

The MME has been developing studies for climate risk analysis and has identified that the energy sector presents a low vulnerability (medium uncertainty) to climate change, due to its solid structure and experience in the implementation of actions that have contributed to increasing the resilience of the NIS infrastructure. Within the framework of the PIGCCme, the MME has identified the possible impacts that the industry could face and has consolidated a list of 115 possible impacts with high and very high valuation (medium uncertainty): 43 associated with climate change conditions o and 72 associated with climatic variability. These impacts are expected to create negative risks associated with the production of energy and increases social conflicts in the territories where the projects are carried out.

The MME has carried out specific analyzes around two critical issues: the impact of the increase in temperature on the demand for electrical energy and the effect on the water supply in the Magdalena-Cauca river basins where a large part of the hydroelectric generation is located. the country. Faced with the impact of the increase in temperature, it was identified that the regions have different sensitivities regarding the increase in energy demand when they are exposed to an

³⁴ Such plan was produced by the Ministry of Mines and Energy in Oct 2021 , having been develop with the support of GIZ and CIAT, among other cooperation entities.

³⁵ Understood as both green hydrogen (produced from electrolysis using renewable energy) and blue hydrogen (derived from Steam Methane reforming, using natural gas and then capturing associated CO₂ emissions through CCUS technologies). Both these types of H₂ are considered under Colombia's H₂ RoadMap.

average temperature increase of 2°C; sensitivities that will depend of factors such as the level of urbanization and advances in electromobility.

It is necessary to continue deepening the analyzes on the effect of climate on electricity demand, improving the spatial and temporal resolutions of the information. It is expected that the increases in the average temperature may push the country's electricity consumption upwards, which will require greater generation capacities and significant efforts to diversify the electric generation matrix with marginal use of fossil fuels.

Given the country's high dependence on hydroelectricity, the biggest climate threat to the national electricity system has been the El Niño phenomenon, which reduces precipitation, affecting hydroelectric dam levels, therefore diminishing total electric generation. This generates important effects on the sector. For example, in 2016, a year marked by an El Niño phenomenon, contribution of hydroelectric generation accounted to only 67% of total electricity production. On the other hand, during 2017, which was a relatively wet year, hydroelectric generation represented a total share of 86% of electricity production.

Institutional framework and capacity

Colombia's policy and regulatory framework for energy transition has been enacted through laws and regulations which seek to diversify the energy matrix and decarbonize the energy sector:

- **The Renewable Energy Law:**³⁶ established concrete instruments to promote NCRE and energy efficiency measures, including tax incentives, and the creation of the Fund for Non-Conventional Energy and Efficient Energy Management (FENOGE) to finance these projects.
- **The National Development Plan of 2018-2022:** included enhanced tax incentives extending the uplift on income tax to 15 years and creating an automatic Value-Added Tax (VAT) exemption for solar panels, controllers, and inverters. In addition, it set ambitious targets regarding NCRE in the country's generation matrix (for growing from 22.4MW in 2018 to 1,500MW by 2022) and established that a minimum of 8% to 10% of electricity purchases made by retailers in the wholesale energy market must come from long-term contracts with NCRE generation.
- **The Energy Transition Law:**³⁷ established provisions on energy transition, the revitalization of the energy market and economic recovery. It included tax provisions applicable to NCRE projects and expanded those to power storage, AMI and power management for NCRE, as well as investments in goods, machinery and equipment used in the manufacturing, storage, packaging, distribution, re-electrification, research, and final use of green and blue hydrogen. The Energy Transition CONPES's Document No. 4075/22 encouraged knowledge and innovation in energy transition; the development of an energy system with low GHG emissions to reduce the effects of climate change; and the generation of greater competitiveness and economic growth supported by the energy sector.

³⁶ Law 1715 of 2014

³⁷ Law 2099 of 2021

- **The Sustainable Mobility Law:**³⁸ set a series of incentives to use zero and low emission vehicles and specific targets for incorporating electric or zero emissions vehicles in all Bus Rapid Transit (BRT) systems of the country, and for the implementation of rapid charging stations for EV in the main cities of the country; and **The Law for the Protection of Rights to Health and to a Healthy Environment**³⁹ sets emission limits for all urban and regional public systems, including those in medium-size cities.

In addition, essential regulations issued during the past decade, which have contributed to the promotion and penetration of NCRE, are described in Annex VI.

Role of private sector, innovation, and leverage of resources

Mobilizing capital for energy transition and electromobility requires increasing the role of the private sector and an enhanced role for international and national development finance institutions. They are critical to catalyze these investments and provide concessional financing and better terms and tenors in loans to develop new technologies. MME estimates that the energy transition will require around US\$ 8 billion in investments over the next eight years. Projections also show that massive and strategic public transportation systems could acquire more than 2,735 e buses between 2021 and 2030, representing an investment of US\$ 833 million. Increased public

investment in infrastructure is not feasible in a post-Covid environment where the limited funds available need to be allocated to healthcare and other priority sectors. Therefore, strong partnerships between public and private sectors are needed to attract the diversified, resilient sources of capital needed for multi-year and multi-decade investments in energy systems.

Private investors in the energy transition include companies and individual energy consumers. They are interested in becoming self-generators through the implementation of PV technology or in participating in demand aggregation schemes, electromobility pilots, and programs to reduce their carbon footprint. These initiatives also require financing to reach a scale impact.

The private sector and national authorities need to join efforts to carry out research and investigations through partnerships with academia and programs led by the Chambers of Commerce and others, which lead to the critical component of innovation. For example, Ecopetrol and the Ministry of Science and Technology support research groups in accelerating local capacity building for energy transition technologies, such as hydrogen and carbon capture. Other efforts in this direction include initiatives from energy clusters from the Bogota and Medellin Chambers of Commerce, in which industry is integrated with academia to achieve synergies in topics such as energy efficiency, NCRE integration, and electromobility.

NDBs such as Bancoldex and FDN can play an important role in co-financing and managing risks. These NDBs have progressively increased their role in filling major financing gaps and developing long-term financing. Colombia has a limited project finance market and thus, infrastructure financing needs have traditionally been met through corporate loans or from a small set of commercial banks. However, current high-interest rates and companies' low liquidity can make it

³⁸ Law 1964 of 2019

³⁹ Law 1972 of 2019

difficult for developers to access credit and local commercial banks and investors are unfamiliar with clean energy and electromobility projects.

Additionally, these type of investments present barriers (as earlier outlined) such as high up-front capital costs, new technologies that have not been tested in the country and/or are not financially viable without the use of concessional resources, short concession periods in some market segments, and business risk perceptions that reduce access to credit for project developers, which can be overcome based on concessional financing and TA offering. Thus, concessional financing, risk mitigation and TA provision will be necessary to manage the spectrum of outlined financing opportunities and attract private sector investments into these types of projects.

Complementary activities by other development partners

Several multilateral and bilateral donors are actively involved in promoting renewable energy. Main donors' current support is following described, while ANNEX IV presents in more detail activities supported by other cooperation partners.

IDB and IDB Invest: The IDB Group has supported the energy transition in Colombia through policy and investment operations as well as technical assistance, as follows:

- Approved the Energy Transition Support Facility (US\$50 million) in 2021 with Bancoldex. The Facility will support the decarbonization of the economy by reducing GHG and accelerating the country's inclusive energy transition by financing NCRE projects and associated transmission lines, energy storage, energy efficiency, DER, AMI and electric mobility in Colombia. It is proposed that CIF-REI financing will provide co-financing for eligible projects to be financed under this facility⁴⁰. The implementation period of this facility is 4 years.
- Implemented a rural electrification project in the Pacific area of the country (US\$91 million), providing financing to connect 20,000 new users and carrying out various access related studies to promote private sector participation, ensure sustainable solutions and reduce emissions by substituting diesel-based generation plants⁴¹.
- Implemented an energy efficiency project (US\$10 m CTF) in San Andrés, Providencia and Santa Catalina and is preparing a new energy efficiency project for the seven departments of the country's Caribbean region⁴⁶.
- Approved three policy-based loans since 2019 supporting energy transition and climate change for US\$2 billion⁴².
- Approved a credit line for US\$600 million and a first operation for US\$70 million, to the *Metro de Bogotá* company, for the construction of the first line of Bogotá's subway and elevated train system⁴³.

⁴⁰ For more information, see: <https://www.iadb.org/en/project/CO-L1258>

⁴¹ For more information, see: <https://www.iadb.org/en/project/CO-L1156>

⁴⁶ For more information, see: <https://www.iadb.org/en/project/CO-L1119>

⁴² For more information, see: <https://www.iadb.org/es/paises/colombia/perspectiva-general>

⁴³ For more information, see: <https://www.iadb.org/en/project/CO-L1234>

- Supported the projects and studies on infrastructure requirements and business models for fleet adoption and infrastructure deployment for EVs⁴⁴.
- Assisted the Government in preparing the H2 RoadMap and currently helps structure an H2 regulatory sandbox and other technical studies⁴⁵.
- Financed the Intelligent Colombia program, which defined the country's roadmap and vision for smart grids⁴⁶.
- Provided technical assistance in current pre-investment phase of the Panama-Colombia interconnection project; and supports the regional energy integration initiative of SINEA⁴⁷.

World Bank: The WB has also been supporting Colombia's integration of renewable energy in its energy matrix through technical assistance and financing products. The main activities currently under implementation or recently finalized are:

- Supporting the government of Colombia through three policy-based loans for a total of US\$2 billion since 2020, on topics of Resilient and Sustainable Infrastructure for Recovery and Equitable Green Recovery⁴⁸.
 - Implementing a transport electrification project, supporting the implementation of the Bogota Metro Line 1, for US\$70 million⁴⁹.
-
- Providing technical assistance in various areas related to the energy transition, including, among others:
 - Supporting the development of the Offshore wind roadmap.
 - Financing studies related to the HVDC reinforcements to evacuate wind and PV generation from the Guajira region.
 - Informing policy related to the implementation of a low-carbon hydrogen certification scheme, which is essential to develop the industry and allow for hydrogen exports.
 - Studying the impact of electric mobility on electric distribution networks and how this can be reduced to allow for increased penetration.
 - Providing recommendations on business models to support private investments in Energy access.
 - Providing recommendations on the main electricity system vulnerabilities and a roadmap for addressing them.

AFD, GIZ, KEXIM, UNEP, UNDP, UK-Pact, GGGI, USAID and NREL are providing technical assistance supporting different areas such as the development of low emissions H2, the promotion of national

⁴⁴ For more information, see: <https://blogs.iadb.org/ideas-que-cuentan/es/vehiculos-electricos-hacia-un-transportelimpio-y-asequible/>

⁴⁵ For more information, see: <https://blogs.iadb.org/energia/es/colombia-gana-posicionamiento-en-la-industria-dehidrogeno-verde/>

⁴⁶ For more information, see: <https://www1.upme.gov.co/Paginas/Smart-Grids-Colombia-Visi%C3%B3n-2030.aspx>

⁴⁷ For more information, see: <https://blogs.iadb.org/energia/es/interconexion-colombia-panama-integracion-regional/>

⁴⁸ For more information, see: <https://projects.worldbank.org/en/projects-operations/project-detail/P176788>

⁴⁹ For more information, see: <https://www.bancomundial.org/es/news/press-release/2018/07/31/el-metro-de-bogotaavanza-con-el-apoyo-del-bancomundial#:~:text=El%20Proyecto%20de%20apoyo%20a,obras%20de%20cimentaci%C3%B3n%20del%20viaducto.>

passengers and freight transport decarbonization, and work on the technical structuring and impact assessment of new energy access solutions with NCRE.

The acquisition of electrical fleets for public bus transportation systems in specific cities is being assessed by KEXIM and WRI, while UK-Pact is promoting national freight transport decarbonization through its Giro-Zero initiative, and UNDP is looking into transport digitalization through its ACCES initiative. UNEP is promoting regional integration for electromobility development through its MOVE program. Also, CAF, KfW, and AFD aim to support the acceleration of electromobility in different Latin American countries through their Electric Mobility and Low Carbon Transportation - EMOTION initiative.

Since 2019, the UK-Pact has funded the Support Program for the Deployment of Smart Grids in Colombia implemented by CarbonTrust, which has analyzed benefits and data from pilot projects developed in Colombia in the last few years.

USAID and NREL have provided assistance to the GoC, and more specifically to the MME and FENOGE, in the evaluation of potential promising hydrogen projects to receive support from FENOGE.

Recently, the UNDP established a cooperation agreement with IRENA to offer Colombia technical assistance in energy-related topics, which may include grid flexibility analyses and capacity building in hydrogen technology.

IV. Program Description

The objective of Colombia's CIF-REI IP is to support the decarbonization of the economy by accelerating the country's clean and inclusive energy transition. Specifically, the CIF-REI will: (i) reduce financial, technical, and operational barriers hindering the integration of renewable energy generation into the Colombian power grid; (ii) support the development of appropriate infrastructure, plus enabling conditions, for increasing amounts of variable NCRE to be incorporated in both grid and off-grid systems, and iii) support the emergence of large-scale energy demand with an active role in the operation of the system and the market price formation, adding to the flexibility necessary for a sustainable integration of intermittent generation.

CIF-REI concessional resources will catalyze MDB's financing, private investment and other cofinancing in technologies/projects required to meet the country's NDC and decarbonization commitments. The types of technologies, infrastructure, innovative models, and enhancement activities prioritized by the program which will be eligible for receiving funding correspond to those described below in the Supported Activities section.

CIF-REI resources will be implemented through two components led and executed by Bancoldex, FDN and FENOGE as follows:

Proposed Interventions

Component 1: Financing to support Colombia’s energy transition projects through Bancoldex and FDN (US\$ 79 m. IDB, US\$5 m. CTF, and US\$68 m. CIF-REI, US\$194.88 m. others⁵⁰). The objectives of this component to be executed through two separate operations with Bancoldex and FDN will be to support the decarbonization of the economy by reducing GHG emissions and accelerating the country’s clean and inclusive energy transition.

Bancoldex and FDN will use IDB funding along with CIF-REI concessional and non-reimbursable resources, accompanied by CTF resources in the case of Bancoldex, to provide financial support to public, private and/or public/private/popular developers of bankable clean and inclusive energy transition projects in Colombia through direct/indirect loans, contingent loans, and/or guarantees. Through this component, CIF-REI financing will be made available to any or all of the four types of activities prioritized under the program (see section Supported Activities below), thus potentially including AMI, battery energy storage systems (either at utility or distributed scale), transmission lines associated with NCRE projects, infrastructure associated with fostering an active and flexible energy demand, construction of EV charging stations and acquisition of electric vehicles, buses, vessels, trucks, trains, trams, subways or elevated railway systems; development of GH2 projects with potential to absorb variable grid NCRE power and rural electrification projects with participation from the private sector, among other related options as later described.

This program does not establish specific amounts to be allocated for each type of project or type of financing (direct or through financial intermediaries), but most of the resources will be used through direct financing based on Bancoldex’s and FDN project portfolios. Individual projects with direct financing will have access to funds starting at US\$1.000.000 with a maximum investment of US\$30.000.000.

To ensure inclusiveness, the program will design and implement incentives to access concessional funds as a tool to overcome some of the existing gender and social inclusion challenges in the energy sector. Some of the actions that will be required from public and private developers to be eligible to access to funds are: i) strengthening human resources and procurement policies with gender equality and social inclusion lens; ii) promoting female labor force participation in non-traditional

sectors such as construction, transport and energy by developing training programs for women in professional or technical areas; and iii) carrying out capacity building activities such as leadership training programs for women, recruiting techniques, selecting and hiring processes, and prevention and mitigation of gender-based violence and workplace harassment. Moreover, priority will be given to those projects that promote social inclusion and include tasks such as i) delivering training courses and workshops on labor inclusion of people with disabilities, ii) reviewing the feasibility of employment activities for people with disabilities, according to their skills, and iii) hiring of people with disabilities at equity conditions. Social and gender inclusion activities will continue to be planned and coordinated between the IDB and the Implementing Entities (IEs) towards implementation with MDB’s support, and alignment with sector policies.

⁵⁰ Including equity, commercial banks financing, and IDB Invest or other international financial institutions. Said amount is indicative, but anyhow considered to be the minimum possible expected co-financing from third parties, triggered by CIFREI concessional resources

The expected outcomes of this component include⁵¹:

- Acceleration of the decarbonization of the economy. The program anticipates an overall reduction of GHG emissions of approximately 110 kt CO₂ / year by 2030 from total financed projects and a cumulative reduction of 1.6 Mt CO₂ throughout their lifetime.
- Acceleration of the energy transition by providing financing for eligible projects. Financing from third parties mobilized by the program is estimated at, at least US\$280 million.
- Promotion of climate resilient energy infrastructure, through the incorporation of climate change adaptation criteria in all projects to be supported
- Promotion of social development under popular economy schemes, through sustainable rural electrification solutions based mainly on solar and biomass energy sources, and empowerment of users to act as prosumers and boost their participation in the electricity market thanks to the massification of AMI.
- Deployment of infrastructure and/or new fleets of vehicles and systems that increase the share of NCRE in the transportation sector, in both its public and private segments, accompanied by the adoption of NCRE purchasing mechanisms.
- Deployment of infrastructure and systems that increase the flexibility of the grid operation and energy markets.
- CIF-REI concessional financing may facilitate the deployment of first-of-its-kind private sector-led GH₂ and/or offshore wind projects. The development of such pilot projects shall lay strong foundations supporting the development of these technologies in the country and could assist in diversifying its sources of energy and in decarbonizing energy intensive sectors such as industry and transport. CIF-REI support towards the development of these technologies turns appropriate, following the growing interest from private developers and completion of the Hydrogen and Offshore wind roadmaps.

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- Increased in gender lens investing in renewable energy as measured through [2X challenge](#) certification⁵⁷.
 - Increased number of projects promoting social inclusion

Component 2: +H₂ Colombia Program (US\$0.12 m FENOGE, US\$2 m CIF-REI grant financing, US\$1 m other bilateral financiers). CIF-REI non-reimbursable technical assistance (TA) will be channeled by IDB and executed through FENOGE to support the “+H₂ COLOMBIA Initiative”. This initiative was launched at the beginning of 2022 by the MME and FENOGE to support the development of Colombia’s Hydrogen Roadmap by promoting and encouraging knowledge and applications of

⁵¹ Estimated outcomes are indicative, as final results will depend on the specific projects (under the CIF-REI eligible activities and GoC’s prioritized areas) financed by Bancoldex and FDN. In the meantime, the assumption used for obtaining indicative outcomes considering CIF-REI + leverage resources totaling US\$ 343.9 m., split as follows: US\$ 98.3 m. for NIZ solutions promoting the use of NCRE sources such as solar and biomass, US\$ 98.3 for EV charging infrastructure deployment and electric massive transportation systems, US\$ 49.1 m. for AMI deployment, US\$ 49.1 m. for GH₂ technology projects, and US\$ 49.1. m for energy storage projects.

hydrogen throughout its value chain in Colombia. The initiative will support pre-investment studies for prioritized hydrogen projects.

FENOGE launched the first call for proposals for hydrogen projects with the purpose of identifying potential projects that require pre-investment studies (pre-feasibility or feasibility) for the production, storage, conditioning, distribution, innovation, research, and/or industrial end uses. FENOGE received proposals throughout the hydrogen value chain that are being evaluated and prioritized for financing. CIF-REI grant resources will be used to co-finance pre-feasibility/feasibility studies for GH2 projects.

The Program will support FENOGE in the implementation of its Gender and Diversity Action Plan which includes: i) conducting a communication campaign to disseminate the relevance of integrating gender and diversity aspects when submitting proposals to FENOGE; ii) support gender mainstreaming⁵² in all projects and technical assistances; iii) delivering training activities to increase women's technical knowledge on clean energy, hydrogen production and conversion, hydrogen technologies, storage, sustainability, and financial market opportunities among others; iv) delivering training activities to increase FENOGE's staff knowledge on gender and diversity issues; v) promoting female labor force participation in the sector through jobs and skills programs targeting women and other social subgroups; and vi) selecting providers willing to promote gender equality.

Expected outcomes:

- 4 GH2 projects with pre-feasibility and/or feasibility studies ready for financing
- Increased number of hydrogen projects promoting gender and diversity equality
- Increased number of people (including women) trained on clean energy, hydrogen production and conversion, hydrogen technologies, storage, sustainability, and financial market opportunities

Supported Activities

⁵⁷ <https://www.2xchallenge.org/criteria>

Colombia's CIF REI co-financing will support the following activities (expected outcomes, indicators and relative targets are presented within section VIII and complete IRF in ANNEX VII):

i) Rural Electrification with NCRE

Projects or programs oriented towards the electrification of off-grid areas with NCRE, involving private investment which contributes to achieving universal electricity access by 2030 shall be able to receive concessional financing support as long as solutions to be provided can foster the

⁵² Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programs, in any area and at all levels. It is a strategy for making the concerns and experiences of women as well as of men an integral part of the design, implementation, monitoring and evaluation of policies and programs in all political, economic and societal spheres, so that women and men benefit equally, and inequality is not perpetuated. The ultimate goal of mainstreaming is to achieve gender equality." ECOSOC. 1997.

development of energy communities promoting a solar outburst (massive deployment in PV technology use) and/or popular and communitarian associative schemes where users play an active role in the appropriation, care and basic maintenance of these systems. These projects are to be developed, ideally, together with the identification of potential productive activities which can be supported or enabled through use of the electricity, and which may be stimulated in the context of popular economies, whenever applicable, maximizing the possibilities for these solutions to turn sustainable and scalable in the medium and long term.

The empowerment of communities to benefit from these solutions will facilitate the development of productive activities, in which renewable energy sources, such as solar, can be appropriated. In addition, capacity building activities can also be promoted to increase women's knowledge on the use, installation, and maintenance of solar panels as well as kitchen features using clean energy technologies.

Public-private partnerships (PPPs) represent an opportunity which has been analyzed to leverage resources in order to reach SDG7 goal on accessible and low carbon energy by 2030. Based on this, the GoC is currently structuring a scheme to promote private participation through PPPs, which may eventually be implemented. The design of the PPPs includes technical and financial requirements, contract structure, and rates for the remuneration of the investment. CIF-REI funds could support these types of partnerships by providing concessional financing that will allow the participation of private investors in areas/projects that are not otherwise financially viable.

At the same time, NCRE based solutions intended to substitute current diesel consumption for the production of electricity NIZ areas shall be eligible for financing, with the use of biomass being a possible substitute, besides solar PV to offer flexibility within hybrid systems.

With 269 MW of diesel based generating capacity, compared to only 26 MW in renewable energybased current solutions in NIZ, the MME and IPSE have identified the need to progressively substitute existing diesel-based solutions with NCRE based ones (e.g. solar and biomass).The MME has been working on the prioritization of communities where this substitution can begin to occur, and specific solutions for three communities in Chocó and Valle del Cauca have begun to be structured, with the aim of these being implemented with participation from the private sector. If such pilot projects are successful, the GoC would like to replicate them throughout the country.

The solutions shall additionally be accompanied by monitoring and information sharing capabilities which allow for a track record of quality and reliability to be kept and shared as may be necessary to produce effective evaluation of the effectiveness of these solutions.

In the case of zones in the areas of influence of the NIS (not considered as part of the NIZ), in which non-interconnected solutions represent lower costs and advantageous cost-benefit ratios compared to the interconnection option, such solutions may be considered to access resources from the CIF-REI program (as long as they correspond to rural areas for which there are no plans for the future extension of the network, thus maintaining their character as non-interconnected areas)

ii) **AMI, transmission and grid support infrastructure**

One of the expected outcomes of the CIF-REI program is to contribute to the massification of AMI in the country, enabling the active participation of users and the democratization of energy

generation and consumption empowered through the creation of interconnected energy communities. With this purpose, CIF-RE financing will be available for the execution of AMI massification plans, offering demand response capabilities and bringing long-run cost reductions to the system, accelerating implementation while reducing overall cost thanks to concessional conditions.

Studies indicate that cost savings derived from 75% AMI implementation in NIS by 2030 could be approximately US\$42 million/year, increasing to US\$429 m by 2040 and US\$726 m by 2050. Furthermore, a scenario of 100% decarbonization of the electrical system by 2040 with smart grids and NCRE show that benefits to be obtained would offer a net present value (NPV) of US\$4 billion by 2040. Additionally, the deployment of this infrastructure will allow greater involvement and awareness of users with their use and production of energy, allowing to develop markets where energy can be generated and sold at competitive prices, giving way to co-benefits such as the emergence of prosumers and active players within a democratized and open energy market that gives rise to the creation and dynamic participation of energy communities.

Transmission associated to NCRE: transmission network reinforcements or expansion for the integration of NCRE capacities, same as for neighboring countries grid interconnections shall constitute eligible projects for financing as long as concessional resources is proven to assist in the development of key specific activities enabling the project's materialization, and resilient criteria are incorporated within their design and construction.

Grid support infrastructure: furthermore, the deployment of energy storage systems and other technologies increasing the overall flexibility of the grid, from either demand or supply sides will be eligible for financing. For example, electric battery systems, including both utility-scale and distributed solutions could be financed, as they reduce the need for curtailment of future variable integrated sources. Other projects to be supported include those that finance technologies offering system stability within established operating parameters in response to changes in voltage, frequency or reactive power to be introduced by NCRE generation sources, such as STATCOMs, FACTS, DFACTS and similar synchronous compensation systems, among other possible technologies.

iii) Transport Electrification

The electrification of the transport sector represents the cornerstone for decarbonization of the most emissions-intensive, energy-consuming sector in Colombia. The transport sector also represents a large potential market for consumption and management of increasing volumes and surplus of power generation to be produced from variable sources. The MME, Ministry of Transport, UPME and National Planning Department (DNP), with the support of MDBs and other donors, are creating enabling conditions for the massification of electric vehicles.

Projects eligible for co-financing with CIF-REI resources include those generating a demand for NCRE based electricity, while establishing potential capabilities for acting as enablers of growing variable generation integration.

In such sense, projects building up EV charging infrastructure allowing battery based EVs to interact with the grid shall be eligible, same as the acquisition of battery based EVs themselves. Qualifiable EVs shall include either public or private owned vehicles to provide official, freight or public transport in either urban, intermunicipal or interdepartmental contexts. On the other hand, development of new electric based massive transport systems, promoting clean electric means of transportation for the general public, with affordable and equitable access, such as electric railway

based Subways, Trams or Elevated train systems shall be eligible for financing, as long as these procure their energy from NCRE projects, and/or incorporate infrastructure and strategies that increase demand flexibility and minimize the cost of intermittence, thus representing a new electricity demand which displaces the use of fossil fuels and can be supplied by expected wind and solar generating capacities to be integrated to the system, without the need for thermoelectric plants to operate. Experiences as those documented by (Climate Action, 2017), (Boudoudouh et Maaroufi, 2018) and (Sharpe, 2020) are good examples of ways in which these railway-based systems shall contribute to variable NCRE sources integration⁵³.

In the case of EV charging infrastructure, a recent study from the MME and DNP, financed by the IDB, proposes five different possible business models for rapid and fast charging infrastructure deployment, with either the combined or sole participation of public and private funding. The study is also structuring the two first pilots in which one or two of the proposed business models are to be implemented to install one charging station in a major city and another at a midpoint in a main connecting highway. Once the business model is decided, financing will be required to implement the schemes

Among possible prioritization criteria for financing the replacement of transport fleets with EVs, the contexts of vulnerable communities and air quality may be considered, as well as ecologically vulnerable areas in which the potential to eliminate associated damages caused by internal combustion vehicles (e.g. school vehicles or vehicles from the education and health sector).

All of the electromobility infrastructure to be supported will include climate risk assessments and will promote the inclusion of climate resilient criteria.

iv) Green hydrogen, offshore wind and other NCRE technologies

GH2: CIF-REI will provide concessional financing and non-reimbursable TA to support in the development of GH2 projects. Decarbonization of both the transport and industry sectors, which are the two most carbon-emitting energy-consuming sectors in the Colombian economy (with 37.5 Mt CO₂eq and 13.1 Mt CO₂eq produced in 2018, respectively), requires alternative solutions for fossil fuel substitution. Colombia has recently begun to work in the development of low emissions hydrogen production, based on its Roadmap for H₂ issued in 2021. In order for first milestones and goals to have the possibility of being achieved as early as 2030, high investments will be necessary, and concessional financing will be required to facilitate these investments and attract the private

sector, together with co-financing and possible grants from the public sector (e.g. through funds such as FENOGE, and funding by public-private owned companies such as Ecopetrol).

To specifically achieve such support to GH2 projects, this IP expects to provide assistance in the structuring of promising projects which may contribute to achieve gradual costs reductions, making these finally affordable to consumers. This should enable for future projects to be developed at lower cost without donor support. Through TA to be provided to first studies and the structuring of pilot projects, technical capacity building is expected to be created among local participating companies, and later on through NDBs to co-finance this technology. As an outcome of this support,

⁵³ This can be both by taking NCRE from the network, or by installing their own PV systems in stations or along tracks to supply part of the consumption of trains and stations, as is already being carried out in different cases (e.g. see references: El Colombiano, 2022 & Delta Electronics India, 2021).

knowledge is expected to be generated for local industry to procure, deploy and make equity investments in GH2 and build public confidence in GH2 to create a future growing market demand. Through Bancoldex and FDN, concessional financing could be provided to GH2 projects, mainly in the transport and industrial sectors.

Other NCRE technologies: Deployment of new or NCRE technologies not existent in the country, could be co-financed with CIF-REI. These technologies include offshore wind projects, which combined with GH2 production represent attractive opportunities for the future production of efuels for both domestic consumption and exports. In this sense, such technologies play a key role in Colombia’s energy transition towards a green productive economy which detaches from its current dependence on extractivism.

V. Financing Plan and Instruments

Requested budget envelope for investments

This section presents the financing plan for the implementation of the activities proposed to be supported by Colombia’s CIF-REI Program, including costs and sources of funding. The requested envelope for Colombia’s CIF-REI IP amounts to US\$70 million, of which US\$ 66.5 million correspond to concessional resources and US\$3.5 million to grant funding.

The IP proposes for CIF-REI resources to co-finance two components being: i) the Energy Transition Financing Program with Bancoldex and FDN; and ii) the +H2 Colombia Program managed by FENOGE.

* Concessional: conditions corresponding to an interest rate of 0.98%, up to 20-year tenure and 8-year grace period

** TA: non-reimbursable resources from CIF-REI and CTF

Table 3 presents how CIF-REI is to leverage and complement funding for such two components.

Financing Source →		CIF-REI (through IDB)			Leverage		
					IDB	CTF	Bancoldex, FDN and FENOGE’s own resources, BID Invest, equity and/or commercial loans
Component ↓ / IE →		Bancoldex	FDN	FENOGE	Bancoldex & FDN	Bancoldex	Bancoldex, FDN & FENOGE
1	Financing of Energy Transition	US\$34 m. (US\$33.25 m. concessional * + 0.75 m. TA**)	US\$34 m. (33.25 m. concessional * + 0.75 m. TA**)		US\$79 m.	US\$5.0 m. (3.5 m. concessional * + 1.5 m TA**)	US\$194.88 m.
2	+H2 Colombia			US\$2 m. (TA**)			US\$1.12 m.
Subtotal		US\$70 million			US\$280 million		
TOTAL		US\$350 million (70 m. concessional + 5 m. TA + 275 m. ordinary capital and from 3rd parties)					

* Concessional: conditions corresponding to an interest rate of 0.98%, up to 20-year tenure and 8-year grace period

** TA: non-reimbursable resources from CIF-REI and CTF

Table 3. Indicative financing plan for CIF-REI Colombia

Costs and sources of funding

CIF-REI resources will be allocated through IDB and channeled through Bancoldex, FDN and FENOGE.

Component 1: Financing to support Colombia’s energy transition (US\$79 m. IDB, US\$5 m. CTF, and US\$68 m. CIF-RE, US\$194.88 m. others). Financing from CIF-REI is proposed to co-finance an Energy Transition program with Bancoldex and FND. In the case of Bancoldex such program was approved by the IDB Board in December 2021 and is expected to be signed by the end of 2022. Bancoldex will use the IDB, CTF and CIF-REI resources to lower its financing costs and lengthen the loan periods, and to diversify its funding sources, thus better responding to the financing needs of private and public investors in sustainable energy and electric mobility in Colombia. In the case of FDN, the program will be conceived with starting leverage from IDB, to finance same prioritized enabling technologies. Each Implementing Entity (IE) will receive US\$34 m from CIF-REI (US\$33.25 m concessional financing and US\$0.75 m of technical assistance), to be used for financing projects meeting all CIF-REI eligibility criteria. In the case of Bancoldex, CTF funding (US\$3.5 m in concessional finance and US\$1.5 m in grant financing) specifically supports battery storage projects. This program is also expected to have US\$194.88 m in co-financing from third parties (including equity, commercial banks financing and IDB Invest or other international financial institutions).

In the case of non-reimbursable CIF-REI’s program funding, up to 1% of the total envelope amount is expected to be used to partially cover swap costs from dollars to Colombian pesos, , amounting to a total US\$700,000.

Recipients of funding under this program will be either private, public, or private-public owned companies or entities complying with the program’s eligibility criteria and the environmental and social safeguard policies of the IDB.

Costs, fees and financial conditions applicable to CIF-REI resources upon disbursement to Bancoldex and FND, will correspond to CIF funds Financial Terms and Conditions published in November 2020⁵⁴, complementing Operational Modalities for the Climate Investment Funds’ New Strategic Programs published as of April 2020.⁵⁵

Component 2: +H2 Colombia (US\$0.12 m. FENOGE, US\$2 m. CIF-REI non-reimbursable TA, US\$1 m. others). CIF-REI TA resources will be channeled through IDB and executed by FENOGE to cofinance both pre-feasibility/feasibility studies for GH2 projects, and design of GH2 pilot projects. FENOGE will contribute US\$0.12 m of its own resources and other development partners are expected to contribute at least US\$1 m.

Recipients of funds under this program will be either private, public, or private-public owned companies interested in developing GH2 projects. As per the guidelines of the +H2 Program, beneficiaries will need to contribute at least 10% of the cost of the studies. FENOGE launched in early 2022 a competitive process for supporting of green or blue hydrogen projects. The selection

⁵⁴ Available at:

https://climateinvestmentfunds.org/sites/cif_enc/files/meetingdocuments/joint_ctf_scf_cif_financial_terms_and_conditions_nov_10_0.pdf

⁵⁵ Available at:

https://www.climateinvestmentfunds.org/sites/cif_enc/files/meetingdocuments/joint_ctf_scf_22_4_cif_operational_modalities_new_programs_final_0.pdf

of prioritized projects was based on a set of criteria developed by FENOGE and were selected by a technical panel. Among others, selected projects had to demonstrate a clear commitment by the developer to implement the project if the pre-feasibility/feasibility studies demonstrate its potential for development (therefore the requirement that the developer provides at least 10% of the cost of the studies); and have a potential to be replicated or expanded beyond the pilot phase. Eligible projects for CIF-REI financing should only be those related to green hydrogen for the transport or industrial sectors.

VI. Additional Development Activities

Parallel activities to be funded by other development partners

Relevant parallel activities to those to be financed by the CIF-REI program include the following:

- **In the field of NIZ energy solutions with NCRE, the IDB is helping the GoC define business models to substitute diesel-based generation solutions, leading the way to structure solutions which CIF-REI resources could finance.** Also, the FDN is assessing and structuring possible auction mechanisms to expand the service coverage through PV stand-alone systems and/or NCRE based microgrid solutions. By the end of 2022, results are expected to be ready, so the new administration may consider the possibility of using auction schemes to incorporate private capital funding and participation for the development of sustainable rural electrification solutions which contribute to achieving universal access by 2030. With financial support from UK-PACT, GGGI has also been offering assistance to the MME and IPSE, same as to subnational entities and private developers advancing sustainable energy solutions which may become accessible to rural communities and vulnerable homes, in alignment with State policy guidelines.
- **CarbonTrust provides technical assistance to UPME and the MME in the deployment of smart grids in Colombia since 2019, thanks to funding provided by UK PACT.** As of 2022, no

information is known on donors or cooperation partners providing grant or concessional funding to pilot AMI projects, which have been developed mainly by major grid operators.

- **Multilateral and bilateral financing entities with direct access to the private sector, including IDB Invest, IFC, KfW and AFD are currently working in the financing or identification of projects for financing in the areas of GH2, offshore wind, regional integration transmission lines, AMI and e-mobility.** At the same time, AFD, GIZ, USAID, PNUD, KEXIM, CAF, IDB and WB currently provide technical assistance to the MME and FENOGE for the implementation of the Colombian Hydrogen Roadmap⁵⁶. In regard to offshore wind development, WB is supporting the MME in advancing enabling conditions to the extent possible, defining steps to be carried out towards the development of the first of such projects in Colombia.
- **In regard to new transmission projects enabling the integration of increased renewable energy shares, and incorporation of technologies offering grid flexibility capacities, the WB provided TA to UPME to develop the studies to enable the development of the first HVDC transmission line connecting La Guajira with central NIS.** In the case of the first utility scale storage project to be developed in Colombia, commercial banks have provided financing facilities for the

⁵⁶ Detail on the activities that each of these cooperation partners has recently conducted or is currently conducting in regard to Low Emissions Hydrogen and other areas of support of relevance for this IP can be checked in Annex IV

development of said infrastructure expected to be in operation by 2023⁵⁷. Also, three DFACTS systems are currently being developed in the region Guajira -Cesar – Magdalena, to enable adequate system operation, as per UPME’s analyses, upon the entry of three wind park projects expected to be there connected.

- **WWF’s NAMA Support Project (NSP) for facilitating enabling conditions to promote electromobility through both financing of EV fleets and the provision of technical assistance.** Such an NSP proposal for a EUR 19.6 million grant was presented to the NAMA Facility by the Ministry of Transport and the MME, with the assistance of WWF, back in 2018, and its detailed preparation funding was completed by 2021. However, implementation funding was not approved. The NSP considered the possibility to finance last mile delivery electric transport, same as electric public transportation fleets and charging infrastructure. The GoC now foresees the possibility of presenting this project for funding of other global funds supporting electromobility and sustainable transport. If this initiative gains funding within the next two to three years, synergy with CIF-REI could be procured for EV charging stations deployment and new EV fleets financing.
- **A NAMA Support Project (NSP) proposal for supporting production and use of green hydrogen for the decarbonization of the industry sector was prepared and presented by IDBG in 2022.** This NSP applied for a EUR 25 million grant, of which EUR 23.25 million would be made available for providing financial support to GH2 projects, and EUR 1.75 million would be used for technical assistance. It was estimated that preliminarily considered projects could require as much as EUR 337 million in additional funding to be completed by 2030. The tentative project pipeline under such NSP considered green fertilizers production (via GH2 for ammonia and urea production), use of GH2 and natural gas blends in non-ferrous metal manufacturing, substitution of yellow hydrogen with GH2 for vegetable oil hydrogenation, steel galvanization and floated glass manufacturing. The outline also considered support for an H2 fuel-cell forklift-truck pilot

project, plus the structuring of larger cement and steel industry projects to be developed beyond 2030. The NAMA Facility did not choose this project for financing on its 2021-2022 round, but the proposal may be reformulated to apply once more to the Facility or other financing sources.

VII. Implementation Potential with Risk Assessment

Implementation and Risk Potential

Implementing the proposed CIF-REI Investment Plan faces great potential and appetite from investors as long as resources can be delivered at competitive financial conditions. At the same time, implementation faces risks associated with the financial terms, new technology, borrowers’ creditworthiness, new regulation, environmental and social impacts, plus general political stability.

Financial Terms.

The Colombian energy sector and financial institutions are strong. There is a track record of experience in receiving non-reimbursable and reimbursable resources and successful implementation. However, there is a high risk that demand for loans is lower than expected due to

⁵⁷ <https://elnorte.com.co/index.php/2022/04/26/scotiabank-otorga-credito-a-empresa-que-desarrollara-proyecto-de-almacenamiento-de-baterias-en-atlantico/>

the financial conditions which may be offered by CIF-REI implementing entities. Due to the historic COP depreciation trend and associated volatility, accepting debt in US\$ represents a high cost for local financial institutions and sub-borrowers (developers). Loan repayments in COP to cover a US\$ loan could increase over time, and premiums will be expensive for hedging options. Lending CIF-REI resources in local currency could mitigate this risk, safeguarding their concessionally. In addition, there is a low probability that some sub-borrowers could face a lack of creditworthiness or an inability to comply with implementing banks' requirements to access the resources. For reducing such risk, loans would have to be secured through collateral or specific guarantees.

Technology.

Development of NCRE off-grid solutions based on mature technology, EV charging infrastructure, and AMI deployment do not represent a high technological risk based on international and local pilots' experience. However, green hydrogen technology so far known to few may carry a high technology risk when considering the current low track record, reduced commercial availability, uncertainty in overall performance, and assets' useful life. Also, although there are several international experiences with the construction and operation of HVDC lines, Colombia does not currently have any expertise on the matter, making this a novel electricity transmission / transport technology. Involvement of expert global engineering firms, knowledge and technology transfer, capacity building, and technical support will thus be necessary to mitigate these technological risks.

New Regulation.

A robust legal and regulatory framework exists in Colombia, seconded by solid institutions. The overall regulatory environment is positive, as remarked by Climatescope (2021) and former Ease of Doing Business (2020). There are areas, however, where the regulation requires adjustments and definition, such as robust planning that account for the emerging uncertainties of grid expansion in the energy transition, technical standardization and remuneration models for electric vehicle charging infrastructure deployment, AMI massification, remuneration models for efficient system flexibility services, new business model adoption for NIZ electrification, and green hydrogen development. Delays in the definition of expected regulations would jeopardize implementing projects in these areas. Therefore, a high commitment from the National Government is required and expected for new standards and regulations to be issued on a timely manner.

Environmental and Social Impacts.

Possible mishandling and disposal of elements like batteries, fuel cells, PV panels or electrolyzer stacks represent an environmental hazard that must be considered and addressed. Mitigation measures include classifying components to be reused, recycled, and disposed of, complying with applicable national and international regulations and MDB's safeguards policies. The water used to produce H₂ could eventually reduce water availability for other uses (agriculture, human and animal consumption) depending on project siting. Project feasibility studies should identify these risks and formulate and ensure the application of appropriate mitigation measures.

Likewise, depending on the scale and location of the projects, the times for requesting and obtaining environmental licenses or permits, as well as for carrying social consultation processes, must be highly considered in the planning stage of projects, anticipating any delays which could jeopardize execution. This is to be specially regarded based on new safeguards to come into place in the near future, as derived from the recent approval of the Escazu Agreement by the Congress of the Republic of Colombia.

With new technology such as massification of AMI, people could lose their jobs associated with tasks as meter-reading and user disconnection and reconnection manual procedures. Staff training and new employment opportunities for AMI maintenance could help mitigate this social impact. Rural electrification could impact people’s culture and customs in NIZ. Proper consultation with communities shall ensure project structuring and implementation which benefits relevant parties without producing counterproductive effects.

Political Stability.

The juncture of facing a current change in Government administration can generate a general sense of caution and perception of risk for some investors. However, priorities and objectives announced by the incoming Government administration in terms of considering the energy transition and climate change as fundamental pillars to be sustained and further developed as State policy, completely align with the CIF REI Investment Plan and reduce such risk significantly.

The following table summarizes risks considered, together with proposed mitigation actions and a qualitative assessment of expected residual risk:

Table 4. Risk Analysis

Risk	Description / Mitigation	Residual Risk
Financial Terms	COP depreciation trend over time makes loans in US\$ represent high capital costs compared to COP loans. Lending CIF-REI resources in local currency would mitigate this risk. If such does not turn possible, the residual risk is considered to be High.	Mod Low
	Some final borrowers could face a lack of creditworthiness or an inability to comply with MDB’s and intermediary banks’ requirements to access the CIF-REI’s resources. Loans would have to be secured through collateral or specific guarantees.	
Technology	While NCRE off-grid solutions, EV charging infrastructure, and AMI deployment do not represent considerable technological risk or uncertainties, green hydrogen and HVDC projects do for the Colombian context. Involvement of global expert engineering firms, capacity building, and technical support will be necessary to mitigate such risk.	Low
Regulation	Delays in the definition of new regulations would jeopardize massification of AMI deployment, electric vehicle charging infrastructure, rural electrification in NIZ, and hydrogen development activities. A high commitment from the National Government is required to issue new standards and regulations on a timely manner.	Low

Environmental	Mishandling and disposal of hardware elements like batteries, fuel cells, electrolyzer stacks and others, represent a potential environmental hazard. Mitigation measures to manage such risk include proper reuse, recycling and disposal, complying with strict regulations and MDB's safeguards policies. Water used to produce H2 could reduce water availability for other uses (agriculture, human and animal consumption), which is why project p feasibility studies shall include proper siting and ensure adequate mitigation measures. On the other hand, the time and complexity associated with obtention of environmental licenses and permits, in line with current applicable regulations, must be taken into account to prevent possible delays from undermining project viability and proper execution.	Mod
Social	With AMI deployment, staff carrying meter-reading and user disconnection and reconnection tasks could lose their jobs. Staff training for AMI maintenance and employability could help mitigate this social impact. Rural electrification could impact people's culture and customs in NIZ. Proper consultation with communities shall ensure project implementation that benefits them without causing major counterproductive effects. Projects execution must also beware of times and challenges associated with social consultation processes, in order to anticipate possible delays and prevent them from causing severe negative impacts.	Low
Political Stability	CIF-REI Investment Plan's alignment with prioritized State policies reaffirmed by the incoming Government administration shall guarantee protection of proposed investments.	Low

Absorptive capacity for REI Program and associated investments

As mentioned earlier, the CONPES 4023/21 defined a 2021-2026 Government's economic reactivation plan including the energy and transport sectors, with investments of US\$4.7 billion (COP18,900 billion) to accelerate country's green energy transition and the decarbonization of the transport sector. This plan has the capacity to absorb the proposed CIF-REI Investment Plan of US\$70 million plus US\$280 to be leveraged. Colombia's macroeconomic context, together with an existing comprehensive legal and regulatory framework, enables it to receive concessional financing same as technical assistance cooperation to support the country's energy transition.

Both Colombia's financial system and developers' execution capacities are suited to absorb required capital and project development challenges, in line with economic recovery and green sustainable growth provisions. Furthermore, the offering of concessional resources through the CIF-REI program, targeting specific investments, represents a clear signal to investors interested in those pillars in which the country intends to accelerate its development.

The fact that the country ranks among the best-qualified countries in the world in terms of economic transformation (No. 31 of 137) as per the BTI Transformation Index 2022⁵⁸, and other related

⁵⁸ <https://bti-project.org/en/reports/country-report/COL>

categories (e.g., position No. 50 of 137 in good governance), illustrates favorable conditions to motivate and attract local and foreign investment. Ranking No. 67 among 190 countries in the Ease of Doing Business index (2020) and 13th among 107 countries in Bloomberg’s 2021 Climatescope contribute to such evidence.

VIII. Integrated Approach to Monitoring, Evaluation and Learning

The Monitoring, Evaluation and Learning approach for Colombia’s IP, based on the CIF-REI’s Integrated Results Framework (IRF), is established by the Government and national implementing entities, in cooperation with the MDBs, for the purpose of enabling the tracking and reporting of progress throughout the achievement of outcomes and objectives, mirroring the results chain from the execution of IP support activities presented in Section V. Within this integrated approach, measurement of program and project impacts are captured via multiple dimensions of monitoring, evaluation, learning, and other key cross-cutting approaches such as gender inclusion, coalesced within the objective of delivering a nuanced and holistic understanding of the program’s progression, and thematic specificities, in delivering a complex and multifaceted program goal.

Theory of change and IRF

In a general sense, each Support Activity considered under this IP aims to address specific barriers towards reaching larger integration of NCRE in both NIZ and NIS areas. Through execution of said activities, thanks to the use of concessional resources, specific outcomes are expected to be obtained as illustrated by **Error! Reference source not found.**, presenting the program’s general Theory of Change approach applying to Colombia’s IP. Furthermore, specific indicators are defined already in connection with the IP’s Integrated Results Framework (IRF), as presented in Table 7, which shall allow monitoring and assessment of achievements to be obtained based on conceived program expectations. Anyhow, it is necessary to point out that, having assumptions been made on the type of investments that sub-borrowers will finally undertake, and the type of projects that will end up meeting eligibility criteria, targets set for these indicators are rather tentative and indicative, with final results to be obtained highly depending on what sub-borrowers’ preferences and IEs financing assessment decisions shall end up being.

Table 5. Theory of Change concept map

Component 1	Component 2
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Barriers	<ul style="list-style-type: none"> Lack of enough public resources, and combined private investment, for rural electrification so as to achieve universal access by 2030 Territory's complexity, difficult access, and low user income / revenues as challenges for building necessary infrastructure reaching non-served users in NIZ and providing them with reliable and sustainable energy solutions 	<ul style="list-style-type: none"> High cost of technology shift Overall market based on fossil fuel Risk perception from investors and financing entities making credit access difficult 	<ul style="list-style-type: none"> Pending regulation to offer certainty to Grid Operators for deployment of AMI plans and investments (to be surpassed in 2023) High investments upfront cost (approx. US\$ 2 billion) 	<ul style="list-style-type: none"> High technology costs (e.g. energy storage and HVDC) Lack of proper grid infrastructure to offer reliable service in specific NIS areas (complex to address) Environmental licensing and social consultation processes cause prolonged delays and costs in execution of transmission projects Lack of priority among involved parties for grid interconnection materialization in between countries 	<ul style="list-style-type: none"> High upfront costs of new technologies Lack of local skills and knowledge Pending Market reforms (to be surpassed in 2023) Difficulty of new agents to obtain adequate financing for developing NCRE based projects under Project Finance (compared to incumbent agents being able to use Corporate Finance structures) 	<ul style="list-style-type: none"> Lack of proper project structuring High upfront costs of new technologies Lack of local skills and knowledge
Supported Activities	<p>Rural Electrification</p> <ul style="list-style-type: none"> Reaching non-served users with NCRE based solutions (may include batteries) Substituting diesel based existing generation solutions with NCRE based systems (may correspond to hybrid systems and include batteries) 	<p>Electrification of Transport</p> <ul style="list-style-type: none"> Deploying EV charging infrastructure Developing electric based massive transportation systems such as Metro, Tram Train and similar type systems Acquiring EV fleets (public or private) 	<p>AMI Massification</p> <ul style="list-style-type: none"> Accelerating deployment of AMI (e.g. smart meters and other related infrastructure to be installed by 2024 Vs 2029) 	<p>Transmission and Grid Support Infrastructure</p> <ul style="list-style-type: none"> Developing NCRE transport or grid interconnecting transmission lines Developing grid connected storage systems (either utility type or as part of decentralized systems) Deploying STATCOM, FACT or DFACT systems 	<p>GH2, Offshore wind and Ocean Energy Technologies</p> <ul style="list-style-type: none"> Developing of GH2 projects for transport and industry applications Developing first stages of offshore wind planned projects Supporting ocean energy technology based projects 	<p>GH2 support at pre-investment stages and pilot projects</p> <ul style="list-style-type: none"> Executing GH2 pre-investment studies Developing GH2 pilot projects
Main expected outcomes	<ul style="list-style-type: none"> Contribute to expanding offgrid energy access through NCRE, and reaching 2030 universal energy access goal, through incorporation of private funding 	<ul style="list-style-type: none"> Contribute to substitution of fossil fuel based transportation, and reaching 600,000 EVs registered by 2030, through lowering financial costs and triggering 	<ul style="list-style-type: none"> Contribute to achievement of 75% NIS users with AMI by 2030, and accelerating such massification through 	<ul style="list-style-type: none"> Contribute to the incorporation of 3,6 GW of NCRE (solar and wind) capacity expected to enter operation before the end of the decade, through 	<ul style="list-style-type: none"> Contribute to the development of GH2 as key element of the clean and just, inclusive Energy Transition, through progressive upfront cost 	<ul style="list-style-type: none"> Contribute to the development of GH2 as a key element of a clean and just, inclusive Energy Transition, through high upfront cost reduction,

			offering financial			
	and participation Transformational change: private investors assume an active participate in rural, inclusive electrification projects based on financing facilities combined with available regulatory instruments	investment decisions Transformational change: electrification of transport (promoting open and equal access) is accelerated as concessional financing makes massive deployment of infrastructure possible, and acquisition of new EV fleets	facilities to Grid Operators Transformational change: AMI enables consumers to provide flexibility to the grid and be able to participate of the market as prosumers, at the same time as the development of energy communities is supported, contributing to the democratization of the energy sector	financing of grid support infrastructure Transformational change: grid support infrastructure is built responding to NCRE integration needs	reduction • Untapping a large NCRE potential which minimizes affectations over population and communities (allowed by offshore technologies) Transformational change: first projects developed as a necessary step towards achieving cost reductions, learning and local capacity building allowing for a future GH2 economy to be possible	proper project structuring and capacity building Transformational change: Local technical capacity, experience and knowledge begins to be built for the development of a future GH2 economy

While the left hand-side columns of the IRF (see Table 7 below), are intended to track key program and project performance, through core indicators defined within CIF-REI’s base IRF, in response to particular Country’s IP objectives, right hand-side columns focus on evaluation and learning approaches, encompassing transformational change signals across 5 relevant dimensions including relevance, systemic change, scale, speed, and adaptive sustainability.

Relevance: Colombia’s IP is based on the consideration that the country requires to achieve transformational changes based on all four types of supported activities here considered. Although some of these activities, such as rural electrification and electrification of transport through NCRE, could be considered to embed a higher priority based on the associated social benefit or a higher impact on GHG emission reductions to be achieved, in principle all of these four types of activities will have equal opportunities to access CIF-REI financing based on the initiatives that investors may present in alignment with the IP and compliance with all eligibility criteria.

Systemic change: through cross-cutting incorporation of gender and minority inclusion approaches within all potential projects to be financed using CIF-REI’s resources, this IP expects to achieve a punctual but progressive impact in terms of how such vision and approach can be integrated into

the development of various types of projects in the energy sector, and more specifically within those framed in the development of a fair and inclusive energy transition.

Scale: in terms of scale, even though the amounts of investment that the country is planning to execute towards the achievement of the energy transition, the economic recovery and overall sustainable growth are considerable, and the resources of the CIF-REI program represent only a small fraction of that total, the purpose of this IP is rather to support marginal progress and objectives which shall be anyhow significant in terms of their replicability and scalability, to the extent that other agents and programs should be able to build over gained experiences and results expected to be obtained.

Speed: the speed factor to be applied over the just transition implies that the introduction of new technologies, such as the deployment of AMI or the adoption of massive electric transportation systems (e.g. Bogota's Metro system), must be accompanied by generation of new employment opportunities to be offered equitably and with priority to those actors who are negatively impacted. In this sense, the affectation to be produced on stakeholders such as, for example, personnel in charge of recording analogous meters readings, or fossil fuel based public transport drivers, shall be duly considered at the initial stage of these projects' funding, and actions shall be undertaken to mitigate effects specially over vulnerable communities. The pace at which these mitigation measures can be applied shall determine the speed at which the new projects should be developed.

Adaptive Sustainability: In the case of rural electrification projects, the identification of productive activities that can be associated and promoted thanks to energy solutions provided, becomes highly relevant considering such income can be decisive for ensuring the sustainability and scaling-up possibilities of the project. Likewise, the generation of initiating human capacities in terms of knowledge and skills around new technologies, in fields such as those of electrolysis or energy storage systems, shall contribute as a catalyst seed for the progressive development of quantities and levels of knowledge sufficient to meet the scale of transformation that the country's energy transition will progressively require.

Different signals over transformational changes to be produced throughout the program's execution can be addressed and analyzed through impact assessments, just transition, co-benefit or social and gender inclusion studies, as well as through other specific learning-oriented activities. This task should be addressed through evaluations and studies promoted by the CIF, the country and the MDBs, as deemed appropriate based on the activities of the program that shall end up receiving financial support. In short, the proposed approaches should make it possible to combine systematized monitoring with research and evaluation designed to complement each other, taking advantage of mixed methods that, through different tools and forms of evidence, contribute to building a comprehensive and clear view on what will end up being achieved and learnt from the program's implementation.

Table 6. Colombia's IP IRF ⁵⁹

CIF INTEGRATED RESULTS FRAMEWORK – RENEWABLE ENERGY INTEGRATION PROGRAM COLOMBIA						
CIF IMPACT Accelerated transformational change toward net-zero emissions and inclusive, climate-resilient development pathways						
RESULT STATEMENT	MONITORING APPROACH				EVALUATION AND LEARNING APPROACH	
	INDICATORS	DESCRIPTION	BASE LINE	MEANS OF VERIFICATION	TARGET	KEY AREAS
CIF-LEVEL IMPACTS						
Accelerated transformational change toward net-zero emissions and inclusive, climate resilient development pathways	CIF 1. Mitigation: GHG emissions reduced or avoided (mt CO2 eq)	Built up and calculated for this particular CIF investment based on contributions from # of installed EV charging stations, # of acquired EVs, new electric based massive transport systems displacing fossil fuel consumption, # of users for which smart meters are installed, NIZ NCRE based solutions in MW capacity and MWh/year production against BAO projected diesel consumption, GH2 production displacing fossil fuel consumption in transport and industry applications, and other NIS emission reductions to be achieved from storage or other grid flexibility capabilities offered by grid support infrastructure to be developed.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual and lifetime reporting by projects and/or countries (to be fed in this case by REI CORE 1 indicator below).	To reflect REI CORE 1 indicator's target.	<p>Transformational Change: understood as deep and fundamental change in a system's form, function, or processes, in the context of global climate crisis. Within Colombia's CIF-REI IP this refers to profound, rapid changes in social, economic, and technical systems contributing to achieving net zero greenhouse gas emissions by 2050, increase social inclusion, managing distributional impacts, enhancing resilience and adaptation to climate change, and reducing stress on finite natural resources.</p> <p>Signals of transformational change will be assessed through both evaluative and learning-based approaches across five dimensions (including relevance, systemic change, scale, speed, and adaptive sustainability). Unlike indicators, signals mark multiple levels of complex systems dynamics based on mixed-methods data collection and analysis of CIF contributions toward transformational change in-situ. As these signals are highly context-specific, they are proposed and will be defined, tracked, and reported on according to the context analysis applicable to each support activity to be developed within the IP. Disaggregated data collection to capture impacts on women, Indigenous Peoples, people with disabilities and local communities, is intended. Ongoing learning and adaptive approaches, shall also be possible throughout the identification and tracking of new and emerging signals as programs and contexts evolve.</p>
	CIF 2. Adaptation: Strengthened climate resilience of land (ha), people (#), and physical assets (\$) through a CIF supported adaptation mechanism	Based on resiliency features incorporated within the design and construction of financed infrastructure and installation of technology assets. Also based on users accessing climate change resilient NCRE solutions.	Already implemented or programmed and financed resiliency measures, and users benefited from solutions similar to those to be financed with CIF-REI funding.	Reporting from projects on built and deployed infrastructure and technology assets, same as on number of benefited users.	To be fed on targets set for REI CORE 2, REI CORE 4, REI CORE 7, REI CORE 9 and OPTIONAL indicator on Increase in grid interconnections to accommodate higher shares of VRE (#).	
	CIF 3. Beneficiaries: Number of women and men benefiting from CIF investments	To consider users benefiting from rural electrification solutions, AMI deployment, EV charging infrastructure, electric transportation fleets and systems, and other infrastructure and technologies to be developed under the program.	Already benefited or planned to be benefited users from implemented or programmed and already financed solutions as those to be financed with CIF-REI.	Reporting from projects on number of benefited users.	To be fed on targets set for REI CORE 4, and applicable REI PROGRAM-LEVEL COBENEFITS and REI PROGRAM-LEVEL OUTPUTS indicators.	Gender-Transformative Impacts: The CIF Gender Program outlines (i) improved asset position, (ii) voice, and (iii) resilient livelihoods of women through gender-responsive institutions and markets as its key impact objective. These aspects are to be assessed through evaluative and learning-based approaches, as relevant to the REI program, and in combination with other monitoring data. Areas which shall be further analysed in the specific case of Colombia's CIF-REI IP are: mechanisms through
	CIF 4. Co Finance: Volume of cofinance leveraged (USD)	Actual project co-financing volume.	That raised by other CIF programs.	Actual final co-financing as reported by projects.	To be fed on target set for REI CORE 6.	which women and their organizations are represented in decision-making on renewable energy New and additional climate finance mobilized: Beyond the immediate co-financing CIF leverages, Colombia's CIF-REI IP aims to play a role as a market catalyst by contributing to triggering further non-concessional financing through replication of CIF investments in technologies, infrastructure, innovations and other areas. Evaluation and/or learning approaches shall be employed to better understand CIF's contributing role in market systems transformation and volumes of follow-on green financing in CIF-supported markets. For this purpose extending beyond direct benefited project co-financing, country metrics by sources such as IRENA, BloombergNEF or others shall be of use.
<p>Program Theory of Change: If Colombia's CIF-REI IP provides enabling technologies and infrastructure, and develops new business models, the country will increase renewable energy penetration in its energy mix, achieve a more flexible and decentralized energy system, improve local capabilities, mobilize capital, increase renewable energy access, reduce systems costs, and foster renewable energy innovation, which will all contribute toward CIF's transformative impact.</p>						

⁵⁹ Proposed Targets are indicative, as final results will depend on final sub-borrowers' decisions. This table is also provided in Excel format as a reading aid.

RESULT STATEMENT	MONITORING APPROACH					EVALUATION AND LEARNING APPROACH
	INDICATORS	DESCRIPTION	BASE LINE	MEANS OF VERIFICATION	TARGET (DATE)	KEY AREAS
REI PROGRAM-LEVEL IMPACTS						
Flexibility of energy systems for smooth integration of higher shares of variable renewable energy generation into the grid and increase in off grid access to renewable energy is enabled	REI Impact Proxy 1: NCRE country's installed capacity	Renewables based electric generating capacity excluding Hydro (i.e. solar, wind, biogas and biomass)	367.1 MW (as reported by XM as of Feb 2022)	XM (NIS Operator) reporting	3,999 MW (2026-2030)	Signals of transformational change: Signals at the program level will focus on more narrowly bounded aspects of energy systems transformation compared to CIF-level impact's section. Proposed signals to be observed and analyses throughout Colombia's IP implementation include those arising from the overall framework in which an envisioned 3.6 GW NCRE project pipeline is expected to be successfully developed to enter operation within the next 4 years (2023/2026), same as those from rural electrification context and endeavours to achieve universal access to electricity by the beginning of next decade, and evolution of patterns within rapid electrification of transport, AMI deployment and GH2 production and adoption as a relevant energy carrier enabling decarbonization (indirect electrification) of industry and heavy transport sectors. Gender and just transition elements: The program impact-level allows space for further evaluations, assessments, and other approaches to take place as the program evolves in these areas. These activities are to be closely coordinated with IEs and are expected to be applied broadly across the program.
	REI Impact Proxy 2: Overall country access to electricity	generating capacities) Fraction of total country households with access to electricity	96.5% as of 2018	UPME's ICEE methodology and score	100% (2030-2035)	
	REI Impact Proxy 3: Overall registered EVs	Nation-wide overall number of registered EVs	8,128 EVs as of 31st May 2022	RUNT's (Single National Transit Registry)	600,000 (2030)	
	REI Impact Proxy 4: Overall users with AMI		Almost 540,000 users currently have access to AMI, representing little below 3,5% of total NIS users, as reported			
	REI Impact Proxy 5: NDC compliance	Achieving emission reductions against BAU scenario, in order to reach 2030 goals	by the Domestic Public Services Superintendency in 2022 Total emissions of 279 MT CO2eq as of 2018 (BUR3 Colombia, 2022) Vs BAU @2018 of approx. 269 MT CO2eq	Biennial Update Reports prepared by the country (Ministry of Environment and Sustainable Development, through the Institute of Hydrology, Meteorology and Environmental Studies - IDEAM as its affiliated entity) and presented to UNFCCC	Limiting emissions to 169 MT CO2eq by 2030	
RESULT STATEMENT	MONITORING APPROACH					EVALUATION AND LEARNING APPROACH
INDICATORS	DESCRIPTION	BASE LINE	MEANS OF VERIFICATION	TARGET (DATE)	KEY AREAS	
REI PROGRAM-LEVEL OUTCOMES						
A. Increased penetration of variable renewable energy into power systems and maximized renewable energy potential of countries	REI CORE 1. Mitigation: GHG emissions reduced or avoided (t CO2 eq) – direct/indirect	Built up based on # of installed EV charging stations, # of acquired EVs, new electric based massive transport systems displacing fossil fuel consumption, # of users for which smart meters are installed, NIZ NCRE based solutions in MW capacity and MWh/year production against BAO projected diesel consumption, GH2 production displacing fossil fuel consumption in transport and industry applications, and other NIS emission reductions to be achieved from storage or other grid flexibility capabilities offered by grid support infrastructure to be developed.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual and lifetime reporting by projects.	Overall 1.644 mT CO2eq reductions over projects lifetime and 110 kT CO2eq / year reductions by 2030	Colombia's IP undertakes "whole of energy systems" analyses generating previously outlined country proxy indicators, as the contextual baseline over which financing of activities to be supported will take place, same as within which project appraisal process and monitoring, evaluation, and learning aspects are to be incorporated. Based on such analyses, and initial assumptions on investments that sub-borrower entities shall end up executing, tentative renewable energy grid and off-grid integration interventions are envisioned in association to expected renewable energy installations, annual electricity production, final energy use applications, GHG emissions reductions, and social empowerment through access and democratization of energy use and production. Both estimated and real operational data is then to be consolidated effectively to report across these multiple indicators. Moving down the results chain, the monitoring function becomes increasingly important to capture program outcomes and outputs, whereas the evaluation and learning function will complement core indicators by filling strategic knowledge gaps. Evaluation and learning activities will be selected based on overall stakeholder demand, evidence gaps, and cross-learning opportunities.
	REI CORE 2. Installed Capacity: installed capacity of variable renewable energy available to the grid (MW) – direct/indirect	Based on installed capacity for rural electrification, integrated capacity in association with green H2 production, integrated capacity in association to power delivered through EV charging stations, and integrated capacity for running an electric massive transportation system.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	124 MW (tentatively split as 12.5 MW PV and 0.5 biomass for NIZ solutions, 57 MW PV for EV power, 29 MW PV for GH2 production, and 25 MW wind for massive transport system power) by 2027	

REI CORE 3. Renewable Energy Production: Annual renewable energy output (MWh)	Electricity produced based on financed installed capacity.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	256,000 MWh (2027)
REI CORE 4. Grid Services: Increase in available grid services and improvements (#) (#)	# of users accessing specific real time monitoring and control capabilities both in NIZ and SIN.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	345,560 users (2027)
OPTIONAL: Increase in grid interconnections to accommodate higher shares of VRE (#)	# of grid interconnection projects.	0 as taken from BAU based scenario to determine CIF-REI contributions only.	Annual reporting by projects.	1 project (2027)
OPTIONAL: Reduced curtailment (% or MW)	N/A	N/A	N/A	N/A
OPTIONAL: Reduced loss of load (% or MW)	N/A	N/A	N/A	N/A
OPTIONAL: Reduced reserve inadequacy (% or MW)	N/A	N/A	N/A	N/A
OPTIONAL: Reduction in unplanned energy system outages (#)	N/A	N/A	N/A	N/A

B. Improved policies, plans, and institutional capabilities	REI CORE 5. Policies: Number of policies, regulations, codes, or standards related to renewable energy integration that have been	N/A	N/A	N/A	N/A	N/A
C. Mobilized public and private capital	REI CORE 6 (= CIF 4). Co-Finance: Volume of co-finance leveraged (USD)	Actual co-finance resources entering into CIF-REI benefited projects	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	US\$ 280 million (2026)	
D. Increased renewable energy access	REI CORE 7. Renewable Energy Access: Number of women and men, businesses, and community services benefiting from improved access to electricity and/or other modern energy services – direct/indirect (# of people)	# of users benefiting from NIZ and AMI solutions	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	345,560 users (19,560 users benefited from NIZ solutions and 326,000 from AMI) by 2027. 40% of said users are estimated to correspond with female led households.	Gender-responsive aspects of energy access can be studied in more detail through targeted research, evaluations, and/or case-studies. Examples of relevant issues include those identified within consultations to relevant stakeholders on gender issues such as are: supporting gender mainstreaming in all projects and technical assistances while increasing knowledge on gender and diversity issues, delivering training activities to achieve increasing technical knowledge and skills on new technologies while promoting female labor force participation, targeting women and other social subgroups; selecting providers willing to promote gender equality, and raising women's awareness and ability to use electricity access for productive purposes.
	OPTIONAL: Increase in duration of planned household energy access per day (hours/day)	N/A	N/A	N/A	N/A	
E. Reduced total system cost	REI CORE 8. System Costs: Reduced total energy system cost (USD)	Based on total AMI benefited users, as a fraction of target value by 2030, and estimate cost savings from reaching such goal. Complemented by broad estimate of costs savings associated to storage	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.		US\$ 1.48m / year (estimated as US\$ 1.11m from AMI and 0.3m from energy storage) by 2030	
F. Fostered renewable energy innovation	REI CORE 9 (= CCV 1). Innovation: Number of innovative businesses, entrepreneurs, technologies, and other ventures demonstrating a strengthened climate responsive business model	# of initiatives to receive support from Component 2 (corresponding to GH2 projects)	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	FENOGÉ's reporting over Component 2	4 (2026)	Further support may be provided by MDBs and their innovation fostering platforms to conduct learning-based activities aiming to improve the understanding of REI's innovation and entrepreneurship aspects, specially throughout execution of Component 2 of Colombia's IP.
	OPTIONAL: (=CCV 2): Number of innovative products, services, technologies, and processes that have	N/A	N/A	N/A	N/A	
RESULT STATEMENT	MONITORING APPROACH					EVALUATION AND LEARNING APPROACH
	INDICATORS	MEANS OF VERIFICATION	BASE LINE	MEANS OF VERIFICATION	TARGET (DATE)	KEY AREAS
REI PROGRAM-LEVEL CO-BENEFITS						

Social and Economic Development Co Benefits	CO-BENEFIT 1. Employment and Livelihoods: Jobs created – direct and indirect	# of Electrolysis related GH2 jobs created # of AMI related jobs created # of temporary jobs created by project construction / deployment	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	20 permanent & 300 temporary (cumulative by 2026)	Quality and distribution of jobs: Through both just transition and gender-responsive approaches, further evaluative and learning-oriented analyses may center on the types of jobs created (and lost), which in the case of Colombia's IP are initially and tentatively identified to be expected to be gained in GH2 technology (e.g. electrolysis) design, installation, operation and maintenance, AMI deployment, community basic servicing of PV based solutions, new massive transportation system jobs creation, while expected losses may present in activities such as old metering infrastructure reading and servicing, bus and taxi fleet drivers, and other fossil fuel industry based jobs (such as e.g. gas refueling services). In general terms, as new technologies being adopted shall be more technically advanced and at the same time cleaner than the ones being replaced, jobs to be created shall be of higher quality, pay and equally demand higher skills from workers, making training programs play a central role in this transformative change.
	CO-BENEFIT 2. Just Transition: Social Inclusion and Distributional Impacts	# of people trained to carry a more skillfull and better paid job	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	40 (cumulative by 2026)	Just transition-framed analyses in the case of Colombia's IP shall analyse the extent to which diverse social inclusion is made possible within supported activities, including how providers selection processes can be run, how stakeholder engagement at local and national levels is possible within each type of activity, and the extent to which vulnerable groups in impacted areas can be offered job opportunities or other benefits derived from provided solutions. Distributional impacts, which already form a pivotal aspect of Co-Benefit 1, may also be furthered examined along other evaluative lines or with additional focus on specific subpopulations, such as ethnic, religious, and racial minorities, female-headed households, Indigenous People and local communities, migrants, youth, and persons with disabilities.
	CO-BENEFIT 3. Policy and Planning: Coherence across sectors	N/A	N/A	N/A	N/A	N/A
	CO-BENEFIT 4. Energy communities created	# of officially registered Energy Communities	0	Governmental reporting, in linkage to CIF-REI financed projects	5 (2027)	
	CO-BENEFIT 4. Enables prosumers / self-generators	# of AMI users installing PV systems and selling their electricity surplus to the grid	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Grid Operators reporting, in linkage to CIF-REI financed projects	1000 (2030)	
	OTHER	TBD upon specific projects preparation	TBD	TBD	TBD	

RESULT STATEMENT	MONITORING APPROACH					EVALUATION AND LEARNING APPROACH
	INDICATORS	MEANS OF VERIFICATION	BASE LINE	MEANS OF VERIFICATION	TARGET (DATE)	KEY AREAS
REI PROGRAM-LEVEL OUTPUTS						
A. Improved market design and systems	OPTIONAL: Number of policies, regulations, codes, or standards supported to enhance the enabling environment for renewable energy	N/A	N/A	N/A	N/A	N/A
	OPTIONAL: Number of technical/financial analyses completed to enhance the enabling environment for RE uptake (#)	Pre-feasibility / Feasibility studies sponsored under FENOGGE's +H2 Colombia	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	FENOGGE's reporting	4 (2026)	
	OPTIONAL: Number of persons trained on issues related to renewable energy markets and systems (#)	N/A	N/A	N/A	N/A	N/A
B. Improved demandsupply management	OPTIONAL: Number of supply management technologies, infrastructure, or other solutions deployed	# STATCOM, FACTS or other different from storage grid support projects	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	0	
	OPTIONAL: Number of demand management technologies, infrastructure, or other solutions deployed	# of users accessing specific real time monitoring and control capabilities both in NIZ and SIN.	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	345,560 users (2027)	

C. Deployment of energy storage systems	GESP 1. Energy Rating: Energy rating (MWh) of storage systems installed	Energy rating for storage project	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	136 (2027)	
	GESP 2. Power Rating: Power rating (MW) of storage systems installed	Power rating for storage project	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	34 (2027)	
	OPTIONAL: Number of energy storage systems installed	# of Energy storage projects	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting	1 (2027)	
D. End-use electrification solutions	OPTIONAL: Number of end use electrification solutions deployed	e.g. # of NIZ access solutions; # EV charging points	Base numbers are 229,000 users with access to energy in NIZ and 225 existing rapid and fast charging points distributed throughout the country	IPSE and Grid Operators reports, in linkage to CIF-REI financed projects	Access solutions for 19,560 users and 4,497 charging points	
	OPTIONAL: Number of women and men reached with new end-use electrification solutions	e.g. # benefited women and men from off-grid access solutions / AMI and EV charging infrastructure	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	345,560 users in 40% female - 60% male household responsibility proportion (NIZ and AMI solutions combined); and 44970 users for EV charging (10 new EVs for every new charging point) in 33.3% female - 66% male vehicle ownership proportion. This, as of 2027.	
	OPTIONAL: Number of businesses reached with new end-use electrification solutions	Interpreted as number of NIZ energy access solutions benefited users who develop or improve a productive activity based on supplied electricity	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Ideally one of every 10 NIZ deployed solutions develops or feeds a productive activity based on supplied electricity.	1956 (one out of every ten solutions) by 2027	
	OPTIONAL: Reduction in number of outages due to new end use electrification solutions	N/A	N/A	N/A	N/A	
E. Deployment of renewable mini and off-grid solutions	OPTIONAL: Number of renewable mini and off-grids solutions installed	# of mini-grid projects installed as part of NIZ rural electrification projects	0 as based on BAU assumed scenario (with no CIF-REI intervention) to capture CIF-REI contributions only.	Annual reporting by projects.	3 (2027)	

System-wide Analysis

The IP's Integrated Results Framework serves as a fundamental instrument that grounds the country program's high-level goal statement on measurable national-level indicators and targets, and thereafter links the program's theoretical objectives with the measurable outcome-level results anticipated via its constituent project pipeline. As the IP has been developed collaboratively between different Government institutions and supportive MDB partners, the process of defining project-level objectives, and aggregating the related results via the IRF, has constituted a consistent and system-wide approach on the coherence of and between interventions, and on accountability between proposed goal statements and pragmatic results estimations. Activities defined to be supported based on CIF-REI program objectives have been defined based on thorough examination of the country's context in terms of NCRE development and barriers to achieve expected and further integration of solar and wind variable sources. To this extent, overall NCRE project pipeline expected to enter operations within the next four years, existing gap to reaching universal energy access, current penetration of EVs and AMI deployment are considered as proxy country indicators setting the baseline upon which CIF-REI interventions are to be introduced to produce system changes contributing to the overall goal of supporting domestic decarbonization by accelerating the country's ongoing clean and inclusive energy transition.

Anticipated program-level impacts

Colombia's IP currently expects to deliver on up to 8 of the core objectives of the REI Investment Program, and the country's IRF therefore tracks core indicators as relating to each of these outcomes, with the expected target values collating the fractional outcomes expected from individual projects within IEs' program pipelines. Each target value delineates the share of results anticipated from each discrete project, allowing for a differentiated analyses of the varying levels of impacts, vis-à-vis investment volumes and targeted approaches. As such, the IRF will be responsive to any changing dynamics within individual projects, and under- or over-achievement of program level results will allow for learning and adaptation based on challenging or opportune investment environments.

As relevant outcomes, Colombia's IP is expected to contribute to Colombia's NDC by enabling the obtention of 1.42% of total expected GHG emission reductions from the electric sector by 2030⁶⁰. In addition, the IP will help the Government's plan by⁶¹:

1. Contributing to reach universal electricity access by reducing up to 4.9% of the existing gap.
2. Deploying approximately 2.6% of overall AMI required to be in place by 2030.
3. Enabling reaching 149,750 EVs by 2026, representing approximately 2.4% of fleet penetration.

⁶⁰ The 1.42% corresponds with expected GHG emission reductions of 110 kt CO₂eq/year, compared to 7.73 million Tons CO₂eq/year total reductions expected from the electric sector for meeting the NDC by 2030 (based on figures from the PIGCCme). Final results regarding GHG emissions reduction may vary depending on sub-borrowers' decisions.

⁶¹ As a result of the proposed IP implementation, these figures assume that new 19,560 users will receive electricity access solutions with NCRE, 326,000 smart meters to be installed, and 1002 Tons GH₂/year to be produced by 2030. National Targets by 2030 include 400,000 new users with electricity service to achieve universal electricity access, 12,348,000 smart meters installed (75% of all NIS users), and production of 70kt GH₂/year. Final results regarding these contributions shall vary depending on sub-borrowers' decisions.

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4. Producing up to 1.4% of the total expected GH2 production by 2030.

Protocols for tracking

The monitoring and reporting of outcomes will be a collaborative process amongst all stakeholders. Country focal points and implementing agencies, in collaboration with the CIF AU Monitoring and Reporting team, will lead on tracking the country-level IP impact indicators set out at IP approval. Implementing MDBs will monitor, and report annually to the CIF AU, all outcome level core indicators relevant to each approved project, in accordance with the methodologies, reporting requirements and timelines set out within the REI IRF, and within the forthcoming REI M&R Toolkit. As such, MDBs will be responsible for incorporating these outcome level indicators into the monitoring and reporting frameworks and mechanisms for each implemented project, alongside any optional outcome indicators and at least one co-indicator per project, also in accordance with the REI IRF and REI M&R Toolkit. Country-level IP M&R workshops, anticipated at inception, midterm, and IP-conclusions along with any, as needed, interim country M&R workshops, will allow for multi-stakeholder consensus on indicators, targets, methodologies, and related gaps, lessons, or enhancements.

Bancoldex and FDN, being borrowers and Implementing Entities (IEs), acting as intermediary banks for properly allocating CIF-REI resources, will be responsible for reporting to MDBs on an annual basis over IRF indicators. Sub-borrowers implementing projects associated with IP's supported activities shall have within their responsibilities with IEs the provision of required information to comply with monitoring and reporting requirements, based on commitments incorporated within sub-lending contracts.

As part of finance eligibility criteria, it shall be important to note that sub-borrowers shall be in a position to report periodically on different indicators relating to projects performance and achievements, inclusion aspects, GEI emission associated reductions, benefited users including their gender distribution and applied inclusion principles, along with core achievement progress and other transversal co-benefits which shall apply according to each project's context.

The program will be overall monitored through periodic Project Monitoring Reports (PMR) to be prepared based on the reporting by IEs and sub-borrowers. MDBs will conduct regular evaluations to support and evaluate the program's execution.

The program's financial statements will be audited in accordance with the procedure previously agreed upon within the MDBs. The IEs will present within 120 days after the end of each fiscal year of the project, during the original disbursement period, or its extensions, the audited financial statements of the program, duly signed / endorsed by an independent auditing firm acceptable to the MDBs.

Tracking and evaluation of transformational change, just transition, and inclusivity aspects

Transformational change, just transition, and inclusivity effects from the execution of the proposed IP shall be evidenced in job creation quality and distribution of jobs, use of gender-responsive approaches, and achievement of impacts such as reduced emissions and contamination. Rural electrification is regarded as the activity within the program with the most potential for generating

social transformational impact through new opportunities for improving the quality of life of final users.

The program will track and evaluate just transition activities, and in particular progress related to: i) women and socially inclusive community members' training and employment in the servicing and maintenance of implemented projects/solutions within their communities; ii) development of productive activities and local economic growth thanks to rural electrification; and iii) number of individuals losing their jobs and trained and employed to participate in economic diversification.

The extent to which social inclusion is achieved in terms of ethnic, religious, and racial minorities, female-headed households, Indigenous people and local communities, migrants, youth, and persons with disabilities, shall depend on final projects to be supported, but will anyhow be an essential aspect for keeping track of and following up to assess positive program transformational change in this regard.

Reporting shall also help verify which adopted policies are gender-responsive, e.g., involving equal shares of female and male installers for AMI, or in the operation and maintenance of electrolysis equipment, etc. Safeguards monitoring will include continuous evaluation of potential sexual exploitation and gender-based violence.

IP execution shall be made visible to newly developed energy communities and communication links shall be established for queries and feedback to be facilitated. Other means to obtain information shall also be explored to measure transformational change, just transition and inclusivity aspects through these communities.

ANNEXES

ANNEX I. Assessment of country's absorptive capacity for integration activities

Macroeconomic context:

In 2021, Colombia presented the highest economic growth in the LAC region, with a 10.6% increment in GDP compared to 2020 and 2,8% growth compared to 2019 (pre-COVID levels). Such recovery followed a 2020's contraction of 6.8%, as the worst GDP decline in the country's history. The impressive recovery evidenced in 2021 has been driven mainly by private consumption and gradual pick-up of employment, which has reached almost same pre-covid levels by the end of the fourth quarter of 2021 (unemployment of 11.03% in December 2021 Vs 10.5% in December 2019).

GDP is now expected to grow by 6.33% in 2022 and 3.535% in 2023. Strong commodity prices have improved the terms of trade and supported fiscal outcomes, against the background of rising external demand. Nonetheless, recovery has affected inflation rate, with this increasing well above target (reaching up to 11% by the end of 2022), initially driven by food and energy prices, which have particularly affected low-income households.

While Colombia has only a small direct trade and financial exposure to Russia and Ukraine, it is a major commodity exporter and higher oil and mineral prices have buttressed exports and fiscal

outcomes. At the same time, global scarcity and increasing prices of fertilizer products have been responsible in good part for high evidenced inflation levels of recent months.

Overall inflation effect has pushed the Central Bank to increase interest rate from a steady 1.75% evidenced from October 2020 to September 2021 to 99% as of July 2022. Rising interest rates may increase financing costs and affect portfolio capital flows. Under such conditions, concessional resources have the potential of wakening major appetite from investors (as long as currency exchange risk can be mitigated), making it necessary to apply proper filters and selection criteria for ensuring proper allocation of these resources (based on CIF-REI objectives and guidelines).

Additionally, since year 2000 and up to 2019, Colombia showed continued economic growth and social progress, which allowed the country to become a member of the OECD. In response to COVID pandemic and aforementioned economic contraction, in February 2021, the Government approved its “Policy for Economic Reactivation and Sustainable and Inclusive Growth” (CONPES 4023/21). Through such document, the country articulated a comprehensive set of policies and investment programs aimed at supporting the economic recovery to its pre-COVID-19 growth level, while transitioning to a more sustainable and resilient growth in the long term. COP135 trillion investments were planned through such recovery package (US\$35 billion, equivalent to 12.5% of GDP) to be executed over a five-year period 2021-2026, in partnership with the private sector. Within such package, 42.4% investments are to be allocated in transport infrastructure construction, while 26,3% are to be used in mining and energy projects.

On the other hand, due to the withdrawal of a tax reform proposal back in April 2021, which led to social unrest and shortages of fuel and basic goods, Standard & Poor’s and Fitch Ratings downgraded Colombia’s credit rating. Yet, the country maintains access to international financing, having the Flexible Credit Line (FCL) of the International Monetary Fund (IMF).

In September 2021, under a national consensus process, Congress approved a new tax reform called the “Social Investment Law”, which aims to collect 1.4% of GDP from austerity in public spending, less tax evasion, and changes in corporate tax rates. This approval influenced Moody’s decision to maintain Colombia’s investment grade with a stable perspective, highlighting the country’s commitment to fiscal sustainability.

With large ongoing investment plans, a new tax reform to be approved by the end of 2022, high inflation and interest rate levels, plus a fiscal recovery agenda which government is required to follow, conditions are expected to remain proper for allocation of concessional resource investments specially as interest rates are expected to remain at relative high levels.

Law, regulatory and institutional context⁶²:

Colombia’s current legal and regulatory context nourishes entrepreneurship and foreign investment, while institutions are considered strong. Throughout the last 20 years the country has been regarded by foreign investors as an attractive destination for new business development, bolstered in a mature financial system, and facilities for creating new enterprises. Colombia also ranks 13 among 107 countries in Bloomberg’s 2021 Climatescope, surpassed only by Chile and Brazil in the region, as most attractive countries for clean energy investments.

⁶² https://bti-project.org/fileadmin/api/content/en/downloads/reports/country_report_2022_COL.pdf

The constitution of 1991 guarantees freedom of association and assembly, and these rights are enforced. Political and independent civil groups are allowed to form freely. Through a mechanism called “right to petition”, citizens have the right to submit requests for information and public institutions are required to answer requests within a time frame that varies between 10 to 30 days depending on the type of information that is required. Whereas the institutionalized NGOs are more influential, with international ties, there are also a range of active community-based organizations, social movements, and informal political control platforms.

In the last few years, Colombia has strengthened its instruments of financial regulation. This includes the implementation of Basel III standards since January 2020 and the adjustment of regulatory schemes to transform the banking system. The state has engaged in the expansion and strengthening of basic administrative structures. Yet large swaths of territory remain without access to public services provision in an efficient and reliable fashion. Corruption, gaps in basic infrastructure, the impact of the armed conflict, and lack of technical skills and personnel affect state capacity. In Colombia, the state’s functions and activities are decentralized to a significant extent. Municipalities are responsible for delivering crucial services such as water supply, basic health, education and energy.

Ultimately, while Colombia has made important advances in efforts to end the political violence and strengthen democracy, issues such as sustainable growth, inequality, poverty and corruption have remained major challenges, as are to be confronted by the new government administration which assumed office in August 2022.

Technical and managerial context

Bancoldex, is one of Colombia’s National Development Banks (NDBs), and that in charge for business growth in Colombia, leveraging companies of all sizes, all sectors and all country regions.

As a NDB, Bancoldex offers both financial instruments and relevant information services to its customers. As such, in recent years the bank has progressively increased its role in filling major financing gaps and developing long-term financing. Colombia has a limited project finance market and thus, infrastructure financing needs have been traditionally met through corporate loans or by a small set of commercial banks. Local commercial banks and investors are now slightly familiar with clean energy and electric vehicle projects (though not at a deep technical extent). Furthermore, local banks are not at all familiar with projects relating to new technologies such as those of green hydrogen production or EV charging infrastructure. Additionally, common characteristics to this type of investments which the bank is embracing to support are: (i) high up-front capital cost; (ii) short concession periods in some market segments; (iii) business risk perceptions that may limit micro and small firms access to credit; (iv) lack of access to preferential interest rates and subsidies to cover capital costs; (v) lack of well-structured projects; (vi) complex regulatory system for the energy sector which limits the appetite of commercial banks to finance these relatively new types of projects; and (vii) new technologies that have not been proved and/or do not turn financially viable without concessional financing, among others. Thus, risk mitigation and credit enhancement

mechanisms shall be necessary to manage this spectrum of financing risks and attract private sector financiers to this type of projects.

Bancoldex, as a multipurpose first- and second-tier banking institution is profiled to play a key role in financing and co-financing long term sustainable and bankable clean and inclusive energy transition projects and help mitigate their associated risks. For such purpose, IDB has provided and is continuing to provide technical assistance to enhance the Bank's capacity to assess and tackle this type of projects and its potential risks, based on which it is already establishing a track record of private investments mainly based on renewable energy and energy efficiency, which are now ready to move on to electric mobility and other energy transition technologies.

The FDN is an another important NDB that promotes the participation of private companies in the local infrastructure sector. FDN was created in 2011 to help overcome the financing difficulties of some large infrastructure projects. Since then, the entity has been working on credit solutions to finance infrastructure projects and improve their credit risk, facilitating the entry of private banks and other financing institutions. Recently, the bank has been expanding to other sectors such as energy, transportation and health, making its first investments in PV projects in 2019. The actions carried out by the FDN in terms of financing have been focused on identifying financial market gaps and designing appropriate mechanisms to close them.

FDN has established a corporate sustainability roadmap, through which it aims to ensure that projects to be supported are well aligned with national sustainable development objectives, and very importantly to contribute to the achievement of Colombia's NDC. As part of the process in preparing to achieve such purpose, the entity is currently working in the development of its Environmental and Social Risk Management System (SARAS), same as in the conformation of groups of interest, a corporate government and internal ecoefficiency as part of a sustainability strategy, for which it has been receiving the support of the IDB mainly.

In August 2022, FDN and FENOGE have signed a cooperation agreement for the development of synergies, activities and joint spaces with the aim of promoting the development and financing of projects in the energy sector, mainly encouraging and promoting NCRE projects, same as those in the field of Efficient Energy Management.

ANNEX II. Stakeholder consultations

Colombia's CIF-REI Investment Plan is the result of a consultative process, led by the GoC in head of the MME to identify and prioritize lines of action in which financing support mechanisms are required to accelerate the integration of RE. This plan has been conceived as an important instrument to advance in the energy transition and climate action paths the country has set, policy wise, towards 2030 and 2050 sustainable growth, emission reductions and climate change action.

Performed consultation process included governmental agencies such as DNP, MHCP, MADS, the Ministry of Transport, UPME, IPSE, CREG, and representatives from the private sector, academia, and international cooperation development partners.

Throughout the preparation of the IP, two major consultations were held, the first of which took place during the Scoping Mission performed in February 2022, which was used to start conversations with different levels of government and relevant stakeholders. Based on these discussions, the main strategic themes that should be included in this IP were identified. Participants of these discussions are listed in the Table 7.

The second consultation scenario took place within the Joint Mission carried out in July 2022, to which NDBs were invited to participate, as well as network operators from the NIS and the NIZ, possible project developers and investors and experts on social inclusion and gender issues. In Table 8 participants of the different meetings held during that Mission are listed.

Throughout the process of preparing the IP, multiple meetings and dialogues were also held between representatives of the MDBs and the potential implementing entities (EI), with the objective of addressing issues of relevance to the IP, among which the topic of gender inclusion and minorities was prioritized. In addition, consultations were held with representatives of the public, private and financial sectors to identify the main barriers that women currently face in the energy sector and identify solutions that can be implemented in the short, medium or long term to close existing gaps, as presented later in this same annex, in greater detail.

Finally, the draft of the PI was published for comments on the MME's website on October the 25th 2022, receiving comments from relevant stakeholders, associations and the general public, which were considered for the final round of revision to which the document was subjected leading to this final presented version

Table 7. Participants of the Scoping Mission held on the 22nd and 23rd February 2022

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Table 8. Participants of the Joint Mission which took place on the 11th and 12th July 2022

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Stakeholders Inclusive Consultations on Gender Issues

As earlier mentioned, throughout the IP preparation process consultations with stakeholders were carried out to understand gender challenges as well as opportunities in the broad Colombian context and particularly in the energy sector. Throughout the remaining design process and implementation of the project additional possibilities for actively include women and diverse populations will be considered- depending on the areas of intervention - in line with the Government of Colombia's priorities on gender equality and popular economy, and following the IDB Sector Framework on Gender and Diversity, its Operational Policy on Gender Equality and Gender Action Plan as well as the Integration Guidance Note for Climate Investment Fund Projects and the CIF Gender Action Plan

Consultations

Within the months of September and October 2022, virtual meetings and semi-structured interviews were planned and carried out with representatives from the Government of Colombia, industry representatives from private sector, the financial sector, Non-Government Organizations (NGOs) and Civil Society Organizations (CSOs). Table 1 provides details on representatives from participating organizations. The questions that guided the consultations were:

- ✦ What are the barriers that women may differentially face in benefitting from projects that will be supported by this IP? How can these barriers be addressed?
- ✦ What opportunities women have to benefit from these projects?
- ✦ What activities or strategies could the CIF-REI funds finance to promote gender equality and enhance women's economic empowerment?

Table 1. List of organizations and persons consulted through virtual meetings and interviews

GOVERNMENT/ PUBLIC SECTOR	DESCRIPTION	CONTACT PERSON	POSITION
Ministry of Mines and Energy	Colombia's Ministry of Mines and Energy aims to formulate and adopt policies aimed at the sustainable use of mining and energy resources to contribute to the economic and social development of the country.	Marie Paz Rodriguez	Gender lead at the Environmental and Social Affairs Office
National Planning Department	The Department of National Planning is the Colombian Government's think tank that coordinates, articulates and supports the country's short-, medium- and longterm planning, and guides the public policy cycle and the prioritization of investment resources.	Juanita Bernal Rosario Gonzalez Celis	Gender deputy director at the Department for National Planning Mining and energy deputy director at the Department for National Planning
TRADE UNION	DESCRIPTION	CONTACT PERSON	POSITION

ANDESCO	Andesco is a non-profit trade association that represents the interests of the affiliated companies of residential public utilities and communications. These include public, mixed and private companies. They have the task of representing the companies and being spokespersons before the government, as well as promoting best practices.	Adriana Arevalo María Fernanda González Martínez	Electric energy and gas professional Sustainability manager
ASOCODIS	The Colombian Association of Electric Energy Distributors - ASOCODIS -, created in 1999, is a non-profit organization that brings together the main electricity distribution and marketing companies that serve regulated and non-regulated users in Colombia.	Olga Lucia Polania	Deputy Director

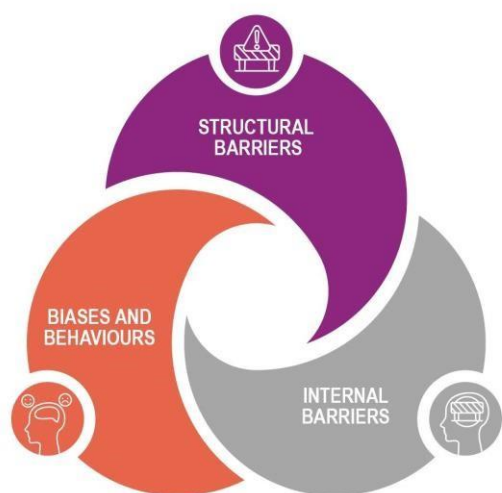
Asociación de Hidrógeno Colombia	The Colombian Association of Hydrogen is the guild promoting the development of hydrogen as an energy vector in Colombia. Founded in May 2021, Hidrógeno Colombia brings together companies, nonprofit and academic entities and individuals interested in developing hydrogen for decarbonization purposes in our country.	Mónica Gasca	Executive Director
SER COLOMBIA	SER Colombia is a private non-profit entity, created in March 2016, which brings together more than 70 companies locally and globally, which are committed to the implementation and development of nonconventional renewable energies in Colombia.	Maria Camila Mejia	Engineer and Compliance Professional
CIVIL SOCIETY ORGANIZATION	DESCRIPTION	CONTACT PERSON	POSITION
Asociación Nacional de Mujeres Campesinas, Negras e Indígenas de Colombia	The National Association of Peasant, Black and Indigenous Women of Colombia ANMUCIC (National Association of Rural, Black and Indigenous Women of Colombia) is a non-profit, trade union and gender-based organization that emerged in the 1980s with the aim of improving the quality of life of rural women. It is made up of departmental associations.	Nelly Antonia Velandia Avendaño	Legal representative and president
coMpower	coMpower is a community founded by young women professionals in the energy sector in Colombia to support and promote future professionals and leaders	Juanita Fonseca	President and co-founder
	in the energy industry.		
FIRM	DESCRIPTION	CONTACT PERSON	POSITION
ENEL Codensa	Enel is a multinational energy company and a leading integrated operator in the world's electricity and gas markets.	Lorena Buitrago and Mabeth Novoa	People Care and Happiness

EPM	Empresas Públicas de Medellín, better known as EPM, is a Colombian industrial and commercial company owned by the municipality of Medellín, created on August 6, 1955. It is a multi-Latin company that provides public utilities (energy, gas, water), the largest in Colombia in this sector.	Giovanna Perez and Milena Giraldo	Cultural Transformation Unit Professional VP Human Resources
AES Colombia	AES Colombia is the first 100% renewable generation company in Colombia. It has been present in Colombia for 40 years.	Patricia Aparicio	Corporate Affairs and Sustainability Manager
FINANCIAL SECTOR	DESCRIPTION	CONTACT PERSON	POSITION
Asobancaria	Asobancaria, the Colombian Banking and Financial Institutions Association, is the representative association of the Colombian financial sector.	Nataly Siza Perez	Sustainable Development Professional

Methodology

Consultations were carried out applying a systemic approach, where it is understood that gender equity is only possible if structural, bias and behavioral barriers, same as internal barriers are jointly addressed (Figure 1)⁶³. In this sense, women's empowerment is understood as a process over time where it is necessary to have resources, as a precondition of agency, so that women can make transformative decisions for their well-being. Applying these concepts to the energy industry is crucial to understand a) the barriers women face in the sector, and b) to address these barriers with practical solutions that can be implemented in the short, medium or long term to close the existing gaps.

⁶³ Consultations were carried out by a consulting firm. CoreWoman, which uses the framework of Naila Kabeer (1999, 2008) and adaptation made by Susana Martinez-Restrepo (Director of CoreWoman and founding partner) for Latin America and the Caribbean region.



6. Structures affecting gender equity include legislation, and institution protocols and norms (supply side), laws, regulations, written norms affecting access to productive assets, land and infrastructure, clean water, childcare services, etc. Within businesses, it can also relate to policies and protocols that affect or enable gender equality.

2. Biases and behaviors, conscious or unconscious biases (implicit or explicit) of trainers, technical assistants, financial institutions, and communities affect women’s opportunities to start and open a business, be in commercial settings, access jobs in certain sectors, and live free from violence.

3. Women’s internal barriers resulting from gender socialization processes through which gender

norms are internalized from an early age, e.g. lack of confidence, risk aversion.

Figure 1. Methodology with a systemic approach

Source: CoreWoman, 2019

In addition to the systemic approach, public consultation questions were conducted based on Gender-lens Investing (GLI) tools. GLI is a strategy that incorporates gender analysis into investment processes and decision-making to improve social, environmental, and business outcomes. It includes five strategies for investment funds and investee companies to apply a gender perspective to their business models. The CIF-REI funds can benefit women based on these strategic focuses.

Table 2. Gender-Lens Investing Indicators (GLI)

Strategic focus	Type
Leadership	Women-owned and/or with female representation in management
Contractors/Employees	Committed to a gender-diverse and equitable workforce
Supply Chain	Committed to a gender-inclusive value chain
Products and Services	Committed to offering and designing products or services that take into account the specific needs of women as a consumer segment
Community	Companies committing to ensure that their operations do not harm women in the community

Source: CoreWomen adaptation based on CDC Group and IFC, 2020.

Results of the Public Consultation Process

During the interviews the following barriers were identified:

Structural barriers:

- **Geographic inequalities:** Geographic inequalities affect the access to knowledge. Gaps in obtaining technical information about new technologies, especially in rural areas where there is less access to the Internet. Women, especially, are affected by this since it is most common that they do not have access and/or control of the technology and resources needed.
- **Data gaps:** The lack of data and inaccurate measurements impede our ability to measure preempt and respond to gender disparities. Many of the indicators are disaggregated by households, not individuals, nor are they disaggregated by sex. This makes it more difficult to understand what the project's impact is.
- **Lack of women in the workforce:** The low training of women in the positions and roles necessary within the sector (specially STEM careers) leads to women being at a disadvantage to men. Fewer women apply for these positions. This is a problem in the energy sector, and more generally one that has to be tackled in the education sector.
- **Suppliers:** When it comes to suppliers, men enterprises are already established and have access to markets and resources. There is a trust that has been developed and which gives them advantage over new enterprises led by women. Additionally, energy projects need a high quality and technical knowledge, which takes time to build. Standard and terms of reference developed for these projects could become a barrier to women's employment, both as direct workers and as suppliers. Women are less likely to be suppliers for these projects due to education and access to credit.
- **Time constraints:** a) It is common for the jobs in this sector to pay little attention to personal and work life, and due to gender norms, women are expected to take up most of the care duties at home. Since these types of projects are usually done in rural areas, it is common for professionals to have to move to lead the development of the projects. This is a barrier for women who might be reluctant to move if they have care duties at home. B) Many of the programs include capacity building for women in leadership role, however many women are not able to participate in them due to time scarcity.
- **Caretaking duties:** Social norms have established women's role as primary caretakers at home which translates into a pressure on women to continuously provide support for their children, the elderly and/or the sick. This makes it difficult for them to be included in the development of the projects, partly because they usually entail a physical displacement.

Women organizations/associations/-led enterprises:

- **Lack of business knowledge:** Many women in the communities do not know how to do business. Companies can support them by providing adequate training.
- **Time constraints:** The calls for proposals are very strict with the times of planning, design and execution of projects. This should be more flexible especially in the case of those that involve rural women; in many occasions for instance, they do not have the tools to adapt to external shocks such as pandemics, strikes, pre-election periods.

Bias and Behaviors:

- **Machismo:** Unconscious biases affect the way women are perceived. Machismo permeates the business groups/organizations/companies in an institutional manner, which affects how women interact with other colleagues, if they get promotions, and what work they are assigned to. Therefore, it is necessary to work the way talent is perceived within the organization. Indeed, social norms and behaviors affect women's access to leadership roles within the sector because of how male-dominated the sector is. It is common for women to be thought of as "problematic" and "less efficient".
- **Gender roles:** Culture and gender roles hinder the insertion of women, especially among ethnic groups. Even the issue of entrepreneurship is affected by culture, for example, it is understood that the culture of La Guajira is welfarist, but it is necessary to promote entrepreneurship. Each municipality has a different reality. Sometimes there are no women who want to work.
- **Training for women in the communities:** Training specifically designed for women can create conflict within communities. It is seen as unjust to men and due to stereotypes and social norms, men normally believe they are more entitled to training because of the idea of men as the breadwinner.

Internal Barriers:

- **Self-confidence:** Internal biases are also an important factor. For instance, the idea that there are roles for men and women affect which roles women apply to, many times because they believe they are not capable of pursuing certain goals.
- **Socialization and STEM careers:** Stereotypes, social norms and socialization affect women's interest in pursuing STEM careers and to be interested in the energy sector. Additionally, the lack of representation of women in the sector is demotivating for women to pursue careers that can position them in the sector.

Opportunities to Promote Gender Equality through activities under this Program

- **Increase the number of women in the sector:** By promoting specific type of education among women, especially related to STEM careers. In terms of long-term goals on educational achievements, Colombia can promote women's uptake of these careers and jobs to make the sector more gender diverse.
- **Transformation of the territories:** These projects present an opportunity to transform the territories if done in an integral manner, especially through a public-private partnership. Many companies have led social investments in the communities, for instance through the creation of schools to build trust with the community, but they need support from the government to fully bring socio-economic development to these communities. Specifically for women, the projects should be created with a gender focus in mind, they should leverage women's leadership in the communities and elevate it, both to promote gender equality and the sustainability of the project.
- **Decentralization of energy systems:** The interconnected system is very centralized, even when demand is low, there are communities without energy. Activities under the Program could

contribute to decentralize the system and positively impact women from rural areas. Hydrogen, specifically, provides these territories with the opportunity to create decentralized systems of energy in Colombia.

- **Gender equality within companies:** Projects, if done with a gender lens in mind, meaning they place several priorities and requirements concerning gender equality, can lead to important changes within the companies that implement the projects. For EPM, the Hidroituango project led to an important process concerning gender inclusion that has improved gender equality in the organization due to the environmental and social requirements of the project.
- **Strengthen women organizations:** It is possible for women organizations to create installed capacity to execute larger resources and to manage or execute their projects in the area. It

- **Women-owned businesses:** Projects can promote the creation of women-owned businesses. It is necessary to have entrepreneurship platforms in the regions to formalize and support women in their ventures so that they can benefit from the economic progress that is being brought through the projects. These small women-owned businesses should be given the technical assistance they need to compete with other companies for contracts in the future.
- **Meet energy demands:** Renewable energy projects can make it possible to meet the energy demands of women's homes and productive units. This includes enabling the use of their appliances, machinery and the purchase of inputs, especially for ethnic communities that live in areas where there is still no energy and people have to migrate to reach energy systems. They cannot communicate, they cannot charge their cell phones and that limits woman a lot.
- **Energy communities:** Energy communities are an opportunity to promote the popular economy and especially women's leadership. Women can be central to their success because they have demonstrated to be good at organizing people and communicating with the communities.
- **Contractors:** This program could contribute to the inclusion of more women as contractors. Many of Enel contractors have started developing programs to promote women as their employees. This is a joint effort between Enel and their contractors to diversify the workforce. Many are known as seed programs that attract women to the sector and in which women are provided with information about the opportunities and roles open to them. Communication is an important factor, women should understand they are capable of the same as men.

Actions to Promote Gender Equality through activities under the Program

- **Gender guidelines:** Companies that implement the project must have a gender equity policy and the funds should not only demand this from the companies but also from the governments in which they invest in. Governments should provide a roadmap or priorities for the companies to follow when it comes to gender equality and diversity.
- **Gender-lens planning:** Projects must be developed from a sustainability-over-time standpoint. Achieving women's participation implies thinking about women from the planning stage. This requires more dissemination and socialization of these types of initiatives, the actors in charge of the projects should lead the way in a conscious manner. For example, through gender roundtables where different gender issues are discussed, so that women are included in these spaces and their involvement is verified.
- **Consultations:** It is common for the consultations to be done with the leaders of the community, who are usually men. When this occurs and the result of the consultation is financial compensation, this money is not equally distributed, and men usually stay in control of it. In the case the compensation is more focused on the necessities of the community and leads to the provision of a service, it could occur that this service does not tackle women's specific needs. Based on this, SER Colombia noted that consultations should not only lead to financial compensation, providing the community with other resources, or fulfilling a specific necessity could have a bigger impact, which strengthens the communities and their governance. To address gender inequalities within the communities it is necessary to consult women separately and/or specifically call them to be part of the community consultation. Data shows that women tend to think more about the common good and are less likely to be corrupt. If women are

- included from the beginning, the social good can be improved. It is necessary to identify the specific barriers in the territory, especially how gender roles within the communities can be broken

Indicators: Companies should give priority to their monitoring efforts. The development of indicators with a gender lens at every company level. It should include aspects such as training, profit, recruitment, professional advancement, among others.
- Educational institutions:** Articulate work with educational and training institutions to motivate the participation of women in these processes. This is not only a job for the companies, but the labor market should also offer women in these positions that are masculine. Likewise, there should be a pool of talent that helps to find women for the job openings. Sometimes it is difficult to find women.
- Popular economy:** These projects can allow for the development of the popular economy by achieving the territorialization of the guidelines. MME found that when the realities of the territories are reviewed there are specificities that should be considered, for example a high number of gender based-violence (GBV) survivors that increase with the presence of the sector. Capacity building and strengthening can be carried out in the communities of influence to raise awareness about these issues. It is also important to talk about female empowerment: what happens when women work in the sector only out of necessity; how can they take advantage of these benefits while they are associated with productive projects; how to promote economic development that is not dependent on the sector; etc. The projects should take advantage of existing leaderships within the communities to increase their impact.
- Training platforms:** Companies that lead and develop the projects should give visibility to the platforms they have for training and the opportunities available, both in terms of education and training as well as social projects that could positively impact their livelihoods. This entails clear communication with the communities and active promotion of such options.
- Suppliers:** The supply network is set up with mostly men-owned businesses, but new businesses could be set up where women can play an important role, especially when it comes to energy use, energy efficiency, and operation and maintenance. Technical Assistance (TA) should be the rule in this case, and women-owned businesses that do not have the experience or trust can be considered if they are strengthened through TA. This should be viewed as a long-term goal, even if they do not become suppliers in the short-term, they can participate in these in the future. This should be done in coordination with other institutions and funds that support women (such as *Mujer Emprande*). Likewise, in alliances with universities and companies to promote changes in social norms and behaviors. Moreover, companies developing the projects should revise their internal processes and requirements for suppliers or any contractor, specifically look for any that differentially affects women
- Government cooperation:** Organizations and enterprises should be aided by the government when they start working with a community. It is very common for communities to lack the basic services that should be provided by the government. This creates high and misaligned expectations for what the project will provide, it is common for the community to expect the organization leading the project to provide them with all the services they lack, which is not possible. This creates conflict. It is important to note that renewable energy projects usually have a low cash-flow and they are not able to lead big community initiatives.

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- **Address biases and behaviors:** People are afraid to confront their biases and behaviors, it is important to raise awareness of the little progress that has been made and the negative consequences they bring to gender equality. It is common for internal communications to be very positive and rewarding for people to see, but reality should be placed front and center. This communication effort should be complemented with capacity strengthening and training with a gender-lens, both to address gender biases and women’s internal barriers (such as lack of selfconfidence).

Include men: Women and the organizations should work in coordination with men. It is common for men to not be involved in gender initiatives, especially in leadership issues. This applies not only to potential leadership from the roles, but also to the positions at any hierarchical level.

Main conclusions

As a result of consultations, it was found that there are several components, part of the structural, bias and behaviors, and internal barriers, that need to be addressed for women to fully participate as active actors in the projects to be funded by the CIF-REI Program.

There is a diverse list of structural constraints. First, there is a lack of women in the workforce in the energy sector since women’s participation in STEM careers is still low. This, hence, lowers the number of women that either apply for jobs in the energy sector or create businesses that can become part of the supply chain. Second, for suppliers, it is important to be well established and have access to available resources and markets. This puts any new venture led by women in a disadvantageous position. Third, women lack the time to re-skill and up-skill themselves to participate in leadership roles or become part of the sector partly because of the caretaking duties that become a burden to them. Fourth, when it comes to women in the communities of influence, they usually lack the adequate knowledge to lead productive ventures.

Bias and behaviors, referring to the conscious and unconscious biases that affect women’s opportunities, are also prevalent in the sector. *Machismo*, a concept associated with a strong sense of masculine pride, permeates businesses and communities in Colombia and affects women’s inclusion in professional and community projects, which is also related to gender roles. Also, there are multiple internal barriers that affect women’s participation in the sector, including for instance, self-confidence. Therefore, they tend not to participate in leadership roles, and usually have lack of interest in STEM careers.

There are nevertheless opportunities for women employees or contractors, business owners, and communities to benefit in different ways from projects supported under the Program as they can provide the opportunity to increase the number of women employed in the sector, strengthen women organizations, increase the number of women-owned businesses, and promote an inclusive transformation.

Increase the number of women in the sector as employees:

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Projects that aim to mainstream gender issues as the ones that will be funded by the CIF-REI Program are an opportunity to increase the number of women in the sector and in leadership positions. A first barrier to increasing the number of women is current social norms and behaviors in the country. In a sector as masculinized as the energy sector, women are not perceived as capable as men to lead projects or perform technical and even manual work. It is common to see men reluctant to be led by women, and for women to see the jobs in energy projects as “men’s work”, and that “it is men who can successfully lead these type of projects”. Especially with new technologies such as the ones the CIF-REI Program is promoting, it is assumed that it is men who can be more “resilient” and better at learning on the go.

Therefore, it is important to pursue a change in social norms and stereotypes within each participating company in the Program by encouraging capacity training on gender equality, promotion of women in leadership positions and mentoring programs for women. As an employee from Enel noted, when pushing for gender equality, men should be included. A way to motivate men to participate in gender equality efforts is to find allies within the company who can echo the messages and motivate other men to join the efforts. Also, companies should strive towards a safer environment in the workplace, which can be done by establishing gender-based violence protocols.

Time scarcity is a barrier for women's leadership and participation in the sector. As expressed by an employee from Enel, many women are not able to participate in training and capacity building activities due to time scarcity. On one hand, women in leadership positions say they are not able to commit to long-term programs because they are already very busy. On the other hand, women are already under time constraints at home due to social norms and stereotypes that make women the main caretakers at home, which leads to double shifts. Moreover, representatives from the DNP expressed that it is common to pay little attention to the work life balance in the sector, and since gender norms create expectations and duties about women's role in their homes, they end up taking most of the care duties at home.

Activities under the CIF-REI Program can provide the opportunity to promote and spark interest in the sector among young women. Women are underrepresented in STEM careers which already puts them in disadvantage if they want to be part of the energy sector. Education and training for women, through quotas and scholarships, should be considered so that women can increase their participation in STEM areas – starting from school – and in positions that require lower levels of education. There is an enormous potential in renewable energy sub-sectors such as the development of green hydrogen projects which involves more diverse work groups and have a great number of participating women such as those with a degree on chemical engineering.

Lastly, it was noticed that it is key to promote more women-owned and -led businesses in the sector. There are some barriers to increasing the number of women-owned and -led businesses in the sector, especially when it comes to funding: in Colombia, few women have the economic opportunity to develop renewable energy business ideas as they require large capital investments that very few women have access to. It is necessary to identify and strengthen these women-led businesses to promote their participation. According to AES and coMpower, a strategy for this strengthening may consist in creating calls exclusively for women.

Increase the number of women contractors and women-owned businesses as suppliers:

The supply network in Colombia is set up mostly with men-owned businesses, but according to the feedback received during consultations, new businesses could be set up where women can play an important role, especially when it comes to energy use, energy efficiency, operation and maintenance.

Specifically, when it comes to contractors, men's enterprises are already established and have effective access to markets and necessary resources. There is a trust that has been developed and which gives them advantage over new enterprises led by women. Additionally, women are less likely to be suppliers in the sector because of barriers to access to the right education, training, and

financial credit. On one hand, limits in getting the technical expertise needed to become a supplier can be due to social norms and internal barriers. On the other hand, the lack of access to credit can become a barrier for women-owned enterprises to meet the standards set to become a supplier for a project. Activities under the Program could lead to medium- and long-term outcomes if they provide women with tools such as entrepreneurship platforms, technical assistance, and/or access to credit.

In addition, the need to have entrepreneurship platforms in different country regions was identified, to formalize and support women in their ventures so that they can benefit from the economic progress that is being brought through different projects in the energy sector. Small and medium women-owned enterprises need technical assistance to compete with other companies in the future. For example, even though contractors continue to be a majority of men, many of Enel contractors have started developing programs to promote women as their employees. This is a joint effort between Enel and their contractors to diversify the workforce. Many are known as seed programs that attract women to the sector and in which women are provided with information about opportunities and roles open to them. Lastly, it was also identified that companies developing energy projects need to revise their internal processes and requirements for suppliers, specifically looking for any that differentially affects women.

Improve the well-being of the communities of influence:

Infrastructure projects are often led in rural areas and regions that do not have a strong governmental structure in place and lack the provision of most public services. In this context, renewable energy projects can be beneficial to everyone if they provide the product and service to the community they operate in, while also aiming at creating new jobs and bringing in economic growth. When this is done with a gender lens to promote gender equality, companies have to work around the social norms of the territories and aim to change stereotypes and behaviors.

Social norms and behaviors are a barrier for women to benefit from any project in their community. On one hand, when creating jobs in the communities, companies have to understand that women might believe that they are not qualified for the jobs, even so, as noted by SER Colombia, in many ethnic minority women might not be allowed to work. This should be considered to avoid conflict within the communities, as men might believe they are more entitled to the jobs since they are the breadwinners of their households. On the other hand, it is common for women to not have the training and/or education to become contractors. Companies could provide capacity building and training for women and create entrepreneurship platforms to promote and provide technical assistance to women in the development of their own companies.

Projects that want to have a differential impact on gender equality within the communities they work in should lead consultations that consider women which can be done through separate consultations with women or to specifically call women to be active participants of the general consultation process. This way they can express their needs and they can be taken into consideration when providing compensation or leading social responsibility programs for the communities. It is crucial to include women in these consultations since they know their communities and are very socially aware of the most pressing problems to their communities' development. Additionally, they are very good at communicating and leading, which makes them allies for the success and

sustainability of any projects through time. These projects present the opportunity to create and strengthen women associations.

A specific example where communities could play a central role are energy communities. Energy communities exist by providing an energy solution in low-income neighborhoods, in locations not connected to the grid. The community is responsible for maintaining, monitoring, and operating the parks. These are an opportunity to promote the popular economy and especially women’s leadership. Women can be central to their success because they have been shown to be good at organizing people and communicating with the communities. However, all the stakeholders should come together to define what these energy communities will look like, and to identify the instruments and tools needed to lead these projects. The lack of knowledge surrounding energy communities and how to develop them is a major barrier. Women are assumed to be an important beneficiary of the energy communities, but stakeholders should first develop their understanding of what the communities are and how women can be put at the center of them.

Lastly, companies leading the projects should be aided by the government to have a social impact in the communities they work in. These projects present an opportunity to transform the territories if done in an integral manner, especially through a public-private partnership. It is common for the territories to lack most public services and many times the communities expect the companies to provide these services through their projects, however this is not always possible. This can result in conflict and false expectations. Many companies have led social investments in Colombian communities, for instance through the creation of schools, as a way to build trust with the community, but they need support from the government to fully have a greater socio-economic impact.

The Gender Lens Investment (GLI) perspective:

Table 2 shows that different strategic focuses, most of which were addressed during the interviews, can be considered for a differential impact on different population groups.

Table 2. CIF-REI Funds from a GLI perspective

Strategic focus	Type	How can the CIF-REI Funds could benefit this groups
Leadership	The funds are committed to promote women-owned enterprises and/or with female representation in management	<p>This strategy is two-fold: increasing women’s leadership in the already established enterprises that will implement the projects and promoting the creation of women-owned enterprises in the renewable energy sub-sector that, in the long-term, can implement projects of magnitude.</p> <p>Increasing the number of women in leadership and management positions in the already established companies can be done through mentoring and capacity training. Companies with women as founders and cofounders, owned by women can be prioritized from CIFREI funds.</p>

Contractors/Employees	The funds are committed to a genderdiverse and equitable workforce	Companies and projects that receive the CIF-REI funds should have or need to be committed to a gender-diverse workforce and to improving workplace equity. This could be achieved by guaranteeing that a percentage of workers in all hierarchies and divisions are women, particularly in
		those traditionally male dominated sectors. Human talent departments should work to promote a culture within the project personnel that accommodates women’s needs, schedules and safety concerns. This includes an environment free of GBV and sexual harassment in the workplace.
Supply Chain	The funds are committed to a genderinclusive value chain	Companies/projects funded with the CIF-REI funds, need to prioritize the purchase of goods and services from women-led producers and suppliers. This could be achieved by having entrepreneurship platforms in different country regions to formalize and support women in their ventures. Their small and medium women-owned businesses need to be supported with the technical assistance they need to compete with other companies for contracts in the future.
Products and Services	The funds are committed to offering and designing products or services that take into account the specific needs of women as a consumer segment	More companies cater to the female market by offering products and services tailored to women’s needs. This includes for example if women benefit from clean energy products that are more affordable, or that reduce the time they allocate towards cooking, doing the laundry, and in some rural communities, gathering fuel.
Community	The funds are committed to invest in companies committing to ensure that their operations do not harm women in the community	Companies/ projects that benefit from the CIF-REI funds need to be committed to ensure that their operations do not harm women in the community. More companies are developing strategies that consider the needs of women in the community. To address gender inequalities within the communities it is necessary to consult women separately and/or specifically call them to be part of the community consultation. It is necessary to identify the specific barriers in the territory, especially how gender roles within the communities can be broken.

ANNEX III. Development co-benefits

Main co-benefits to be obtained from the development of projects to be financed under this IP have been identified to correspond as follows:

Employment and Livelihoods: Jobs created – direct and indirect

Through the deployment and later operation and maintenance of rural electrification solutions, smart meters / AMI, EV rapid charging infrastructure and hydrogen production facilities, among other possible activities to be financed, temporary and long-term employment positions are to be open, with this being an important parameter to be assessed and later on monitored and reported for projects to be financed / co-financed with CIF-REI resources. In the case of EV charging infrastructure, a major Utility considers between 50% and 60% of components involved in the construction and deployment of said infrastructure can be produced by local industry, both supporting local jobs creation and reducing overall costs when compared to 100% imported solutions.

Just Transition: Social Inclusion and Distributional Impacts

Training and relocation assistance shall be key activities to be performed and provided in order to achieve this co-benefit from specific projects to be supported. In such way, replacement of jobs (e.g. staff previously taking readings from analog grid meters being replaced by smart / advanced meters, same as carrying service disconnection and reconnection procedures which shall now be performed remotely, receiving training to carry operation and maintenance tasks in relation to new deployed infrastructure) should be procured whenever possible.

Training for women who can perform technical duties in the installation and maintenance of new equipment should be prioritized. In the case of NIZ, inclusion of minority groups should be procured for job opportunities dealing with maintenance and service of deployed solutions, or other tasks such as tariff collecting.

As a relevant point, gender balanced shares in management and leadership positions shall also be promoted whenever possible.

In general terms, the provision of rural electrification solutions with NCRE and the deployment of AMI infrastructure will have the fundamental purpose of offering users the possibility of becoming active actors in an inclusive and increasingly democratized electricity sector, along with promoting social-economic development activities. For this, the conformation of energy communities will play a fundamental role, giving users representativeness, facilitating their participation in the electricity market, and making it possible to obtain benefits for both the system and the users themselves.

Policy and Planning: Coherence across sectors

Working through coordination and cooperation with other development partners should be a priority, same as doing so with different national and territorial government agencies. Taking as an example the deployment of EV charging infrastructure, in this case urban planning, electrical, civil and communications works and permits are required, in a way that progressive regulation and adoption of standards and good practices shall be helpful in enabling all of these tasks to be improved and made more efficient and successful over time. In this sense, territorial entities are expected to receive the support from the national government and entities developing growing

capacities and experience, in order to be able to replicate successful strategies throughout the country.

Reduction of air contamination

Burning of diesel fuel both in mobile and static GHG emission sources (e.g. public transport and heavy-duty transport or thermal industrial and electricity generation equipment) emit particulate matter (PM) material quantities mainly dependent on the quality of fuel and the combustion technology employed. As these sources of energy conversion using diesel fuels are phased out, such contamination is eliminated, not only contributing to GHG emission reductions, but lowering the concentration of PM in the air which is proven to cause health problems. Positive impacts shall be noted especially among youth and elders' population (e.g. prioritizing for example the renovation of transport fleets with EVs in the case of schools or hospitals). The same may occur for substitution of other fossil fuels such as coal, bunker fuel and similar, as renewables-based electricity generation starts to take over, and clean fuel substitutes such as hydrogen are employed where final use of energy remains to be thermal.

ANNEX IV. Existing activities in the field of renewable energy, by other development partners

For the last 10 to 15 years, Colombia has received assistance and financial support from multiple cooperation agencies and institutions in order to develop both a proper framework and deploy increasing renewable energy capacities and capabilities. Some of the most contributing entities are hereby listed, accompanied by a brief description of the activities they have carried out or are currently carrying in order to assist each of the possible lines of investments this IP aims to support.

AFD (French Development Agency):

GH2 – They are supporting the MME in i) a process with ICONTEC (Colombian Institute of Technical Standards and Certification) for the translation, generation and adoption of international standards in the Colombian context; ii) a study on demand and availability of renewable energy sources (as key elements for the GH2 industry), and iii) strengthening of the capacities of the MME and other official entities in this field, same as offering technical academic exchanges with private actors and French institutions.

Other relevant topics- They supported the preparation of the country's Long-Term Climate Strategy – E2050, and have financed specific hydroelectric projects together with their electrical interconnection.

CAF (Development Bank of Latin America, formerly referred to as the Andean Development Corporation):

Regional interconnection – They have been supporting maritime studies for the Colombia-Panama interconnection project.

Electromobility – They have been in negotiations with the Green Climate Fund regarding a business proposal on electromobility.

GH2 – They have been in talks with MME and Ecopetrol to support H2 projects.

GGGI (Global Green Growth Institute):

Rural electrification – Together with the UK Pact, they have supported the structuring of rural electrification projects⁶⁴.

Other relevant topics – They have an alliance with iNNpulsa to strengthen the ecosystem of green enterprises⁶⁵.

GIZ (German Agency for International Cooperation):

GH2- They support the MME and FENOGE on this topic. They work on the development of public policy, and are supporting technical consultancy studies focused on the identification of H2 Hubs and Power to X Hubs, and on the feasibility of implementation of Power to X initiatives. They have also been working on training programs with the H2 Colombian Association. In early 2022 they

⁶⁴ (<https://ggi.org/convocatoria-del-programa-de-asistencia-tecnica-para-proyectos-de-electrificacion-rural/>)

⁶⁵ iNNpulsa is a Business Growth Management Unit, created by the GoC, in partnership with the Ministry of Commerce, Industry and Tourism, whose main objective is to promote entrepreneurship, innovation and business development to improve Colombia's competitiveness. Further info available at: <https://innpulsacolombia.com/innformate/gggi-einnpulsa-colombia-crean-alianza-para-fortalecer-el-ecosistema-de-emprendimientos> .

started implementing a technical assistance initiative called H2 APPs for the structuring of publicprivate partnerships for pilot projects with GH2.

JICA (Japan´s International Cooperation Agency):

Other relevant topics – They mainly offer cooperation in Science and Technology, especially through linking researchers and associations with Japanese entities working on Sustainable Development, with priority in topics of energy and environment⁶⁶.

KEXIM (The Export–Import Bank of Korea):

Electromobility – They have been financing feasibility studies, supporting MinTransporte and DNP, for the electrification of bus public transport systems in Sta. Marta and Armenia. They are articulating with CAF, KfW and AFD, within their EMOTION electromobility support program, which seeks to accelerate the massification of electric vehicles.

GH2 – They are interested in financing green and/or blue hydrogen projects.

UNDP (United Nations Development Program):

Rural electrification – They are supporting a study targeting subsidies for the substitution of Diesel in NIZZ⁶⁷. They consider the possibility of exploring H2 as a solution for NIZZ.

Electromobility – They develop the ACCES transport digitization project, through which they seek to identify projects underway in the transport sector to add the digitization layer, in 6 countries. In Colombia they have a focus on Bogotá and Medellín. A proposal for implementation was presented in June 2022 to the MME⁶⁸.

GH2 – They have access to cooperation through the Climate Investment Platform, of which IRENA is a part. Based on this, opportunities of direct support from IRENA in topics such as GH2 can be assessed by the MME.

Other relevant topics – They supported the preparation of the Long-Term Climate Strategy of Colombia – E2050.

UNEP (United Nations Environmental Program):

Electromobility – They lead the MOVE project⁷⁵ as a platform that works with 14 LAC countries in the initiative “Regional Preparation Project: Advancing with a regional approach towards electric mobility in Latin America” ***UK-Pact:***

Rural electrification – Since 2019 they have been supporting the evaluation and selection of projects to be financed with public resources (e.g. FENOGE), as well as, together with GGGI, supporting

⁶⁶ (<https://www.jica.go.jp/colombia/espanol/office/about/strategy.html>).

⁶⁷ (https://procurement-notices.undp.org/view_file.cfm?doc_id=244065).

⁶⁸ (<https://departamento.pucp.edu.pe/ingenieria/2022/03/18/departamento-ingenieria-presente-proyecto-access/>).⁷⁵ (<https://moveLATAM.org/>)

territorial entities and private developers in the design and structuring of rural electrification projects, through IPSE and MME⁶⁹.

Smart Grids, AMI – They have financed the Program to Support the Deployment of Smart Grids in Colombia (since 2019 and to date), executed by CarbonTrust, in support to UPME and MME.

Electromobility – They sponsor the Giro Zero program executed by the *Universidad de los Andes* since 2019, as a program focused on building a roadmap towards zero emissions in the Colombian Automotive Freight Transport sector⁷⁰. This program addresses the possibility to use GH2 in road freight transport as one of various zero emissions alternatives within such sector.

USAID (U.S: Agency for International Development):

GH2 – In collaboration with the U.S. National Renewable Energy Laboratory – NREL they have technically supported FENOGÉ in the evaluation of proposals for green and blue H2 projects aiming to access pre-investment studies funding opportunities.

Other relevant topics — Between April 2018 and December 2021, they developed the SURE (Scaling Up Renewable Energy) program in Colombia that supported the integration of renewables and the transition to a more resilient, competitive and clean energy system, to diversify energy generation towards renewable sources. They supported the issuance of new regulation and the preparation of the 1st successful RE auction carried out in October 2019, providing training, and supporting XM in the planning, operation, and integration of FNCRE in the national energy market, among others⁷¹.

In June 2022, they launched together with the National Learning Service (SENA) a RE educational program which intends to offer 15-month careers to young women and men in between 15 and 28 years old, living in 13 communities along which most wind and PV projects are being built in the Guajira region. The idea is that these members of the community shall attain the knowledge and skills necessary to access good employment opportunities or develop their own entrepreneurships based on different business opportunities around renewable energy projects' development and operation⁷².

WRI (World Resources Institute):

Other relevant topics – They have supported the GoC in market analysis and regulatory adjustments to promote the integration of electromobility and the generation of non-conventional renewable energy.

WWF (World Wildlife Fund for Nature):

Rural electrification – They work with the MOTT foundation on the subject of electrification solutions for communities without access to energy in developing countries. They are currently advancing in studies with prospects to develop pilot projects and support electrification strategies in Colombia.

⁶⁹ (<https://www.gov.uk/government/news/uk-pacts-first-project-in-colombia-will-improve-energy-access.es-419> and <https://ggi.org/convocatoria-del-technical-assistance-program-for-rural-electrification-projects/>).

⁷⁰ <https://girozero.uniandes.edu.co/>

⁷¹ (<https://www.usaid.gov/es/news-information/fact-sheets/env-scaling-renewable-energy-activity-sure>)

⁷² <https://www.elheraldo.co/la-guajira/sena-y-usaid-lanzan-programa-en-energias-renovables-en-la-guajira-916955>

Electromobility – They prepared a detailed proposal for the implementation of a NAMA Support Project (NSP) in order to establish an enabling environment for the development of electric mobility in Colombia. The NSP was not finally approved for its implementation phase in 2021, but this work provided inputs that WWF classifies as important for the development of this topic in Colombia. It is possible that in the future the GoC still finds other fund different to the NAMA Facility to support implementation of such project.

WB (World Bank):

Transmission lines – They have provided technical assistance to UPME for the development of studies related to the HVDC connection project of La Guajira.

Electromobility – They have financed recent studies on: Challenges of the Electrical System for Electromobility in Colombia (WSP, 2021); and Evaluation of EV accommodation capacity in distribution networks to meet the demands generated by electromobility in Colombia (USAENE & Tecnalia, 2022).

GH2 – They have supported the MME in the assessment of possible origin certification schemes for H2 to be implemented in Colombia. They are interested in exploring possible financing mechanisms to mitigate the risks associated to H2 technologies. They provide technical assistance to the MME and FENOGÉ for the promotion of low emission H2 in general (i.e. green and/or blue H2).

Other relevant topics – They supported the preparation of Colombia’s Offshore Wind RoadMap. They also supported the studies of the Energy Transformation Mission, as well as policy making for green recovery and innovation.

IDB (Interamerican Development Bank):

Rural electrification – They have financed recent studies in support of Public Private Associations – PPP for Non-Interconnected Zones in Colombia (Giraldo et al, 2017), same as identification and analysis of international experiences in the application of innovative energy access models (Pérez Arriaga et al, 2020). Also, in implementation of a Reference Electrification Model to locate users without electricity service and decide on more convenient electrification strategies (WAYA Energy, 2022) and design and implementation of a methodology to calculate an Energy Poverty Index for Colombia (Consulting Energy Studies, to end in September 2022).

They are currently supporting the structuring of diesel-substitution solutions with NCRE for two prioritized locations of the NIZ, same as a study for Identifying and characterizing users without access to electricity in NIZs within La Guajira. Also, support is being provided for a study intending to include cultural and ethnic dimensions in the planning methodologies used by the energy mining sector.

Additionally, they have provided support to identify actions to guarantee the quality and coverage of the electricity service in the medium and long term (CO-T1580, 2020 still in progress), same as for the Development of a Universal Energy Coverage Strategy (CO-T1502, 2019 still in progress). They have assisted the MME with inputs to guide reforms that allow increasing electricity coverage in NIZ (CO-T1438, 2018), together with actions aimed at removing obstacles to the penetration of renewable energy solutions in NIZ, in order to promote the development of private investment in NCRE systems in NIZ (CO-T1411, 2016). They also provided funding for the execution of a

Sustainable Power Plan as part of a Comprehensive Intervention Plan in the Pacific region (COT1408, 2015).

Smart Grids, AMI – They funded the initiative of Smart Grids Colombia with a vision towards 2030, developed in 2016 with the support of the Colombia Inteligente⁷³ initiative.

Grid interconnections and NIS – They have provided technical assistance for the preparation of the roadmap leading the Colombia-Panama interconnection project, as well as its design, technical and environmental studies. Also, through TC CO-T1501, they have supported the strengthening of Colombia’s institutional capacities to integrate NCRE, to ensure that the incorporation of these intermittent sources does not generate major disruptions in the electrical system.

Electromobility – They have financed studies on Interoperability of electric vehicle charging infrastructure in Colombia (Qurato, 2022), structuring and launch of an electromobility financing line through first and second tier financial channels (Sumatoria et al, 2022), and Identification of business models and implementation of roadmaps structuring for the development of a public charging infrastructure network (USAENE, 2022). Also a study on inland waterways electromobility has been funded (Universidad de los Andes, 2022).

GH2 – They supported the preparation of Colombia’s Hydrogen Roadmap (Sep. 2021). They presented a NAMA Support Project proposal to the NAMA Facility for the decarbonization of the industry through GH2 (Apr. 2022). They supported the structuring of the H2 regulatory Sandbox. They are working on a regional strategy to harmonize the adoption of H2 origin certification schemes.

Other relevant topics – They supported the preparation of the Long-Term Climate Strategy of Colombia – E2050, as well as the Energy Transformation Mission, and studies on geothermal energy and biogas

⁷³ Colombia Inteligente is an initiative of the private sector, supported by grid operators, transmission agents, the Electricity Market operator XM, same as the participation of the MME, promoting the development of Smart Grids in Colombia. The initiative exists since 2011, and in 2016 this developed the country’s roadmap and vision for smart grids with the support of IDB.

ANNEX V. Investment Plan component investment concept brief

COMPONENT 1. Financing of Energy Transition through Bancoldex

Problem statement

Colombia's Energy Transition is currently underway and evidencing progress in both solar and wind energy integration. At the same time, the number one priority for advancing in a fair energy transition in Colombia corresponds with closing the gap of energy access, considering all rural offgrid areas (including NIZ and unattended NIS areas), and providing these with access to renewable energies. To do so, the country faces little below half a million users with no current access to electricity. Options for expanding coverage to achieve universal access include grid extension, minigrids and stand-alone PV solutions as alternative options, which turn cost-effective depending on the characteristics and georeferentiation of new users to be attended. The provision of such energy solutions has currently reached a level of maturity which shall allow to create conditions so that the government and public funds can share participation to private stakeholders, to develop solutions which shall turn sustainable and provide an active role for users, through the use of novel business models. To try these new models including private participation, the use of concessional resources may become a decisive factor, departing from successful case studies which have already been developed using commercial bank's financing. Linking access to energy with productive uses, in order to generate social development in the homes and communities that benefit from these solutions, will be a fundamental element for its sustainability and meaning within the framework of the energy transition that the country requires.

In terms of distribution grid's digitalization, while the country has been able to advance in the estimation of potential benefits and cost savings to be obtained from deployment of associated infrastructure (AMI), only a few pilot projects have been developed so far. The MME has proposed targets for massification of smart meters by 2030, with current goal being for 75% of final energy users to have installed smart meters by such year, representing more than 12 million meters by then. However, a legal barrier introduced in 2021 and partially surpassed in June 2022 has delayed adequate regulation to be in place for grid operators to be willing to make necessary investments, with certainty that these will be remunerated in the near future via regulated energy tariffs.

On the other hand, currently the country is positioned as the region's leader in terms of electromobility growth, having presented sales for 1.296 vehicles in 2021, and 1.097 in the first 3 months of 2022, followed by Mexico with 1.140 vehicles in the same year and 570 in the first quarter of 2022⁷⁴. This high volume of EV penetration amounts to a record high of 8.128 registered EVs as of mid-2022. However, as the number of EVs grows, demand for charging stations becomes critical, where one rapid or fast charging stall should be available for every 10 or 33 EVs on the road⁷⁵. Likewise, in order to achieve a significant impact in reducing GHG emissions in the transport sector, it is necessary to speed up the transition to electrification of both mass public transport (e.g. buses, trains, trams and electric subway systems), as well as the substitution of freight transport vehicles (either battery electric or fuel cell based). In the case of major cities such as Bogotá and Medellín,

⁷⁴ DW, 2022.

⁷⁵ One EV charging station for every 10 EVs requiring to charge using public infrastructure, which is equivalent to an average of one charging station for every 33 existing EVs, considering approx. 70% of such vehicles can be expected to be charged using "home" charging.

projects such as the Bogotá Metro, the 80 Metro in Medellín, and the Regiotram regional train systems between Bogotá and its surrounding municipalities, are projects that still require financing and that, in addition to contributing to the economic and social development of these cities and regions, will generate a representative electricity demand in the order of 0.5 TWh/year in their first stages, which will leverage the integration of NCRE to the NIS.

Finally, with the adoption of Colombia's hydrogen RoadMap in 2021, development of green H2 production capabilities is just beginning to be implemented. Many companies interested in the development of this new opportunity, as an e-fuel with potential to progressively substituting fossil fuels, are joining efforts through associations such as H2 Colombia and ANDI-NATURGAS' H2 Chamber. However, high costs associated to what may be considered a future disruptive technology, and lack of track record in large and commercial scale of production, set challenges for investors to bet in the development of first projects. Given the promising role that this novel energy carrier represents for decarbonization of both industry and heavy transport sectors, Colombia is eager to develop an H2 future economy and regional hub which in part could replace current oil exports as the world progresses towards zero emissions and zero fossil fuel-based economies beyond 2050.

Current record high lending interest rates, plus high technology costs and a depreciating local currency, demand for supported financial conditions to be introduced to make possible investments leading to expected continued economic growth within the next few years. Financial facilities such as those to be provided by the CIF-REI program are thus necessary not to delay progress which needs to be made further unto 2030 in order to meet emission reduction targets and switch to the right track towards achieving 2050 net zero emission ambitions.

Proposed contribution to initiating transformation

The Colombian CIF-REI program shall procure to produce a positive transformational change towards accelerated energy transition, based on the promotion of possible projects to enter the pipeline of NDBs in the following areas:

- Initiatives to provide off-grid access to renewables, through solutions involving the participation of both private sector and users and communities, with the aim to procure more sustainable long term business models while involving quality and reliability criteria in the provision of off-grid electricity service. This, as enabling factor for the conformation of energy communities and development of popular economies.
- AMI massification, facilitating the investment of grid operators deploying their first advanced meters programs, once the remaining regulatory uncertainty is removed so investments may be remunerated over time based on regulated tariffs. With this, users are expected to have the means to actively participate in both the generation and consumption of electrical energy, promoting the sector's democratization.
- HVDC lines connecting regional markets in neighbor countries such as Panama and Ecuador, or Guajira's power generation to be evacuated towards the country's interior, same as smaller scale grid-flexible technologies such as FACTS, STATCOM and similar projects envisioned by UPME to be required beyond 2023.
- Both acquisition of EV fleets, including cars, trucks, buses, trains, trams or subways, and the deployment of EV rapid and fast charging infrastructure, led by the government or public institutions, to allow for continued growth in the adoption of EVs. In the case of EV charging

infrastructure this is expected to trigger dynamics which shall later allow for private investment models to operate by their own to naturally deploy faster growing infrastructure, once a critical mass of vehicles has been reached.

- Green Hydrogen projects to start developing production capacities for such energy carrier, same as handling, storage and usage technologies which shall enable for this to become a substitute to fossil fuels currently used in industry and heavy transport segments, in order to reach their eventual decarbonization.

Implementation readiness

NDBs are potential Implementing Entities identified and expected to properly allocate resources to be received from CIF through MDBs. As such, these entities are key in identifying a pipeline of mature enough projects, and those in earlier stages, with potential for financing eligibility under the current program, within a timeframe of 3 years.

In such sense, NDBs have so far indicated to count with a preliminary project pipeline aligned with here presented eligibility criteria, thus to be evaluated on a case-by-case basis for obtaining program's support.

In terms of AMI, both large and small grid operators have manifested being interested in TA possibilities which may be obtained to assist them in preparing their plans for such infrastructure massification to take place once investments firm remuneration regulation has been issued. Based on this, MDBs may procure directing available TA under current cooperations towards this purpose, helping finance required pilot projects / plan preparation with special target on those agents with less financing facilities.

Based on the new regulation expected by the end of 2022 and the support of programs such as CIFREI to support the massive deployment of AMI, end users will be able to become an active part of the NIS, as well as find it easier to produce their own energy and sell their surplus to the grid. Based on this possibility, and together with the development of rural energization solutions in NIZ, using schemes where Grid Operators of the NIS or other private investors may be involved, and though which active participation of users is enabled, the aim is to support a solar outburst equivalent to massive access to solar energy sources, through photovoltaic technology. This will be accompanied by the development of the concept of energy communities that make possible a real empowerment of users regarding their participation in the activities of electricity generation and consumption.

Additionally, while HVDC and other grid-flexible technology projects will continue to be pushed forward by UPME, as technical-economic analyses proof the need and cost-benefit to do so, these solutions will be implemented according to what the system expansion framework allows, with users paying for such cost-effective solutions through regulated energy tariffs. Such projects shall ensure the adequate operation of the system and reliable energy supply in the future as variable NCRE adoption continues to grow. Nevertheless, if any possibility to use concessional resources arises for accelerating projects which could reduce overall system costs and enable higher shares of RE integration, such shall be possible as long as early benefits to be procured through the CIF-REI program are evident.

Recent success cases of participation of private companies in the provision of NIZ NCRE based solutions for the shift from diesel-based generation systems to reliable hybrid schemes is proofing the adequacy of such business models through PPA contracts subscribed between companies with

capacity and experience for the construction and operations of PV plants, and commercializing companies attending NIZ users.

In the case of EV charging infrastructure, major utility and grid operator companies in Colombia have shared their interest in accessing CIF-REI resources for deployment of public or semi-public ⁷⁶ charger stations as part of plans being developed with companies interested in EV fleets adoption. Also, some have plans to deploy rapid charging infrastructure along the main highways and roads connecting main capital cities, with some of them already having started to do so and expecting for the number of EV to increase to obtain a financeable business case.

In the case of new mass transportation systems projected to be developed within the country, the Bogotá Metro which started construction in 2021 is expected to come into operation in 2028, as long as the planned works achieve an adequate financing under the macroeconomic conditions evidenced as of the end of 2022.

Rationale for REI financing

Projects to be financed by Colombia's CIF-REI program shall fall within either of following categories:

- Scaling up renewable energy enabling technologies: AMI and GH2 associated technologies, grid-flexible technologies such as battery-based storage systems, FACTS, STATCOM, or others, EV charging infrastructure, and EV fleets plus electric transport systems deployment.
- Enhancing infrastructure to be renewable energy-ready: regional interconnections and essential transmission lines to allow the evacuation of wind and PV power from high resource areas to concentrated demand regions.
- Supporting renewable energy innovation: innovative schemes enabling reliable energy supply through NCRE in off-grid areas (NIZ), involving the participation of the private sector plus an active role of users, through new business models.
- Enhancing system and market design and operation: Fostering participation of new players in the energy generation market, same as that of experienced companies in the development and operation of solutions ensuring access to electricity services through efficient subsidy allocation, low cost to users and acceptable quality and reliability.

All of these shall contribute to current or future integration of renewable energy capacities, mainly considering PV and wind technologies increasing shares to be incorporated to the electrical system in the following 3 to 4 years, and further on towards 2030.

At the same time, while electricity consumption currently represents approx. 18,6% of the country's final energy demand, it is the intention of both the GoC and the CIF-REI Program to increase that figure, as electrification of transport and industry is supported. As this is achieved, electricity may be expected to participate in more than 50% of final energy consumption by 2050.

⁷⁶ Stations to be reserved for the use of specific commercial fleets at certain times of the day, and open to general public at other hours, ensuring proper feed to e.g. electric trucks or utility vehicles, while maximizing the use of the infrastructure throughout other hours of the day.

Results indicators

The following shall be result indicators to be monitored throughout the execution of this component within CIF-REI Investment Plan for Colombia:

- MW of RE based solutions providing off-grid energy access.
- No. of users benefited by AMI deployment.
- Installed Flexibility Capacity (MVAR or similar), for FACTs, DFACTs, STATCOM or similar projects, for management of either active or reactive energy produced or required from the integration of NCRE.
- Installed transport capacity (MWs or MVAs transport capacity), which may be associated to reduced curtailment.
- No. of rapid and fast EV charging stations, and number of new adopted electric transport systems or acquired EVs.
- Green hydrogen production capacity (Tons GH2 / year), which shall in part be associated to reduced curtailment of wind and PV generation plants (not evidenced yet, but expected to occur as installed capacity increases based on the development of such flexibility options).
- GHG emissions reduced or avoided (Tons CO2eq) – direct/indirect.

Financing plan, including financial instruments

Financing source →		CIF-REI (through IDB)		Leverage		
				IDB	CTF	Bancoldex and FDN own resources, BID Invest, equity and/or commercial loans
IE → Component ↓		Bancoldex	FDN	Bancoldex & FDN	Bancoldex	Bancoldex & FDN
1	Financing of Energy Transition	US\$34 m. (US\$33.25 m. concessional* + 0.75 m. TA**)	US\$34 m. (33.25 m. concessional* + 0.75 m. TA**)	US\$79 m.	US\$5.0 m. (3.5 m. concessional* + 1.5 m TA**)	US194.88 m.
Subtotal		US\$68 million		US\$278.88 million		
TOTAL		US\$ 346.88 million (70 m. concessional + 3 m. TA + 278.88 m. ordinary capital and from 3rd parties)				

* Concessional: conditions corresponding to an interest rate of 0.98%, up to 20-year tenure and 8-year grace period

** TA: non-reimbursable resources from CIF-REI and CTF

Project preparation timetable

For the operation with Bancoldex:

	2022	2023				2024				2025				2026			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
IP Endorsement	X																

BID – Bancoldex operation preparation		X	X														
Official agreement				X													
1st disbursement					X												

Execution					X	X	X	X	X	X	X	X	X	X	X	X	X
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For the operation with FDN

	2022	2023				2024				2025				2026			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
IP Endorsement	X																
BID – FDN operation preparation		X	X	X	X												
Official agreement						X											
1st disbursement							X										
Execution							X	X	X	X	X	X	X	X	X	X	X

Non-reimbursable component funding (US\$1.51. million)

Following activities are considered for request of non-reimbursable resources, as part of the total US\$68 million required for execution of this Investment Plan’s component:

Currency hedging: funds to be used for obtaining hedge coverage in order for MDBs and NDBs to be able to provide loans in local currency.

Social and gender inclusion: resources to be used for the execution of activities and actions aimed at promoting gender and social inclusion among IEs, sub-borrowers and/or suppliers. These activities may include:

- Conditional interest rate reductions
- Capacity building programs
- Employability, innovation and/or entrepreneurship training programs
- Associated monitoring and reporting

COMPONENT 2. +H2 Colombia through FENOGE

Problem statement

The objective of achieving GHG emission reductions to meet both NDC commitments by 2030 and longer term decarbonization of the country's economic activity to turn carbon-neutral by 2050 implies achieving ambitious transformations both in the AFOLU and Energy sectors. In the case of the Energy sector, such transformations include those of intensive energy consuming segments as transport and industry, currently relying mainly in consumption of fossil fuels. To achieve such transition, direct and indirect electrification of these sectors through NCRE turns necessary, considering the option of e-fuel production as a relevant solution which shall play a key role in the decarbonization of segments relying on thermal energy uses which are technically impossible to electrify. To do so, the use of renewable energies to produce GH₂ for its use as a zero-emissions fuel, will partially and progressively allow for substitution of fossil fuels to take place in applications where other renewable technologies are not feasible.

At a global scale, hydrogen is attracting great interest in becoming a key instrument in the energy transition towards the adoption and management of clean and sustainable energy sources. Hydrogen is the simplest and lightest element in the periodic table and its versatility as an industrial raw material, fuel and energy vector for the storage and transport of energy, allows a large number of applications, most of which are just starting to be developed. Also, combustion or use of hydrogen through fuel cells produces no carbon or other GHG emissions during its end use. Given its reactivity, hydrogen does not usually occur in isolation in nature having to be extracted from water, hydrocarbons or biomass. Depending on its means of extraction, and the energy source used, CO₂ associated emissions for producing H₂ vary, with the advantage of being null when renewable energies are used to produce it through the electrolysis process, which uses pure water and electricity (case in which the obtained H₂ is referred to as green H₂). Nevertheless, currently produced H₂, used mainly as a raw material for the processing of oil in refineries and the production of ammonia for the fertilizers industry, is produced via steam methane reforming (SMR), a process which extracts H₂ from natural gas, producing some 8.9 t CO₂eq for every t of H₂ extracted (with H₂ produced in this way being referred to as grey H₂). Unfortunately, comparing the cost of producing grey H₂ with that of green H₂, the current difference is disadvantageous for green H₂, with such ranging in between 2 and 3 times the cost of grey H₂, depending mostly in the RE source availability and thus the LCOE for electricity used in the electrolysis process.

Low-emission hydrogen shall contribute to accelerating the achievement of Colombia's decarbonization strategy, starting with goals as of 2030 of achieving GH₂ production costs in the order of 1,7 USD / T GH₂, compared to current 4,9 to 6 USD / Ton if using grid electricity, against 1,7 to 2,3 USD/ Ton for local grey H₂ production vis SMR (costs as of 2021). As an energy vector, hydrogen will accelerate the deployment of Non-Conventional Renewable Energy Sources (NCRE sources), such as solar energy and wind, through seasonal storage of energy and its transport to the centers of demand. In order to get there, however, technology demonstration and cost reductions are yet necessary to be achieved in coming years.

Proposed contribution to initiating transformation

Based on Colombia's H₂ Roadmap, the country's vision to develop low emission H₂ for industrial and transport applications, and partially displace the use of fossil fuels, includes the incorporation

of 1 to 3 GW electrolysis capacity, accompanied by 1.5 to 4 GW wind and/or PV generating capacity for the production of 70 kt GH₂ by 2030. This vision is accompanied by the deployment of a fleet of 1500 to 2000 light fuel cell vehicles, plus 1000 to 1550 heavy duty fuel cell vehicles and 50 to 100 hydrogen refueling stations. Building up such infrastructure requires between US\$ 2,5 and US\$ 5,5 billion investments, generating 7.000 to 15.000 new jobs, and producing total cumulative GHG emission savings of 2,5 to 3 million tCO₂eq 2022 through 2030, equivalent to annual reductions of 0,7 million T CO₂eq / year by 2030.

In order to promote the development of said capacities, in 2022 FENOGE has called for projects associated to either segment of the value chain of low emission hydrogen (including production, storage, transportation, handling and use of either green or blue hydrogen) in order to support eligible projects with financing facilities. Such facilities are planned at first to co-finance the execution of pre/feasibility studies using grant resources together with developers' own resources, then expecting to offer special funding through both concessional and grant resources which may become available from public funds, international cooperation and other sources FENOGE shall be able to procure. From this call, 58 expressions of interest were presented, and out from the evaluation carried out by FENOGE and technical assistance from GIZ, USAID and KEXIM, 10 projects were selected for initial pre-investment studies funding, using USD 1,5 million of FENOGE's own resources.

FENOGE expects to make more funds available to both support other studies, and later enable financing for execution. FENOGE also envisions to open a permanent window for developers to present their structured project proposals in request of access to these financial facilities. Through envelope's TA component No. 22, USD 2,0 million of non-reimbursable resources are being requested to go directly to this facility.

In April 2022, the IDBG also presented to the NAMA Facility a Nama Support Project (NSP) outline for decarbonization of industry through the use of Green Hydrogen, which was not selected for funding under the 2021-2022 call, but was part of 7 initiatives selected for a detailed evaluation (out of 40 projects which were presented), and obtained positive feedback which makes possible for the project to be reformulated and presented once again in a next call. As part of this initiative, a pipeline of potential projects to be supported was initially identified including the fertilizers industry, followed by opportunities in non-ferrous metals production, steel galvanization, oil hydrogenation, floated glass manufacturing, and finished goods / parts handling. Furthermore, the structuring of projects for the iron and cement industries was also envisioned towards execution in between 2030 and 2040. Total potential grant resources requested where EUR 25 million, expecting to leverage approx. EUR 335 million more, while estimating potential emission reductions of 192 kt CO₂eq / year by 2030 and up to 715 kt CO₂eq / year by 2040 (with additional financing being required for envisioned cement and iron production green-projects).

Additionally, considering advantages associates to hydrogen in comparison to electricity for transport applications, in terms of longer range and much shorter filling times, hydrogen has a potential specially in heavy road transport, same as in segments as those of maritime and air transportation. Together with battery based EVs, fuel cell trucks and hydrogen powered vessels and aircraft make total decarbonization of the transport sector possible, regardless of the time it may take for these technologies to have been fully adopted. As an initial step in application of H₂ for transport in Colombia, *Ecopetrol* launched in 2022 a first green hydrogen pilot project, in which a Toyota *Mirai* H₂ fuel cell vehicle was incorporated, being the very first H₂ vehicle to operate in the country. Furthermore, *Ecopetrol* plans to have a fuel cell bus pilot operating by the end of 2022 in

Bogotá, while *Grupo de Energía de Bogotá* is currently planning to develop a 10 H2 fuel cell bus fleet pilot to be running by 2025 in Bogotá's *Transmilenio* system.

Adding all expected projects to be called through FENOGÉ, plus possible NAMA Facility NPS, and other initiatives aligned with Colombia's H2 Roadmap, sets first steps towards exploiting the potential of producing reductions of up to 13.2 million Ton CO₂eq/year by 2050, giving a perspective of the open investment portfolio which this investment plan has the potential to help kick off in this specific area of GH₂.

Implementation readiness

As mentioned earlier, FENOGÉ's call for projects identified 58 initiatives related to low emissions H₂, 60% of which corresponded to green H₂ production, 12% to conditioning and transport solutions, and 28% to end use applications. Based on a thorough evaluation exercise, 10 of such initiatives were selected for funding of their pre-investment studies, benefiting 9 companies including an energy retailer, a biogas producer, a bus bodywork manufacturing company, a university and various renewable energy and GH₂ projects developers.

Colombia already has two operating GH₂ pilots running as of mid-2022, one consisting of GH₂ production for its use in the Cartagena Refinery of Ecopetrol, and the other for the injection of GH₂ for blending with natural gas, and transport of such blend through Promigas gas pipelines, to distribute mainly among industrial users in the Mamonal industrial area in the outskirts of Cartagena City.

Since 2021 the country also has a Colombian Hydrogen Association, same as a Chamber for Hydrogen since 2022 run by the National Industry Association – ANDI and the Colombian Natural gas association – Naturgas. *Rationale for REI financing*

Use of grant resources for the execution of pre-investment studies shall reduce risk for developers, and help properly structure financeable projects. On the other hand, these resources shall help leverage the use of concessional resources from Component 1 of this PI, together with third party resources to be used in the execution of those projects to be structured under Component 2.

Support to the production of this type of studies with both foreign and local consultants' participation shall produce a knowledge transfer necessary for capacity building among local community, which is expected to disseminate and spread through socialization and experience sharing events to be prepared by both FENOGÉ and IDB as part of the development of the CIF-REI program.

The potential for growth of this field, all based on the incorporation and integration of increasing shares of renewable energy is considerably large (US\$2.5 to 5.5 billion), while allowing the decarbonization and indirect electrification of industry and transport sectors. As perhaps most relevant for the CIF-REI program, together with the production of this type of EV Fuel from integrated RE capacities, the use of GH₂ and derived products such as green ammonia for storage purposes shall allow for large shares of variable renewables to be managed thanks to high installed electrolysis capacities which shall be used together with storage facilities to ensure grid stability at all times (something seen feasible towards 2040-2050 as per Colombia's H₂ Roadmap).

Results indicators

The following shall be result indicators to be monitored throughout the execution of this component within CIF-REI Investment Plan for Colombia:

- No. of projects to receive TA for pre-investment studies
- Potential GH2 production capacity (Tons GH2 / year) assessed and proven to be feasible accompanied by technical and financial structuration
- Potential GHG emissions to be reduced or avoided (Tons CO2eq) – direct/indirect from the development of GH2 projects made feasible
- RE capacity to be installed (MWs or MVAs transport capacity) for GH2 production

Financing plan, including financial instruments

Financing Source →		CIF-REI (through IDB)	Leverage
			FENOGE own resources, bilateral cooperation and others
IE →		FENOGE	
Component ↓			
2	+H2 Colombia	US\$2 m. (TA)	US\$ 1.12 m.
TOTAL		US\$ 3.12 million	

Project preparation timetable

	2022	2023				2024			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
IP Endorsement	X								
BID – FENOGE Operation preparation		X							
Disbursement			X						
Execution				X	X	X	X	X	

ANNEX VI. Regulation supporting NCRE integration

Table 9. Regulation supporting NCRE integration in Colombia

Regulation	Description
Small scale selfgeneration and distributed generation (CREG 030-2018, 135-2021, and 174-2021)	Resolution 174-2021, preceded by resolutions 135-2021 and 030-2018, sets conditions for self-generators to sell their surplus electricity with preferential conditions for systems bellow 100 kW, and differentiated for those below 1 MW as small-scale threshold, while allowing simplified connection procedures for projects below 5 MW. Besides this, a complete framework for users wanting to become self-generators and utilities developing distributed generation projects is established.

<p>Grid connection of PV and Wind generation systems (CREG 060-2019, 075-2021, 148-2021)</p>	<p>Resolution 060-2019 modified the operational ruling dating from year 1994, enabling the connection of both PV and wind projects to the electrical National Transport System (NTS), introducing necessary specific technical requirements that these types of technologies must meet to ensure the safe and reliable operation of the system. Resolution 148-2021 did the same for Local Distribution Systems (LDS). Resolution 075-2021 updated procedures to be followed for the assignment of grid connection and transport capacity for new projects (including PV and others).</p>
<p>Firm Energy calculation for NCRE projects (CREG 2012-2017, 167-2017, 132-2014 and 153-2013)</p>	<p>When resolution 071-2006 established the way in which Firm Energy were to be calculated for participating of Reliability Charge Auctions, no PV or wind technologies were then considered. However, methodologies for these two technologies would later on be introduced leading to resolution 167-2017 which addresses the case of wind farms and resolution 201-2017 for PV farms. In between, also methodologies for determining firm energy contributions from biomass and geothermal projects were introduced through resolution CREG 153-2013 for biomass and resolution 132-2014 for geothermal energy.</p>
<p>AMI integration guidelines and remuneration (MME 40459-2019 and CREG 101 001-2022)</p>	<p>Resolution 40072-2018 first established guidelines and targets for AMI's deployment. The target set then was for 95 % of urban users and 50% of rural users to have AMI by 2030. However, such target was revised by resolution 40459-2019, decreasing it to 75% of all NIS users. Later on, resolution 101 001-2022 introduced a way through which partial recovery of investments shall be possible, however limited by the provision set in Article 56 of Law 2099 prohibiting for final users to remunerate advanced meter costs. Now that such provision has been removed, new regulation from CREG is expected to be issued in the second half of 2022 allowing full investments remuneration over time (with a draft proposal having been presented in July 2022 – Resol. 701 011-2022 by CREG -but not yet finally adopted).</p>
<p>Technical requirements for EV charging stations (MME 40223-2021)</p>	<p>Resolution 40223-2021 was the first to establish minimum requirements which are to be met by agents installing EV charging infrastructure to supply EV charging services to general users. In this sense, it establishes the need to comply with electrical safety guidelines by RETIE⁷⁷, same as</p>

	<p>to offer at least a Type 1 connector in every AC Level 2 or Level 3 charging station, and at least one CCS Type 1 connector in every DC Level 3 charging station. At the same time it states connectors are to be fully certified according to applicable international standards, and the cost of such service is to be freely set by the agent offering the service.</p>
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⁷⁷ Technical Regulation for Electrical Installations, which any electrical installation is obliged to meet in Colombia.

<p>Off-grid electric service coverage expansion in NIZ (Decree MME 0992021, CREG 701 0012022, 701 005-2022 and 701 006-2022)</p>	<p>Decree 0999-2021 by the MME introduced the possibility for extension of electric service coverage to be carried out either through i) Physical Networks or ii) Logistics and Service Networks. The last of these, referring to the case in which Grid Operators (from NIS) develop individual solutions for servicing isolated users, while being in charge of the administration, operation and maintenance of such systems. The Decree also established necessary investments can be made with public, private or combined resources, to be remunerated through tariff schemes provided by CREG for that purpose. Also as a very important point, the need to prioritize non-conventional sources of energy or liquefied petroleum gas was set, for determining either centralized or individual solutions, procuring most economical and technically efficient solutions. Later resolutions 701-001, 701 005, 701 007 of 2022 have been issued for further ruling over this decree.</p>
<p>ICONTEC's adoption of international standards for NCRE and e-mobility plus an update of the Electric Code</p>	<p>Other related administrative acts complement previous cited Government regulations, and from the technical side ICONTEC has produced more than 40 standards in regard to solar energy (resource modelling, PV, thermal technologies and all related components), at least 11 standards for wind energy, 33 standards in relation to EVs and their charging infrastructure, plus a standard for AMI system requirements in electricity distribution networks (NTC 6079:2021), and others. Also, the update of the Electric Code NTC 2050, introduced in 2020, based mainly in the American National Electric Code (NEC), introduces relevant elements for Distributed Energy Resources DER and NCRE integration.</p>

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January 20th, 2023

INDEPENDENT TECHNICAL REVIEW OF THE REI INVESTMENT PLAN FOR COLOMBIA (IPCOL)

1. Title of the investment plan: REI - Investment Plan for Colombia (IPCOL)
2. Program under the GCAP: Renewable Energy Integration Program (REI)
3. Name of the reviewer: Christian Rafael JARAMILLO HERRERA
4. Date of submission: January 20th, 2023
5. Part I: General criteria

Colombia's Investment Plan for CIF REI (hereafter IPCOL) includes an accurate assessment of Colombia's current situation and outlook in the context of the energy transition, elaborating on challenges and opportunities, and describing the country's strategy, in particular regarding renewable energy (RE). The IPCOL is consistent with the goals, strategies and actions in the previous National Development Plan (NDP 2018-2022), the Bases of the new government's NDP 2022-2026 and its Roadmap for a Just Energy Transition, as well with the central planning documents in the energy sector (UPME's National Energy Plan 2020-2050, its plans for electricity transmission and generation, natural gas, liquid fuels, and energy coverage expansion; and the Ministry of Energy's Climate Change Action Plan –PIGCCme, Offshore Wind and H2 Roadmaps) and the priorities set for the energy sector in the Climate Change Strategy E2050. All of these plans incorporate ambitious GHG reduction and the SDG and NDC targets. The IPCOL describes the institutions to be involved in the execution of the CIF REI funding, taking advantage of Colombia's solid energy sector institutions and the proven track record of the finance sector working with MDB in the execution of concessional funding.

With respect to REI, the IPCOL documents and discusses the challenges ahead, in particular regarding barriers to transport electrification and required grid expansion, the electricity coverage gap, operational flexibility and regulatory needs. In line with the current government policy agenda, it also stresses the need for a just and inclusive transition as a key ingredient of sustainability and as an end in itself. On the opportunities side for REI, the plan counts the resource potential, the institutional maturity of the energy sector, the large number of private initiatives for RE and Colombia's commitment to climate change adaptation and mitigation policies. Given that the energy sector is mainly reliant on private sector investment, IPCOL stresses that the availability of financing for risky, innovative, long-term or large CAPEX projects is critical to keep the momentum of policy and unlock change.

The IPCOL's Component 1 focuses on financing of RE infrastructure projects for energy coverage in NonInterconnected Zones (NIZ), and projects conducive to RE integration into the matrix in the National Interconnected System (NIS) –demand and especially transport sector electrification, grid flexibility and AMI, RE-related grid expansion, offshore wind and GH2⁷⁸ –, both of which imply medium-term large-scale impacts. The wide spectrum of projects allowed appropriately reflects the maturity of the energy system, the current stage of its energy transition and the primacy of private sector initiative in Colombia, all of which anticipate an appetite for financing but at the Investment Plan level require flexibility in the possible uses of funding. However, this also implies more stringent checks at the project stage of awarding REI Program funds, to make sure that the Program's objectives are met.

⁷⁸ GH2 is explicitly eligible for CIF REI funding under the REI Program Design. This Reviewer agrees with the REI IEG Report in that GH2, although potentially game-changing in the broader long-term energy transition picture, has little potential to aid in the integration of RE in the short to medium term.

The smaller and narrower Component 2 focuses on TA for long-term, innovative pilot projects in GH2 to build capacity.

<p>a. complies with the principles, objectives and criteria of the relevant program as specified in the design documents and programming modalities</p>	<p>The IPCOL complies with the principles, objectives and criteria stated in CIF REI Program’s Design Document. It reflects the Countries initiatives and challenges, and shows how CIF REI funding complements other relevant, strategic initiatives in the country. It aims at aiding key processes with long-term transformational potential, and at surmounting critical barriers for medium-term large-scale systemic changes in energy use, both in the context of the energy transition and more broadly GHG emission’s reduction. It stresses a just transition, in terms of social inclusion and gender equality, avoidance and mitigation of negative social impact. Capacity building, both for impact mitigation of changes and for development potential, is included.</p> <p>The IPCOL relies on the proven track record of Colombia’s institutions and more specifically of the strength of the energy sector (public and private) for implementation. The IPCOL components target critical barriers and processes in the energy transition, which should lead to a large value creation. Additional to the expected leveraged funds in the IPCOL, these processes, once underway, imply massive energy related investments in Colombia.</p>
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<p>b. takes into account the country capacity to implement the plan</p>	<p>Yes. The IPCOL is explicitly part of and complements many initiatives in the contexts of the Energy Transition, Climate Change, energy sector and the environment more generally; and of the larger development goals of the country as laid out in past National Development Plans (NDPs) and the Bases for the coming one, which stress goals of justice, equality and inclusiveness. The IPCOL explicitly links its components to needs identified in various policy instruments and actions. UPME’s National Energy Plan 2020-2050 and several laws on decarbonization of transport identify mass transportation and EV as crucial goals in meeting NDC targets. UPME’s plans for electricity transmission and generation expect future increases in electricity demand to be met mostly with additional wind and solar generation but recognize the need for added connection capacity and increased flexibility of the electricity system, both at the distribution and transport level. The Energy Coverage Expansion Plan (PIEC) identifies electricity access as one of the paramount challenges for a just and sustainable energy transition, and a critical gap for SDG7. The Ministry of Energy’s Offshore Wind and H2 Roadmaps identify these as medium to long-term avenues of development for decarbonization of the energy use in Colombia. Finally, the IPCOL lists several regulatory reforms already carried out by the regulatory authority (CREG) to better integrate variable energy in the system.</p> <p>The IPCOL channels the funding for Component 1 through Bancoldex and the FDN, well-established NDBs with experience with similar funding resources. For Component 2 (potentially scalable GH2 pilots), the channel is Fenoge, an autonomous fund run by the MME with experience promoting NCRE deployment and research. Since the energy sector in Colombia is based on private investment, the IPCOL expects the private sector to be able to absorb the funding.</p> <p>One aspect of the IPCOL that clearly matches CIF REI just transition criteria at a high level but will need a more detailed definition as specific projects arise is the concept of popular economies. This is a central concept in the new government’s Bases for the National Development Plan (NDP 2022-2026), to promote equality and inclusiveness. In the energy sector, the specific initiative of energy communities (included in IPCOL’s Component 1) reflects this NDP goal. However, the exact guidelines for implementation of these policy goals will be a part of the new NDP by mid 2023. The lack of a concrete operational definition of energy communities at this stage means that more detailed criteria for selection must be developed before individual projects apply for REI financing. However, this also puts the initiatives under the CIF REI Program in a position to modulate the concrete application of just transition criteria, as they would pioneer these policies on the ground.</p> <p>Finally, the IPCOL does not emphasize funding for regulatory development. In accordance with the IPCOL, the Colombian officials interviewed say (and the state of the regulation reviewed and referenced in the IPCOL Annex VI concurs) that the regulatory developments needed are either already underway or supported by complementary technical assistance. According to the interviews conducted, at the time</p>
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	<p>of preparation of the IPCOL it was deemed that the funds would be available when they would be most useful for projects on the ground rather than for regulatory support.</p>
<p>c. has been developed on the basis of sound technical assessments</p>	<p>Yes. The IPCOL explicitly links its assessment of the energy sector, with challenges and opportunities, to a variety of sectoral and issue specific studies undertaken in the context of the Energy Transition policies by the Colombian authorities, the academia and private institutions, often with MDB support.</p>

<p>d. demonstrates how it will initiate transformative impact</p>	<p>The IPCOL identifies barriers that need to be surmounted to unlock specific large-scale, medium-term processes in transport electrification, electricity access in isolated areas, and RE absorption capacity of the interconnected grid. These barriers are financial (large or long-term investments in transmission), logistic (wide deployment of AMI and EV charging infrastructure, need for grid expansion), technological (HVDC design and operational knowledge), and social (energy access gap, general inequality, social marginalization and state absence that fosters community resistance). These are addressed in Component 1.</p> <p>All of the processes in Component 1 require large outlays of capital. Their transformational impact is adequately explained in the IPCOL, but the ability of CIF REI funds to be decisive towards transformation, rather than just additional funding, rests crucially on project-level conditions that focus their deployment on key logs. The IPCOL argues that the wide range of possible projects is convenient at this stage, so as to be flexible when projects arise, but this review does recommend specific “key-log” conditions for some types of projects anticipated.</p> <p>An exception to this comment are the social elements of the Component 1, about energy access. Social impact of closing the energy access gap is necessarily local and thus gradual. The transformational aspect in this case lies in the development and implementation of inclusive models of energy-related governance that empower women, ethnic groups, minorities and local communities.</p> <p>Component 2, associated with longer-term, low-maturity GH2 technology, is necessarily more speculative and riskier in the technical sense. It is however in line with global assessments of long-term transformational opportunities for the energy sector.</p>
<p>e. provides for prioritization of investments, adequate capturing and dissemination of lessons learned, and monitoring and evaluation and links to the results framework</p>	<p>The projects eligible under Component 1 are generally well-suited for REI Program goals and criteria, provided the specific project-level key-log conditions mentioned in the previous comment are designed and applied by the NDBs with the MDB. Given the wide spectrum of eligible projects, at this stage it would be difficult to tailor key-log criteria and use them for a more detailed prioritization, other than the general REI criteria already included.</p> <p>The IPCOL generally states that the criteria already included will be complemented with criteria for social and gender impact, environmental considerations and cobeneficiaries. Again, it may not make sense at this stage to make these more concrete and specific, but care has to be taken at the project-level; the IPCOL proposes to apply 2X Challenge criteria for the gender dimensions.</p> <p>Monitoring and evaluation and lessons learned are envisioned within the REI IRF. Monitoring relies on information collected or generated by institutions in the energy sector and by other CIF projects, and on reporting by the projects to Bancoldex, FDN and Fenoge. This is in line with previous experience with multilateral funding in Colombia.</p> <p>The data disaggregation is as required for REI and CIF gender and social goals, although more specific detail is advisable. The IPCOL proposes a battery of instruments for dissemination of lessons learned, focused on the transformational, gender and social impacts. AT REI level, Core impacts 1-4 are based on analyses carried out by the sector’s institutions. At all levels, for gender and social impacts, proposed instruments are reasonable and appropriate but tentative and subject to project-specific detail.</p>
<p>f. has been proposed with sufficient stakeholder consultation and provides for</p>	<p>The IPCOL includes an annex reporting the consultations undertaken in its preparation. They include extensive institutional engagement from relevant private and public sector agents and organizations at the national level.</p> <p>Consultations at the local level and with specific groups, communities and gender or community activists was more limited. This is consistent with the wide spectrum of</p>

appropriate stakeholder engagement	projects eligible. Potentially, these projects will be in any number of locations in the country and it is difficult to identify specific local groups of potential stakeholders. Additionally, according to the interview with the task force in charge of consultations, the IPCOL took care to avoid creating premature and potentially counterproductive expectations in local populations, given that the exact projects and their locations are not yet known. This decision was agreed with the CIF team.
g. adequately addresses social and environmental issues, including gender	The IPCOL explicitly subscribes to the country's stated social, environmental and gender equality goals, and requires social inclusion parameters and metrics of beneficiaries, appropriately disaggregated. Gender impact considerations are included in the different components of the IPCOL, subject to the limitations mentioned due to the broad spectrum of eligible projects. The IPCOL proposes to use 2X Challenge criteria to assess gender impact in specific projects, which is a welcome, concrete set of criteria. The energy coverage aspect of Component 1 goes comparatively into more detail regarding gender impact, focusing on inclusiveness and the potential to be more effective through women-focused action in isolated areas.
h. supports new investments or funding additional to ongoing/planned MDB investments	Table 3 of the IPCOL indicates that USD 70M will be matched by USD 79M of IDB funds and USD 196M from other sources (excluding CTF funds), for a leverage ratio of 3.92:1. The IDB has indicated its willingness to commit additional funding depending on the local appetite for concessional financing. The IPCOL does describe how other MDB investments complement REI Program funding in other areas of REI. No specific mention of wider MDB financing like country PBL is in the IPCOL.
i. takes into account and institutional arrangements coordination	The IPCOL cites the relevant laws and planning instruments in Colombia, which indicates that the appropriate institutional mandates exist for public sector institutions. The relevant sectoral Ministries were involved in the preparation of the IPCOL, as well as the NDBs. Otherwise, the IPCOL relies on the usual arrangements among the relevant institutions for implementation. As stated before, Colombia has a proven track record of implementing MDB financing.
j. promotes poverty reduction	Yes. Aside for the identified social impacts and co-beneficiaries, the energy access/coverage aspect of Component 1, which aims to promote popular economies (linked to the concept of energy communities in the Ministry of Mines and Energy Roadmap for a Just Energy Transition) explicitly aims at poverty reduction. However, as previously stated, to date a more precise definition or set of criteria for the concepts of popular economy and energy community is being developed in the context of the Colombian NDP 2022-2026.
k. considers cost effectiveness of investments.	The eligible projects under Component 1 are in line with critical initiatives in the Colombian planning instruments which the IPCOL cites. The IPCOL does explain that these planning instruments adopt investment initiatives based on B/C analyses. No additional explicit analysis of the cost effectiveness of the eligible types of projects is in the IPCOL directly. Given that the Colombian electricity service regulates tariffs but otherwise relies on private initiative for individual investments (e.g. electricity generation) or on competitive or regulated-tariff processes (mass transportation, AMI), projects that apply for funding in Component 1 are expected to be financially sound and fulfill relevant B/C conditions. For pilot projects in GH2 in Component 2, IPCOL's criteria demand that each project proposal should demonstrate a potential for scalability and replicability if successful.

6. Part II: compliance with the investment criteria or business model of the relevant program

Please comment on whether the investment plan complies with the criteria specific for the relevant program, as indicated in Annex A.

The IP should broadly demonstrate the country’s commitment to the following:

<p>Reducing or avoiding energy-related greenhouse gas (GHG) emissions via deployment of Renewable Energy</p>	<p>The IPCOL focuses on enabling more NCRE in the generation matrix, decarbonization of transport and industry, increasing energy access through NCRE, and innovation in GH2. All these proposed initiatives reflect the goal of decarbonization through REI. REI has been identified in various Colombian official planning instruments (energy sector plans, roadmaps, climate change plans, Conpes Documents) as critical in the Energy Transition, and the IPCOL also lists a significant body of regulatory changes that have already taken place to enable it. In turn, these planning instruments are aligned with several legal instruments (NDP, NCRE, mobility and climate change laws) explicitly aimed at GHG reductions, the NDC goals, REI, decarbonization and the Energy Transition. The relevant planning and legal instruments are referenced in the IPCOL.</p>
<p>Integrating large amounts of variable renewable energy generation into the power system</p>	<p>The IPCOL clearly shows Colombia’s commitment to REI. It references the Colombian energy plans and roadmaps identifying energy needs and setting specific targets for the integration of wind and solar generation in the Colombia system, both interconnected and in isolated areas. It also references the environmental plans that identify the role of NCRE in GHG reduction targets. It mentions the regulatory changes underway and already in place to accommodate variable energy generation in the interconnected system. Finally, it lists the variable RE projects already underway and the mentions that batteries and grid-flexibility-enhancing technology already are part of the system.</p>
<p>Grounding such commitments in official document(s) such as NDC, energy sector strategies, SDG-related plans, or other relevant low-emission and climate-resilient development plan or strategy referenced or annexed in the EoI.</p>	<p>The IPCOL explains the link btw the energy plans, roadmaps and laws referenced, and the explicitly adopted SDG, NDC and long-term goals of the Paris Agreement Commitments. The documents referenced include the NDP 2018-2022, the National Policy on Climate Change (2017), the Climate Change Act (2018), the Conpes for Colombia’s Sustainable Development Agenda (2018), the Conpes for Green growth Policy (2018), the Comprehensive management plan for climate change in the energy and mining sector 2050 (2021), the Law of Climate Action (adopting the NDC goals), the Long Term Climate Strategy to meet Paris Agreement commitments E2050 (2021) and the Colombian Carbon Neutral Strategy - ECCN (2021).</p>

In addition, the IP should address the following areas:

<p><u>Clear focus on RE integration:</u> Proposed projects and activities contribute directly to the goals of 1) increasing the flexibility of power grids to enhance the penetration of renewable energies into the energy mix, 2) piloting or scaling up innovative renewable energy flexibility solutions, 3) supporting actions for regional power system integration, and or 4) harnessing the potential for electrifying end-use sectors, such as building, transport, and industry sectors.</p>	<p>The activities eligible under Component 1 mirror closely the goals of REI Program. Batteries and grid control technology align with goals (1) and (2). Transmission expansion, both with AC to increase the robustness of the grid (1), and with HVDC to integrate large-scale wind from the Guajira area (1); and international interconnection lines (3). Infrastructure for EV charging (4) and mass transport electrification (4, with key-log conditions). Offshore wind-related infrastructure and regulation (3), GH2 projects and research (2 and eventually 4).</p> <p>The IPCOL is designed to be flexible and accommodate all avenues of REI catalyzers identified in the Colombian energy plans. The downside of this flexibility is the more detailed key-log conditions should be added at the project level that guarantee that the funding specifically impacts actions that eliminate critical barriers and unlock REI, rather than simply adding marginally to the necessarily large pool of project funding.</p>
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<p><u>Catalyze increased investments in RE integration:</u> The investment plan describes how REI investments will attract other public and private finance and lead to replication through demonstration effects, institutional learning, and increased private sector engagement. The investment plan should mobilize additional resources from non-CIF sources, including lending operations of MDBs, complementary funds from other developmental partners such as bilateral, public sector resource allocations, and private sector commercial investments.</p>	<p>In addition to the USD 70M of CIF REI concessional funding, the IPCOL is expected to mobilize additional resources from the IDB (USD 79M), Bancoldex, the FDN and private investors (USD 194.88M) , for a minimum 3.92: 1 ratio.</p> <p>The IPCOL references Colombian planning instruments identifying a potentially large appetite for CIF REI co-funding. Grid capacity and flexibility are currently binding constraints for REI integration, and the electrification of demand is in turn limited by the ability to increase generation capacity, especially since this increase is to be met primarily with NCRE. There are many possible initiatives that would enable REI, and the IPCOL shows why CIF REI funds can fill certain key financing gaps that complement private financing in risky, long-term or unknown projects in line with the REI Program. This is consistent with the manner the Colombian energy sector works, and the NDBs (FDN and Bancoldex) have played similar roles in the past.</p> <p>There is however no explicit description in the IPCOL of how the FDN and Bancoldex will implement their credit lines, other than to set explicit requirements that meet CIF REI Program criteria. At least a minimum threshold for leveraged funding should be included at the project level.</p>
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<p><u>Enabling environment:</u> The investment plan should present the country's long term commitment to including integration in broader country strategies and goals such as NDCs, national energy strategies, etc. The investment plan should also demonstrate how REI support would assist the country in strengthening its policies and institutions with a view towards enhancing the enabling environment for investments in integration.</p>	<p>The IPCOL explicitly links its components to REI needs identified in various policy instruments and actions: UPME's National Energy Plan 2020-2050 calls for electrification of demand and particularly of transport demand and expects GH2 to play an important role after 2035. UPME's plans for electricity transmission and generation expect future increases in electricity demand to be met mostly with additional wind and solar generation. The Energy Coverage Expansion Plan (PIEC) identifies electricity access as one of the paramount challenges for a just and sustainable energy transition, and a critical gap for SDG7. The Ministry of Energy's Offshore Wind and H2 Roadmaps identify these as medium to long-term avenues of development for decarbonization of the energy use in Colombia.</p> <p>The IPCOL explains the link btw the energy plans, roadmaps and laws referenced, and the explicitly adopted SDG, NDC and long-term goals of the Paris Agreement Commitments. The documents referenced include the NDP 2018-2022, the National Policy on Climate Change (2017), the Climate Change Act (2018), the Conpes for Colombia's Sustainable Development Agenda (2018), the Conpes for Green growth Policy (2018), the Comprehensive management plan for climate change in the energy and mining sector 2050 (2021), the Law of Climate Action (adopting the NDC goals), the Long Term Climate Strategy to meet Paris Agreement commitments E2050 (2021) and the Colombian Carbon Neutral Strategy - ECCN (2021).</p> <p>The IPCOL diagnostic stresses the strength of the Colombian energy sector institutions but identifies the need for regulatory developments that allow REI. It concludes that these developments are already underway, assisted by other financing, and focuses on the gaps in financing that private projects are likely to face. It carries out an analysis of risk factors that may jeopardize the REI Program's and more broadly CIF objectives, and to the extent that they can be tackled within the IPCOL, includes mitigation measures.</p>
<p><u>Implementation capacity:</u> Programs will be executed through government and subsovereign agencies, financial intermediaries, private sector or civil society organizations, and should build local and national implementation capacity and institutions. The IP should address the viability of proposed implementation models, including models to engage the private sector.</p>	<p>The IPCOL proposes three intermediaries: the FDN and Bancoldex, two NDBs with proven track record of implementation of similar programs; and Fenoge, Colombia's RE promotion fund, ran by the Ministry of Mines and Energy, which has channeled cooperation and public funds for REI in the past. All three intermediaries are described and discussed, and the implementation readiness of proposed activities in each case is reviewed.</p> <p>For Component 1 projects, NDBs have indicated that a preliminary project pipeline exists. This is consistent with the current state of regulatory incentives and planned expansion, and explicitly reflected in signals from the private sector. For energy coverage projects, progress is shown in developing business models attractive to private investors. In EV charging infrastructure and AMI, grid operators and utilities have signaled their interest. The City of Bogotá is building its Metro System and Medellín is to expand its own.</p> <p>In the context of the relevant eligible projects proposed, whenever less knowledgeable private actors are to be engaged, the IPCOL includes capacity building activities. This is particularly relevant in the case of the energy coverage projects in Component 1, which are intended to leverage energy communities and achieve involvement from communities with potentially little prior understanding of energy generation and related business.</p>

7. Part III. Recommendations

Please provide any recommendations that could enhance the quality of the investment plan.

Key-log conditions

The IPCOL in its Component 1 deliberately allows for a wide spectrum of eligible projects. This flexibility is desirable at Plan level because the maturity of the Colombian energy system implies that relevant projects exist in multiple fronts. However, it also implies that the ability of CIF REI funds to be decisive towards transformation, rather than just additional funding, rests crucially on project-level conditions that focus their deployment on key logs. Specific key-log criteria to be included at the project level may be:

- In transmission grid expansion and international interconnection, REI concessional funding should include criteria that focus on
 - REI projects expected to impact ethnic or marginalized communities, so as to maximize cobeneficiaries and social impacts
 - The least attractive, riskier financing gaps of said projects
- In distribution grid expansion, projects that eliminate bottlenecks for RE integration according to the grid connection analyses by UPME
- Electrification of mass transport systems will require connection capacity and flexible grid operation to accommodate relatively large load in already saturated urban areas. This added demand is expected to be met with RE, but local grids will require expansion or flexibility-enhancing technology. For these mass transport projects, REI funding should target/require:
 - Investment on grid flexibility and/or storage technology.
 - Schemes to manage reactive energy.
 - Electric vehicles that create additional RE demand, provided that the scheme includes:
 - ✦ Additional RE generation implemented in a manner that does not use up connection capacity for other, unrelated RE generation projects in the grid, or
 - ✦ Associated grid expansion, possible with flexibility and/or storage technology, so as to avoid crowding out unrelated REI.

Leveraged funding requirements.

Given the wide spectrum of projects proposed, the leverage ratio of funds for individual projects may deviate from the average 3.92:1. A minimum threshold for leveraged funding should be included at the project level.

Alignment of social and justice goals under the CIF REI Program and the Colombian Government policy priorities.

The IPCOL shows a strong commitment to popular economies, a concept that appears in Colombia's Bases for the NDP 2022-2026 and is associated with energy communities in the new government's Roadmap for a Just Energy Transition. The social impact and to a great extent the gender and inclusion dimensions of the IPCOL clearly rest on the definition and operationalization of these concepts.

Prima facie, at the Plan level, both concepts are aligned with CIF REI requirements. However, for their effective application, ME&L, they need to be defined in more detail, or at least criteria to identify their ingredients in individual projects. The IPCOL allows for a wide spectrum of eligible projects under Component 1 and makes the case that at the Plan level of REI Program, for the current stage of REI in the Colombian energy system, this flexibility is desirable. Consequently, more detail in specifying criteria or guidelines for recognizing or promoting popular economies and energy communities would be premature, as these are concepts that will be implemented differently in the context of the different eligible projects.

The timing of the IPCOL, if approved, may even prove a powerful advantage for advancement of the gender and social inclusion agendas of the CIF in Colombia. It is likely that the REI Program projects would pioneer and thus modulate the operationalization of both concepts on the ground. In any case, it is necessary that at the project stage of the IPCOL, these criteria be clearly stated, along with their links to REI IRF and Theory of Change.

Stakeholder consultations

The IPCOL did carry out a systematic stakeholder consultation process. However, and again in line with the wide spectrum of eligible projects, an in particular with the difficulty to anticipate their geographical influence, consultations with local actors and organizations was limited. This avoids creating expectations in communities that

later go unfulfilled and generate alienation. However, at the project level care has to be taken to conduct the relevant consultations and impact analyses.

Additional comments

In the course of the interview with the WBG team, they raised several concerns with potential impact on the IPCOL's optimality. According to the WBG team, the WBG stopped being summoned to meetings at some point during preparation of the IPCOL, and as a result they worry that some aspects of the IPCOL may be suboptimal. In particular, the WBG mentioned that the new Colombian Government may not be well acquainted with the objectives and the conditions of the IPCOL, and that as a result the IPCOL may not reflect the new government's policy objectives. Also, the Colombian Government may have an inaccurate perception of the convenience of applying for CIF REI resources at this moment.

Given these concerns, a second interview was conducted with the MHCP to ascertain whether the possible issues raised affected the IPCOL negatively. In the course of the interview, the Colombian officials directly stated that 1. At all times the Colombian Government was in direct bilateral communication with the WBG, both in the context of the IPCOL preliminary activities and preparation, and in other contexts, and that the relevant information and decisions about the IPCOL preparation was timely conveyed to the WBG team, including the reasons leading to the Colombian Government decision to work with the IDB. 2. That the IPCOL was thoroughly reviewed by the relevant officials in the new government, the adjustments deemed necessary included, and thus that the IPCOL correctly reflects the interests of the current administration. 3. That it is in the interest of the Colombian Government to apply at the earliest date, to maximize the impact of the funding. The Energy Transition policy is a priority with the current government and the Government considers the need to preserve the momentum of REI.

In view of this answers, this review finds no evidence that supports the concerns of the WBG team about the optimality of the IPCOL as viewed from the Colombian Government's interests.

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http://www.secretariasenado.gov.co/senado/basedoc/ley_1715_2014.html
 - Ley 1931/2018 Directrices para la Gestión del Cambio Climático
http://www.secretariasenado.gov.co/senado/basedoc/ley_1931_2018.html
 - Ley 1955/2019 Plan Nacional de Desarrollo 2018-2022 “Pacto por Colombia, Pacto por la Equidad” http://www.secretariasenado.gov.co/senado/basedoc/ley_1955_2019.html
<https://www.dnp.gov.co/DNP/Paginas/Plan-Nacional-de-Desarrollo.aspx>
<https://colaboracion.dnp.gov.co/CDT/Prensa/PND-Pacto-por-Colombia-pacto-por-la-equidad-2018-2022.pdf> ○ Ley 1964/2019 Ley de Movilidad Sostenible “promueve el uso de vehículos eléctricos”
http://www.secretariasenado.gov.co/senado/basedoc/ley_1964_2019.html
 - Ley 1972/2019 Derechos a la salud y al medio ambiente sano, estableciendo medidas tendientes a la reducción de emisiones contaminantes de fuentes móviles
http://www.secretariasenado.gov.co/senado/basedoc/ley_1972_2019.html
 - Ley 2099/2021 Disposiciones para la transición energética, la dinamización del mercado energético, la reactivación económica del país
http://www.secretariasenado.gov.co/senado/basedoc/ley_2099_2021.html
 - Ley 2169/2021 Impulsa el desarrollo bajo en carbono del país mediante el establecimiento de metas y medidas mínimas en materia de carbono neutralidad y resiliencia climática
http://www.secretariasenado.gov.co/senado/basedoc/ley_2169_2021.html

Other relevant resources

- 2X Global: <https://www.2xglobal.org/>
- 2X Challenge - Financing for Women: <https://www.2xchallenge.org/> ○ 2X Challenge Criteria: <https://www.2xchallenge.org/criteria> ○
- IRENA Renewable Energy: A Gender Perspective (2019-01)
<https://www.irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective>
- OECD DAC List of ODA Recipients: <https://www.oecd.org/dac/financing-sustainabledevelopment/development-finance-standards/daclist.htm>
- United Nations Department of Economic and Social Affairs, Sustainable Development Goals (SDG): <https://sdgs.un.org/goals> ○ SDG 1 No poverty: <https://sdgs.un.org/goals/goal1> ○ SDG 5 Gender equality: <https://sdgs.un.org/goals/goal5> ○ SDG 7 Affordable and clean energy: <https://sdgs.un.org/goals/goal7> ○ SDG 8 Decent work and economic growth: <https://sdgs.un.org/goals/goal8> ○ SDG 9 Industry, innovation and infrastructure: <https://sdgs.un.org/goals/goal9> ○ SDG 13 Climate action: <https://sdgs.un.org/goals/goal13>
- United Nations Climate Change, Gender and Climate Change Guidelines & Tools: <https://unfccc.int/topics/gender/resources/guidelines-or-other-tools-for-integrating-gender-considerations-into-climate-change-related-activities-under-the-convention>



The Climate Investment Funds

The Climate Investment Funds (CIF) were established in 2008 to mobilize resources and trigger investments for low carbon, climate resilient development in select middle and low income countries. To date, 14 contributor countries have pledged funds to CIF that have been channeled for mitigation and adaptation interventions at an unprecedented scale in 72 recipient countries. The CIF is the largest active climate finance mechanism in the world.

THE CLIMATE INVESTMENT FUNDS

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