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NEW FINANCIAL MECHANISMS FOR CLEAN ENERGY INVESTMENTS IN LATIN AMERICA

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List of Acronyms

ANDE	Administración Nacional de Electricidad (decentralized public institution in charge of electricity generation, transmission and distribution in Paraguay)
BICE	Banco de Inversión y Comercio Exterior (national development bank of Argentina)
CABEI	Central American Bank for Economic Integration (in Spanish, BCIE)
CAF	Corporación Andina de Fomento (Development Bank of Latin America)
CAMMESA	Mixed-capital enterprise in charge of the electricity system operation (dispatch) in Argentina
CELEC	Corporación Eléctrica del Ecuador EP (state-owned electricity company in Ecuador)
DevCo	Development company
DFI	Development finance institutions (development banks)
ECLAC	Economic Commission for Latin America and the Caribbean (in Spanish, CEPAL)
EE	Energy Efficiency
ENDE	Empresa Nacional de Electricidad (state-owned electricity company in Bolivia)
ENEE	Empresa Nacional de Energía Eléctrica (state-owned electricity company in Honduras)
ENEL	Empresa Nicaragüense de Electricidad (state-owned electricity company in Nicaragua)
ESCO	Energy Services Company
ESG	Environmental, Social, and Governance (non-financial factors)
FAO	Food and Agriculture Organization
GCF	Green Climate Fund
GDP	Gross Domestic Product
ICE	Instituto Costarricense de Electricidad (state-owned electricity company in Costa Rica)

IDB (or IADB)	Inter-American Development Bank
IDFC	International Development Finance Club
IEA	International Energy Agency
IPP	Independent Power Producer (private power generators)
IRENA	International Renewable Energy Agency
LATAM	Latin America
MER	Mercado Eléctrico Regional (regional electricity market in Central America)
NCREG	Non-conventional renewable energy generation
NDCs	Nationally Determined Commitments (for climate change)
OLADE	Latin-American Energy Organization (in Spanish, "Organización Latinoamericana de la Energía")
PE	Private Equity
PPA	Power Purchase Agreement (long-term contracts for clean energy projects)
PV	Solar photovoltaics
RDG	Renewable Distributed Generation
RE	Renewable Energy
SMEs	Small and médium enterprises
TA	Technical Assistance
UNEP	United Nations Environment Programme
VC	Venture Capital
WB	World Bank

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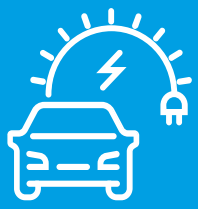
Executive Summary

Due to its geographical and socio-economic characteristics, **Latin America is highly vulnerable to various natural hazards,** affecting the region's living conditions, resulting in the current people displacement and massive economic losses. This is especially affecting people living under poverty, which represents 33% of total population.

Driven by the increasing needs for climate change mitigation and adaptation measures and investments, the region has been actively advocating for climate change investments. All 12 analyzed countries have recently updated their Nationally Determined Commitments (NDCs), and many of them have settled long-term net zero emission targets. The decarbonization of the electricity matrix and the transport systems, including technological shifts (such as electrification) and the development of new energy resources, are paramount to achieve the goals set in the NDCs and other national commitments.



The decarbonization of the electricity matrix and the transport systems, including technological shifts (such as electrification) and the development of new energy resources, are paramount to achieve the goals set in the NDCs and other national commitments.

In the energy sector, climate change effects on the environment pose pressing challenges to the energy generation matrix in the region, which is heavily dependent on hydropower. Severe changes in hydrological cycles in recent years is affecting the ability to predict hydropower resource, jeopardizing energy security.

In the electricity sector, additional factors emphasize the need for incorporating new clean energy resources to the generation mix, including:

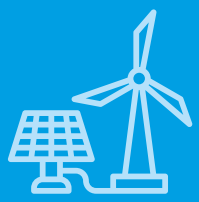
- **Increasing fossil fuels utilization:** Even with a high participation of hydropower in the electricity mix, the share of renewable energy in the power matrix has fallen by 8.2% between 2000 and 2016 in the region. Despite visible efforts, non-conventional energy sources have been gaining participation; however do not yet show relevant penetration numbers at grid level.

- **Off-grid generation and energy access:** The region is home to many communities that aren't connected to the main grid and rely mainly on high-cost fossil-fuel power generation, such as LPG and diesel.

- **Tariffs and Subsidies:** With increasing electricity tariffs, subsidy schemes for fossil fuel provision and end-user consumption have been set throughout the region, posing pressing challenges to national budgets.

- **Transmission and distribution lines:** Due to the relatively low diversity of electricity generation sources and the status of transmission and distribution grids, which present high losses, Latin America is especially vulnerable to power outages and other electricity supply challenges.

- **Seasonality:** Due to hydrological cycles, other renewable sources such as wind and solar PV have been proven to be complementary to hydro energy, helping regional matrixes to fully decarbonize the grid throughout the meteorological year.



The LATAM region has enormous potential in almost all renewable resources. Non-conventional renewable sources are becoming the cheapest sources of power, enabling countries' electricity matrixes to become progressively cleaner and affordable.

There is a need, therefore, to diversify energy sources in the region, and decrease dependency on fossil fuels and hydropower generation. To achieve this goal, the inclusion of other renewable energy resources in the regional electricity matrix will combine both an increase in supply flexibility and security, and the decarbonization of the grid. Additionally, renewable energy generation technologies will contribute to decarbonize other sectors, such as transport and the end-use sectors (residential and industry).

The LATAM region has enormous potential in almost all renewable resources (solar, wind, geothermal, biomass and hydro), and almost all countries in the region have potential to one or more of these resources. The **incorporation of renewable energy generation contributes to diversifying the options of energy sources,** moderates the effects of the volatility of fossil fuel prices on the national economy, and contributes to the low-carbon transition set by national NDCs.

Moreover, **non-conventional renewable sources are becoming the cheapest sources of power, enabling countries' electricity matrixes to become progressively cleaner and affordable.** Cost reductions in clean energy technologies, mainly wind and solar, allow to reach competitive electricity costs both for large-scale systems and for distributed generation for self-consumption.

Even if regulatory sector has room to improve, with several detected regulatory and policy barriers, the combination of enabling regulatory frameworks in place, and the appetite from the public sector to incorporate private investments into the generation sector, shows a clear opportunity to execute renewable energy project pipelines and investments in most of the analyzed countries of the Latin America region.

One of the main barriers for increasing the participation of clean energy resources in Latin America's electricity systems is the availability and access to capital required to build new clean energy infrastructure. Private capital flows do not yet see the right balance of risk and reward in clean energy projects in the region. Additionally, non-financial barriers are still present to adequately supply equity and debt into the renewable energy sector, including:

- **Low involvement of capital markets:** Local and international private equity firms are present in other sectors such as agriculture, services, and real estate, with significant room for growth in the clean energy sector. Venture capital is at a very early stage of development in the region.
- **Perceived political risk:** All countries under analysis have democratic systems in place; however, the region has been characterized for its political and social instability for the past 50 years, with multiple political, economic, and social conflicts in its recent history, which contributes to raising perceived risks by potential investors.
- **Strict market structures and centralized contracting schemes:** In some countries, state-owned companies still dominate the market, and centralized planning and contracting from the public sector prevent the development of new schemes, such as Corporate power purchase agreements with utilities and large consumers.

In Latin America, the financial sector is set to be one of the most important players to unlock private investments in LATAM.

The ability of financial institutions (national banks, commercial banks, and local development banks) to manage and successfully navigate through project financing processes in the clean energy sector is still one of the most evident barriers to attract the capital needed to expand the implementation of these technologies.

The difficulty to finance projects is mainly associated with the limited experience and expertise of the regional financial sector to address particular risk assessments for renewable energy and energy efficiency projects, as well as other characteristics of the market such as:

- **Limited innovation in financial products:** Risk-averse financing sector is mainly focused on consumer and retail finance, reducing product offering and guarantee structures for clean energy projects.
- **Sub-optimal risk allocation among stakeholders:** Poor support or understanding to novel business models and financing structures does not take advantage of optimal risk allocation between financial institutions, project development companies, and equity investors.
- **Early-stage financing gap:** Clean energy finance is mostly focused on construction finance, with few financing options for development companies, especially SMEs, to de-risk projects and pipelines in design and feasibility phase to reach bankability.

Throughout the region studied, development companies and small investment funds are often poorly funded and, when possible, invest their own limited resources to develop new markets and create new business models. This limited resources slows down the development of project pipelines and decrease the quality of the projects, even if they possess the adequate technical expertise to scale-up.

Many initiatives have been deployed to overcome these barriers , mainly led by development finance institutions (DFIs) through concessional and blended finance mechanisms, but also from private investors, creating innovating business models such as third-party ownership and private financing models such as rooftop leasing. However, ongoing initiatives do not cover all gaps that preempt additional private sector financing from flowing into clean energy investments:

1. Technical assistance programmes exclude support for early-stage pipeline development.

2. Credit lines for clean energy exist but with prohibitive requirements in terms of due diligence.

3. Existing programmes focus on individual projects rather than early-stage pipeline development.

To overcome the identified financing gap, there needs to be coordination among multiple parties (public and private sectors, communities, and civil society), **different sources of capital, and innovative financial structures to attract the equity and debt necessary to finance projects** [World Bank Group 2021].

In that sense, grant resources, technical assistance, and public-private partnerships are essential to support project preparation and increase the supply of de-risking instruments. Grant and concessional financing may be needed to provide blended tranches that enable high-impact climate projects that face specific barriers to be implemented, or to provide de-risking instruments to finance" [World Bank Group 2021b].

Throughout the study, several mechanisms and opportunities with high implementation potential have been detected, such as:

Grant resources, technical assistance, and public-private partnerships are essential to support project preparation and increase the supply of de-risking instruments.

- **Aggregation and standardization of projects:** Aggregation and securitization of small-scale clean energy assets into portfolios, increase the transaction size and decrease the risk perceived by financial institutions, improving financial conditions, and lowering transaction costs.

- **Innovative guarantee structures:** Insurance and guarantees dedicated to mitigating risk perception for clean energy projects, such as completion and performance risks, and off-taker liquidity risks, could scale-up project implementation, while offering attractive business opportunities for banks and insurance companies.

- **Pipeline and project preparation facilities:** Capacity building for project development companies and financial institutions will increase the chance to develop high-quality, bankable project portfolios for construction finance. Validation of projects and business models would decrease risk perception from financial institutions.

These multi-stakeholder mechanisms can be powerful tools to accelerate the implementation of private investments in the renewable energy and energy efficiency sectors, creating local capacity, and achieving decarbonization goals

1. Introduction

1.1. Background

There is a global consensus that **fighting climate change, and particularly avoiding its worst effects on the planet, is one of the greatest challenges of our time.** The 27th Conference of the Parties (COP27) of the UN Framework Convention on Climate Change (UNFCCC), held in November 2022 in Sharm El Sheikh, Egypt, has made this consensus more visible, and has reaffirmed that strong efforts would have to be made at a global level, to limit the rise of global temperature below 1.5 degrees Celsius.

At the government level, most countries have announced new commitments to reduce national-level greenhouse gas (GHG) emissions, with many others strengthening their pledges submitted as part of the Paris Agreement. Currently, the countries that have net-zero emission pledges represent 70% of global CO_2 emissions. However, one of the most notable outcomes of the COP27 was the private sector (private corporations, investors, and the financial sector) demonstrating a strong commitment towards the decarbonization not only of their own activities, but towards the activities they support, invest in, and finance. There is an **established sense of urgency across all stakeholders – governments, businesses, investors, and citizens – to take concrete action towards a net-zero economy by 2050.**

According to the International Energy Agency, **the energy sector will play a paramount role in the global decarbonization efforts, especially during the current decade** (2021-2030) [International Energy Agency [IEA] 2021]. The energy sector is accountable for three-quarters of greenhouse gas emissions today. The technologies needed to decarbonize the energy sector, especially within the power sector (solar, wind, and hydro energy) but also other sectors such as heating and transportation are commercially available in some more mature markets, and in most cases cost-effective compared to their carbon-intensive alternatives. Therefore, **it is of vital importance to strengthen the speed of implementation of renewable energy generation and energy efficiency project pipelines worldwide, especially in developing countries**, where the speed of adoption is still slower.

This implementation will require a significant flow of capital into the energy sector, and particularly into renewable energy assets. The final COP27 agreement mentions that "US$ 4 to US$ 6 trillion a year needs to be invested in renewable energy until 2030 – including investments in technology and infrastructure – to allow us to reach net-zero emissions by 2050"[1].

Even though the need of capital in the energy sector represents a huge investment opportunity for all kind of investors – from venture capital and private equity firms to major institutional investors – some challenges have been identified that might prevent capital from reaching areas where it is most needed. **One of the challenges most mentioned by investors is the limited bankable and investment-ready projects and pipelines, especially in developing countries.** On the other hand, project developers suggest that access to capital (both equity and debt) is the biggest barrier to bring early-stage projects to financial closure.

1. Source: https://www.unep.org/news-and-stories/story/cop27-ends-announcement-historic-loss-and-damage-fund#:~:text=Climate%20finance%20was%2C%20as%20expected,%2Dzero%20emissions%20by%202050.%E2%80%9D

As a result, **the renewable energy and energy efficiency markets are experiencing an early-stage financing gap,** in which there is **limited attractiveness for private sector investment.** This is the result of a mismatch between perceived and actual risks and rewards from investing in project and pipeline developments, and a barrier for development companies to gather the capital needed to de-risk those projects.

This gap is even more visible in developing countries in regions such as Africa, South-east Asia, and Latin America, especially in countries where there is a perceived political risk that further increase the returns expected by investors. **In Latin America (LATAM) the financing gap in the clean energy sector is particularly present, posing a clear barrier for the international private equity and venture capital funds considering entering these markets.**

The LATAM region shows a relatively cleaner energy matrix, largely due to its decade-long experience in large-scale hydroelectric projects. However, and despite the visible efforts to install new renewable capacity, **the share of renewable energy in the power matrix has fallen by 8.2% between 2000 and 2016 in the region** [Inter-American Development Bank [IADB] 2019c]. One of the main barriers for increasing the participation of clean energy resources in Latin America's electricity systems is the availability and access to capital required to build new clean energy infrastructure.

> ***"We must work together. That means public money must work with private money, to make it possible for […] business and financial institutions to invest. It is critical is to put the right mechanisms in place for private finance to reach scale. We have great examples of this can be done—such as de-risking equity investments or compensating private sector for more short-term risk. But we don't yet see it being done at scale"***
>
> Remarks by Kristalina Georgieva, Managing Director of the International Monetary Fund, at COP27's Finance Day Opening Ceremony

To overcome the identified financing gap, there needs to be coordination among multiple parties (public and private sectors, communities, and civil society), **different sources of capital, and innovative financial structures to attract the equity and debt necessary to finance projects** [World Bank Group 2021].[2]

1.2. Scope of the report

The United Nations Environment Programme (UNEP), in particular through its Finance Unit[3], has extensive experience in developing and implementing projects whose aim is a rapid decarbonization of global energy systems, the unlocking of private sector capital flows and the building up of climate finance and renewable energy development capacity, in line with the goals of the Paris Agreement and the 2030 Agenda for Sustainable Development. Such projects include the Seed Capital Assistance Facility[4] (SCAF) which

2. Remarks by the Managing Director at COP27's Finance Day Opening Ceremony (imf.org))
3. The Finance Units sits in the Energy and Climate Branch, Economy Division.
4. https://www.scaf-energy.org/

provides financial support to developers active in clean energy frontier markets in Africa and South-East Asia to overcome the early-stage development gap. Running since 2014, this project has generated valuable lessons learned and best practices that can benefit other projects and regions, under the condition that a needs assessment-based and targeted approach is followed to take into consideration sectoral or regional specificities.

UNEP's Finance Unit and Regional Office for Latin America and the Caribbean have commissioned this work to map out regional needs for clean energy investments in Latin America and demonstrate that through an innovative public-private support mechanism, the existing early-stage financing gap for renewable energy and energy efficiency investments in the region can be bridged. This would result in private capital mobilization in frontier markets and technologies[5].

To best position UNEP in identifying the most resource efficient and impactful interventions as well as potentially viable markets and technologies**, a regional financing gap analysis was conducted through desk research and extensive stakeholders' consultation, identifying renewable energy and energy efficiency markets and technologies where private investments fall short.** This included the identification of barriers and challenges faced by particular stakeholders, with a focus on the private sector.

The analysis has been focused on 12 countries in Latin America: Six from Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), and six from South America (Argentina, Bolivia, Colombia, Ecuador, Paraguay, and Peru). Those countries were selected based on criteria such as energy supply, public investments in renewable energy, energy intensity and attractiveness for private equity and capital venture funds, aiming for higher additionality of interventions and climate impact potential. **Throughout this report, for ease of reference, the terms 'the region' and 'Latam' are used to refer to the 12 countries analyzed.**

The report starts with a brief overview of the region's climate, economic, energy profiles and current clean energy investments in section 2. Section 3 takes stock of the current regulatory and policy framework for clean energy and the barriers it poses for clean energy investments while section 4 analyses market and financial barriers. Such barriers are part of a broader context of existing initiatives and trends of which an overview is provided in section 5 to map ongoing efforts and gaps that are left unaddressed. Section 6 works as a conclusion summarizing those gaps and potential ways to address them.

1. For clarity purposes, a brief definition of each key stakeholder mentioned in the report is presented below: **Project and pipeline development companies (or "development companies")**: Companies whose primary business is to develop energy projects from their earlier stages (ideation, design, pre-feasibility) to financial closure, including all the activities up to the actual construction of the project. The main purpose of a development company is to generate returns by creating an valuable project (asset), that can be transferred to an investment vehicle to build, own, and operate the asset. In the energy sector, development companies are focused on different stages of project and pipeline creation, and their reach can also include equity investing, financing, and asset operation.

5. The definition of "frontier markets" and "frontier technologies" with regard of this project, is a market or a technology that is not yet ready to receive private equity or venture capital funding for different reasons, such as limited bankable projects, deficient regulatory or policy frameworks, limited tax or investment incentives, supply chain issues, etc. and would need further public or public-private interventions to be investment-ready.

2. **Investment funds:** Investment vehicles actively participating in different sectors of economy through deployment of capital, with the main purpose of obtaining a return on equity. Investment funds are managed by professional investors, and differ in size and strategy (can invest in different geographical locations, countries, industries, etc.). Investment funds can be active or passive, depending on the involvement in the management of the invested asset. According to their risk-seeking strategies, investment funds can be subdivided into:

    - **Private Equity funds ("PE funds"):** Large institutional investment funds that invest in lower-risk assets and enterprises. They are managed by accredited investors, and the capital is usually raised from high-net worth individuals or companies. They usually invest in established, mature industries and assets. In Latin America, PE funds are mainly present in the oil and gas, mining, agriculture and real estate sectors, with smaller presence in other sectors such as services.

    - **Venture Capital funds ("VC funds"):** Usually smaller in size than PE funds, VC funds focus on startups and earlier-stage, higher-risk enterprises and economy sectors. These investments are associated with higher risk and higher returns. They are also managed by accredited, specialized investors. In Latin America, VC funds are in an earlier stage of development, and currently focused mainly in high-tech industries, such as IT, with presence in other sectors such as fintech, retail, etc.

3. **Small and medium enterprises (SMEs):** In general, represent business that maintain revenues, assets, or number of employees under a defined threshold. In Latin America, SME's are mostly represented by small and medium businesses in the services, food, and agricultural sectors. Some of these companies are part of the informal economy, and most of them share key characteristics such as higher exposure to economic volatility, and limited access to the formal banking system.

1.3. Methodology and work plan

The project followed a "bottom-up" approach to gather information, engaging with different players which are active across the 12 target countries, in different sectors:

- Private Equity and Venture Capital funds (private investors)
- Project and pipeline development companies in the clean energy sector (renewable generation, energy efficiency)
- Public sector officials from the energy, environment, and finance sectors
- Public institutions such as investment promotion and export agencies
- National and regional financial institutions (development banks, commercial banks)
- Public-private financial institutions, such as multilateral development banks

As part of this needs assessment, **over 150 interviews and meetings were conducted at the national or regional level[6], with 43% of female interviewees.** Public sector, private sector, and financial sector stakeholders from the selected 12 countries were interviewed, of which all showed positive engagement and interest about the project and its outcomes. Interviews and meetings were performed in various ways depending on the engagement and the type of information to be collected. Most of the meetings were designed as semi-structured interviews, with a set of direct, concrete questions and open questions.

Information gathered and analyzed from relevant stakeholders has been used to perform **in-depth, individual country analysis for each of the target countries.** Each country report[7] provides a market and regulatory overview, a summary of the information gathered and analyzed in different topics, including:

- Renewable energy and energy efficiency markets and investment trends
- Financial markets profile and trends
- Political, legal, and regulatory environment

These country reports have been used as foundation to produce a regional needs assessment report and conclusions made therein, containing the most significant gaps, barriers, challenges, and opportunities to scale-up clean energy investments in Latin America. This project was carried out between the months of **March and August 2022**, with all information used to the elaboration of this report based on data collected and interviews performed during this period.

In addition to the stakeholder interviews, an **in-depth literature research** was performed throughout the execution of the report. A relevant set of primary and secondary sources of information consulted are mentioned in the References chapter. A comprehensive **national-level review of documentation and statistics for the energy sector was also conducted** from official or accredited sources (Energy and Finance ministries, research institutes, other public institutions).

Beyond providing a general understanding of challenges faced in the Latin American region, the literature review has been used to identify relevant stakeholders and sources of information in the energy, climate, and finance sectors of each selected country. The identification and outreach of key stakeholders at national and regional level has been key to successfully engage with, identify and select the most relevant stakeholders across both the public and private sector. These stakeholders were the main source of information used to perform the national and regional assessments and reports.

The research material was used to define sets of questions to define the interview process and the information to be gathered for each identified stakeholder (see table below).

6. A full list of institutions engaged with is available in annex A, along with the list of interviewees.
7. Country reports analyze how current regulations and policies may present challenges or opportunities for private investors in the clean energy sector.

Table 1. Sets of questions utilized for identified relevant stakeholders, including expected outcomes.

Type of Stakeholder	Expected outcomes
PE and VC funds	• Insights of current status of PE/VC sector in the country (size of market, competition, challenges, and barriers for new players to come in). • Challenges and barriers for private sector investment in the country (tax regulations, currency, etc.). • Level of engagement in the renewable energy, efficiency, or climate sectors. Willingness to invest in seed or early-stage portfolios, identified challenges. Identification of technology preferences (if any) and underlying motives for these preferences. • Additional contacts of other PE/VC funds that invest in these technologies/sectors in the region.
Development companies, National Renewable Energy Chamber or Association	• Insights of current status of RE/EE project pipelines in the country and main barriers and challenges to implement them. • Insights on key players participating in the market and supply chain development. • Current sources of financing for early-stage pipeline development. • Challenges and barriers involved for project financing. • Status of equity (PE/VC) and debt markets in the country, and interest from commercial banks to finance development activities.
Public sector officials in the Energy or Environment sectors	• Government engagement in the renewable energy, efficiency sectors, in terms of regulatory frameworks, direct investment, public-private partnerships, future plans. • Assess the need to attract private capital to any of these sectors. • Assess government engagement with public-private initiatives. • Level of engagement in environmental matters, especially in the energy sector.
Public sector officials in the Finance or Trade sectors	• Government engagement in the renewable energy, efficiency sectors, in terms of regulatory frameworks, direct investment, public-private partnerships, future plans. • Assess the need to attract private capital to any of these sectors. • Assess government engagement with public-private initiatives. • Regulatory frameworks and incentives for foreign investments and trade.

Local and multilateral development banks	• Insights and opinions about current status of private investments in the country, and the role of local development banks to boost private investment. • Insights on public investments in the renewable energy and efficiency sectors, and status of private-public initiatives in the country in these sectors. • Experience in renewable energy and efficiency investments: challenges found, barriers for investment, availability and status of projects and pipelines. • Interest (including Board mandates) to engage in future investments in these sectors. • Available structures to maximize attractiveness of the projects for follow-on funding.
Commercial banks	• Insights and opinions about current status of private investments in the country. • General information about private investments in the renewable energy and efficiency sectors, status of private-public initiatives in the country. • Experience in renewable energy and efficiency investments: challenges found, barriers for investment, availability and status of projects and pipelines. • Characteristics of the desired sponsor (IPP or project developer) or project (size, risk level, guarantees) to be able to get later-stage financing. • Interest (including Board mandates) to engage in future investments in these sectors.
International organizations and DFIs	• Experience with concessional funding in the country. Strategies for investments, barriers and challenges found, especially in the renewable energy, efficiency, or climate sectors. • Opinions on available structures to scale-up investments in target sectors, observed challenges (financial structure, ticket size, tenor). • Other structures to maximize attractiveness of the projects for follow-on funding.

The results of the analysis and cross-check of the information gathered from the literature and from mentioned interviews is presented in this report.

2. Setting the scene: current state of affairs and gaps in clean energy investments in Latin America

2.1. Environmental profile and climate change commitments

A highly vulnerable region to climate change effects

The Latin America region is home to one of the richest biodiversity on the planet. Due to its geographical and socio-economic characteristics, it is **highly exposed and vulnerable to various natural hazard disasters, affecting the region's living conditions, resulting in the current people displacement and massive economic losses.**

According to the World Meteorological Organization (WMO) and the Intergovernmental Panel on Climate Change (IPCC), **LATAM is among the regions most challenged by extreme hydro-meteorological events,** including hurricanes, earthquakes, floods, droughts, and heatwaves, all of which are expected to increase in the coming decades. Extreme tropical rainfalls recently recorded in Central America were 50% above long-term average, while the Southern Cone (Paraná – La Plata basin) is facing a yearlong drought affecting water and food resources. Nearly 30% of all glaciers in the tropical Andes have been lost since the 1980s, increasing both the risk of water scarcity in the region, and the risk of flooding in nearby communities [WMO 2021; IPCC 2022].

People living under poverty and extreme poverty, which represents 33% and 13.1% of the region's population respectively, are even more vulnerable to the changing environment caused by climate change [Economic Commission for Latin America and the Caribbean [CEPAL] statistics 2020]. Because these events have increased in frequency and intensity, they have driven millions of people to migrate. The majority of the population in Central America and the Andean region are located in coastal zones, which amplifies the concerns of potential human and economic effects in the region.

The agriculture sector, which is a very important source of activity for the economy of most LATAM countries, is highly sensitive to changes in temperature and precipitation. Extreme meteorological events lead to decreasing availability of land for agricultural purposes, and a decrease of crop yields. Besides food insecurity events (according to the Food and Agriculture Organization [FAO], a total of 7.7 million people experienced acute food insecurity in El Salvador, Guatemala, and Nicaragua), the **negative impacts on harvests and changes in planting seasons is causing massive economic losses in the region.** Associated impacts include job insecurity and the availability of financial resources for LATAM countries, which are predominantly food exporters and depend on these resources to implement climate change mitigation and adaptation measures, among other activities [Organization for Economic Co-operation and Development [OECD]-FAO 2019].

In the energy sector specifically, climate change effects on the environment pose pressing challenges to the energy generation matrix in the region, which is heavily dependent on hydropower. Severe changes in hydrological cycles in recent years is affecting the ability to predict hydropower resource, increasing the need to use alternative sources of electricity, including thermal generation powered by fossil fuels [YANG, D. 2021].

In 2019, El Niño phenomenon has led to a considerable decrease in many countries' hydropower generation, especially countries which have generation facilities in the Pacific coast, such as Colombia, Perú, and most countries in the Central America region. In Argentina and Paraguay, electricity production was notably affected by low water flow in the Paraná River, affecting Yacyretá and Itaipú hydro power plants [Latin American Energy Organization [OLADE] 2021]. **Due to the relatively low diversity of electricity generation sources and the low resilience of transmission networks, Latin America is especially vulnerable to power outages and other electricity supply challenges.**

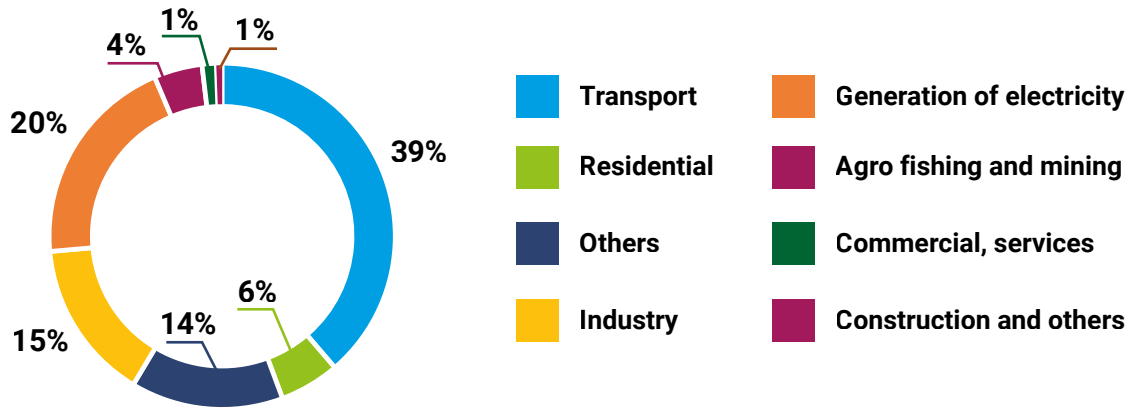
The region's dependence on hydropower also increases the difficulty of energy systems planning, making water availability less predictable and jeopardizing energy security. According to the International Renewable Energy Agency (IRENA), Hydropower generation along the Lempa River Basin could decline by between 33% and 53% by the end of the century [IRENA 2020b], affecting a wide variety of sectors at the backbone of Central America's economy.

Diversifying electricity sources in the region and decreasing dependency on fossil fuels and hydropower generation are critical as a climate change adaptation measure. To achieve this goal, the inclusion of other renewable energy resources in the regional electricity matrix will combine both an increase in supply flexibility and the decarbonization of the grid.

The power sector, the key to achieve national emission reduction objectives

Driven by the profound effects that climate change would have on populated centers and the economy, the Latin America region is one of the strongest advocates to implement climate change mitigation and adaptation strategies. According to UNFCCC and national government officials, **all 12 countries analyzed have recently updated their Nationally Determined Commitments (NDCs), and many of them have settled long-term net zero emission targets.**

Figure 1: CO_2 emissions per sector in Latina America in 2020 [OLADE]



According to OLADE, transport (39%) and electricity generation (20%) sectors accounted for the largest share of CO_2 emissions in the region in 2020. In this sense, **the decarbonization of the electricity matrix and the transport systems, including technological shifts (such as electrification) and the development of new energy resources (such as geothermal and clean fuels), are paramount to achieve the goals set in the NDCs and other national commitments** [OLADE 2021]**.**

Renewable energy sources can mitigate climate induced vulnerabilities whilst ensuring energy security and sustainable socio-economic growth. That is why **most of the NDCs include increased renewable energy generation to their electricity matrixes, energy efficiency improvement, electrification, among other measures.** Defined targets for renewables in the NDCs provide long-term clarity regarding the trajectory of the renewable energy sector, increasing investor confidence and supporting socio-economic benefits. [IRENA 2022b].

Table 2: Energy NDCs and binding targets per country as of June 2022 [UNFCCC webpage info]

Country	Target in law / policy document	Latest NDCs
Argentina	20% NCREG by 2030 1GW RDG by 2030	Further incorporation of RE, EE, DGDevelopment of Green Hydrogen
Bolivia	10% NCREG by 2025	79% REG, 19% NCREG, 6% LED (EE), 76.9 GWh RDG, 10% EV by 2030
Colombia	10% of NCREG by 2030	0,96 - 1,21 Mt CO2 eq mitigation EE, 4,74 - 7,99 Mt CO2 eq mitigation REG, NCREG, RDG by 2030
Costa Rica	100% REG by 2030	100% REG, EE, Green Hydrogen, EV
Ecuador	-	Enunciative RE, NCREG, EE increase
El Salvador	83.2% REG by 2025 Double EE in 10 years	8% EE increase, 334 Kton CO2 Eq mitigation using EV by 2030
Guatemala	80% REG by 2027 -15,1% energy consumption	80% REG by 2030, EE, 24,3% EV by 2032
Honduras	70% REG	20% CO2 Eq mitigation in energy sector through RE, EE, EV
Nicaragua	70% REG by 2033	65% REG by 2030
Panamá	15% REG by 2030 30% REG by 2050	11,5% energy CO2 Eq emissions reduction
Paraguay	-	RE in vulnerable communities
Perú	5% NCREG by 2019	Enunciative CO2 reduction target

Table references for Renewable Energy (RE) and Energy Efficiency (EE)

- **NCREG** – Non-conventional renewable energy generation
- **REG** - Renewable energy generation
- **EE** – Energy efficiency
- **RDG** – Renewable Distributed Generation
- **EV** – Electric Vehicle Growth

According to Table 2, all sample countries show a good level of engagement from the public sector regarding climate change mitigation activities and plans for the 2022-2050 period. Some of them, such as Colombia, El Salvador, and Nicaragua, have clear objectives of carbon dioxide reduction for 2030 linked to sectorial goals in the energy sector. Even if NDCs are still non-binding pledges, many countries have passed different laws and regulations with binding mandates.

Table 3: Countries with net zero targets as of August 2022 [ZEROTRACKER, n/d].

In Law	Guatemala
In Policy Document	Costa Rica, Ecuador, Panamá, Perú
Declaration or pledge	Argentina, Colombia
Proposed/ In discussion	Nicaragua
Without net zero target	Bolivia, El Salvador, Honduras, Paraguay

Translating mandates and commitments into national policies and plans will determine how well these commitments can be integrated into national and subnational budget planning, and later catalyzing concrete investments from both public and private sectors [IRENA 2022b]. The **availability of public and private financial resources will be key to achieve non-binding and binding commitments.**

The stakeholders' consultations have pointed to some countries with a **positive and well-structured coordination within the different offices in national administrations (Economy and finance; Energy; Environment) to match commitments contained in the NDCs with national policy.** Examples are Colombia, Honduras, Guatemala, Costa Rica, and Panamá. However, **the limited financial resources due to increasingly tight national budgets in the region, are encouraging governments to include private sector investments in the electricity sector planning for new renewable energy capacity.**

Private investments in clean electricity generation, energy efficiency and resiliency are necessary in order to achieve emission reduction objectives in the region. To decarbonize some sectors such as transport, agriculture, industry and residential, the electrification and increased efficiency of these sectors are a key part of the strategies to achieve net-zero goals set by countries and private corporations in the region.

2.2. Economic and energy profiles

Economic and development strategies for the regional energy sector

LATAM is composed entirely of middle-income countries in which generally, the private sector has been growing and plays an active role. Even in Nicaragua and Bolivia, who have maintained their respective economies under relatively strict control of their national governments for decades, have started to see inflows of private capital after progressively open policies.

However, according to the IEA and backed up with research and interviews conducted in the region, **private capital flows still do not yet see the right balance of risk and reward in clean energy projects in the region.** While supportive clean energy policies play a key role in creating bankable projects, there are **important factors to adequately supply financing into the renewable energy sector, including:** broad macroeconomic conditions, evolution in the economy-wide cost of capital, domestic financial system development, and the availability and flows of international capital [IEA 2021b].

On the public side, **most countries in LATAM have had reduced national budgets for infrastructure financing due to fiscal deficit challenges[8] and the urgency to respond to other pressing needs,** such as the health and social assistance sectors combined with high indebtedness ratios.

Governments have been facing fiscal deficit challenges and public investments are under increasing pressure to address competing priorities in the region, highlighting the need to crowd-in private capital. The region possesses a relatively enabling regulatory framework and supportive clean energy policies, which pave the way for the uptake of private sector investments in the clean energy sector. Such investments will need to radically increase within the few next decades to keep the region on the 1.5-degree target, avoid resorting to fossil fuel to address the increase in electricity demand, and allow governments to focus on more urgent capital and funding needs.

Electricity matrix: The untapped potential for clean energy generation

Some countries in the LATAM region are major producers and exporters of oil and gas (mainly Argentina and countries in the Andean region), resulting in the fossil fuel industry being deeply rooted in the region's economy and energy sectors. As a result, most of the electricity matrixes in the region are hydro-thermal. **Through a steep increase in electricity demand over the past 30 years, thermal generation has maintained (and in some cases increased) its share in the electricity mix, helped by the adoption of natural gas power plants in recent years [OLADE 2021].**

In order to mitigate the effects of the volatility of fossil fuel prices in national economies, and to contribute to the low-carbon transition, non-conventional sources of renewable energy have been slowly gaining participation in the renewables mix since mid-2000s. However, **the rate of adoption of these technologies has not been fast enough to foster the decarbonization of national electricity systems, and polluting fossil fuel generation is still utilized to supply the increasing demand.**

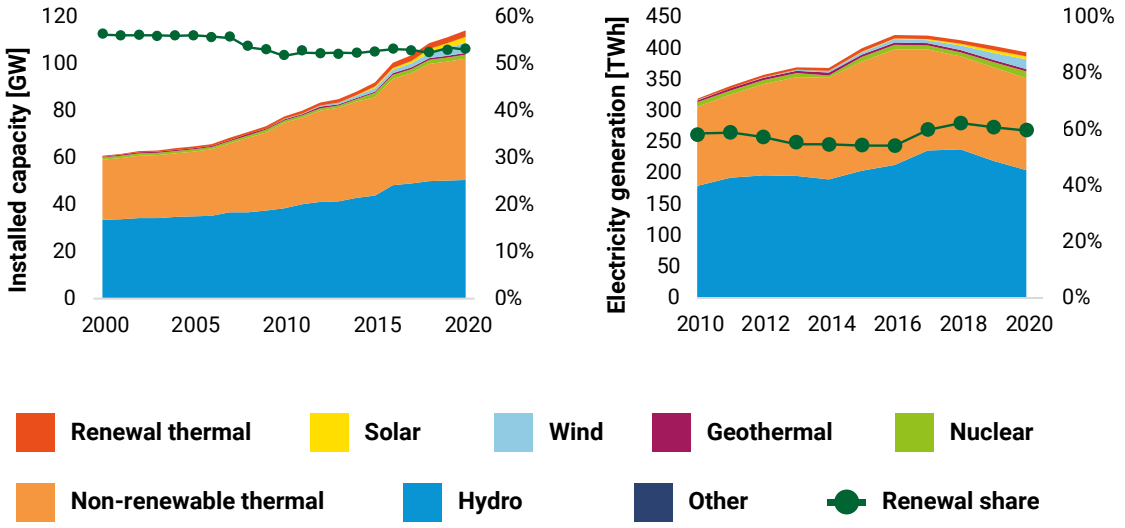
8. In order to finance fiscal deficits, these countries are characterized for having high public external debts, between 40% and 100% of their GDP. [CEPAL, 2021; ECLAC, statistics]

According to OLADE, for the 12 analyzed countries, thermal generation powered by fossil fuels represented 37% of total electricity supply in 2019 and has only decreased 2% since 2010.

Table 4. Electricity generation by source (in %) of all analyzed countries. [OLADE].

Source (%)	ARG	BOL	COL	C.R	ECU	E.S	GUA	HON	NIC	PAN	PAR	PER
Hydro	27%	32%	78%	69%	76%	27%	36%	23%	5%	44%	100%	55%
Thermal	62%	64%	21%	1%	22%	29%	42%	47%	43%	47%	0%	40%
Non-hydro RE	5%	5%	1%	30%	2%	43%	22%	30%	52%	9%	0%	5%
Total (TWh)	129.8	10.2	69.7	11.3	32.3	5.6	12.2	10.5	4.6	11.6	49.4	57.0

Figure 2: Installed power capacity and electricity generation evolution by technology in the twelve analyzed countries [OLADE]



It is widely known that non-conventional renewable sources such as wind and solar PV are becoming the cheapest sources of power [IRENA 2020; IRENA 2021; IEA 2021]. Even though wind and solar PV installations have experienced a high relative rate of adoption, overall installed capacity does not yet show relevant penetration numbers at grid-level in the region.[9]

Due to the low technology costs for wind and solar, renewable generation capacity for these two technologies is expected to grow exponentially within the next decade. Additionally, due to the modularity of PV technology and increasing adoption of lower-scale power generation, **distributed energy resources are expected to gain significant market share in the region within the next few years if different regulatory and financial barriers are overcome** [UNEP 2022].

9. Exceptions are Honduras, El Salvador, and Nicaragua, which show high penetration of solar and geothermal power, and specifically in El Salvador, distributed generation resources, which represent more than 60% of total solar generation capacity installed [OLADE 2021].

The need for a decarbonized grid and the opportunity of lower generation costs demonstrates the requirement for large investments in new clean energy projects in the region.

Additionally, and in order to reach a fully decarbonized grid, it is important to understand the behavior of the power generation systems in an electricity market that is dependent on hydrological cycles. As hydro power generation volume is heavily determined by wet and dry seasons, which affects the availability of water resources, **other sources of power generation have to be developed in order to complement generation during the dry season,** which in many countries of the region occur between the months of November and May[10].

Wind energy potential has proven to be complementary with hydro energy in terms of seasonality, and therefore this technology could help decarbonize Latin-American grids during dry seasons. Scientific studies conducted in Colombia and Brazil, demonstrate that wind resource is higher during the dry season, when the volume of water flow in the rivers are lower [IRENA 2016; Palfi 2013]. This complementarity is also exhibited in Ecuador and Perú's energy system, according to information gathered from public sector officials.

Overcoming regulatory and financial barriers to harness the potential of an increased **penetration of renewable generation is key to complement multi-year and intra-year seasonality in almost every analyzed country, and also to meet projected demand growth, which in most cases does not include big shifts in electricity consumption profiles, such as the adoption of electric vehicles and clean cooking.**

Catalyzing additional private investments in complementary renewable energy such as wind, solar and geothermal would have positive impact for the region across adaptation and mitigation as it would:

- **Lower the region's energy sector's exposure to climate risks** by diversifying energy resources, improving efficiency, lowering variability, and increasing the renewable energy penetration potential in the electricity system [Universidad Nacional de Colombia [UNC] 2012; Aldana Urrea 2019].
- **Allow the region to address the increase in energy demand** through clean energy and avoid additional emissions

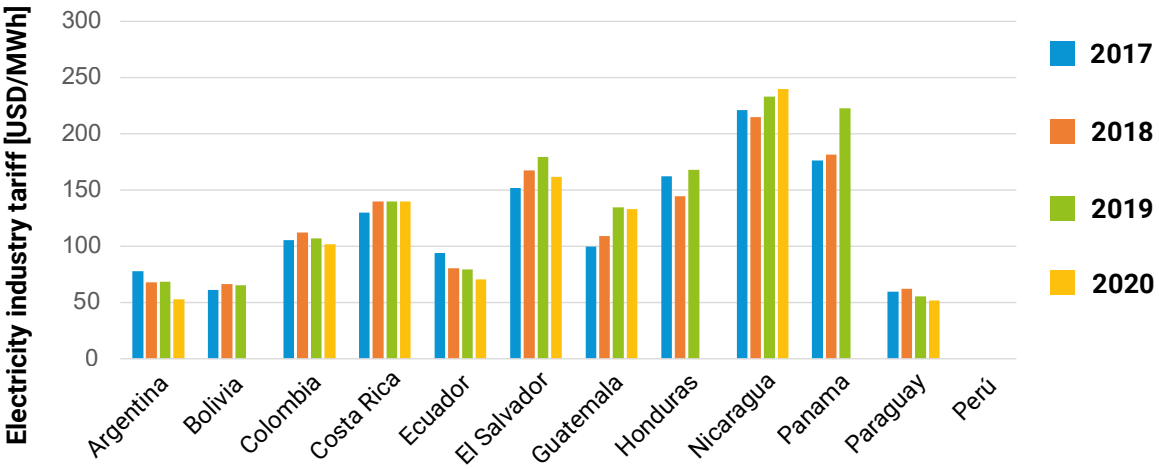
Increasing electricity tariffs are challenging the sector's affordability

Due to different reasons, **electricity tariffs for regulated and non-regulated consumers are higher than in other areas in the developing world.** According to different regional stakeholders interviewed, the main drivers determining electricity tariffs are the availability of internal energy resources, which lead to significant differences in wholesale electricity costs, but also other factors such as the status of the electricity grid, the geographical location of the energy resources, and the level of public intervention in the establishment of tariffs as a public service.

Consequently, there are substantial differences between countries in terms of electricity tariffs. **Countries that do not account with internal fossil fuel resources for electricity generation, have recently been highly exposed to international oil and gas prices**, which have been rapidly increasing due to supply chain issues and the conflict in Ukraine. This has particularly affected countries in Central America, but also countries with high penetration of fossil fuels in the electricity matrix, such as Argentina and Perú [OLADE 2021].

10. According to interviews and national statistical data for electricity generation.

Figure 3: Electricity tariff per country for the industry sector [OLADE, 2021 b].[11]



The increase of electricity costs and tariffs have wide and powerful effects on a country's economic framework, including the competitiveness of their products across all productive sectors, as well as the quality of living of their communities. High electricity tariffs lead to lower margins for enterprises in the real economy, and lower consumption capacity for families.

That is why, **to overcome electricity generation costs, some of the analyzed countries have expensive subsidy schemes in place.** Subsidy schemes mainly target fossil fuel generation in thermal power plants (supply subsidies for oil producers), and electricity consumption by smaller consumers, especially in the residential sector, they act as a way to assist poor communities in reaching higher living standards[12].

The result is that **electricity tariffs, in some cases, are partially covered by public resources and do not properly reflect the cost of energy supply, increasing the need for public spending in the energy sector. Therefore, this makes it less attractive to invest in electricity generation for private players, challenging the feasibility of energy efficiency and RDG projects.**

Electricity subsidies have been increasing in most countries in the region, and in some cases, such as Argentina, Honduras, and Panama, are becoming a very significant expense to national administrations**. While national governments are trying to minimize the use of electricity subsidies and are exploring various ways to decrease its burden for national budgets, the availability of public funds for infrastructure project development and implementation is reduced, and hence the gap between needed and actual investments in new energy infrastructure is increased[13].**

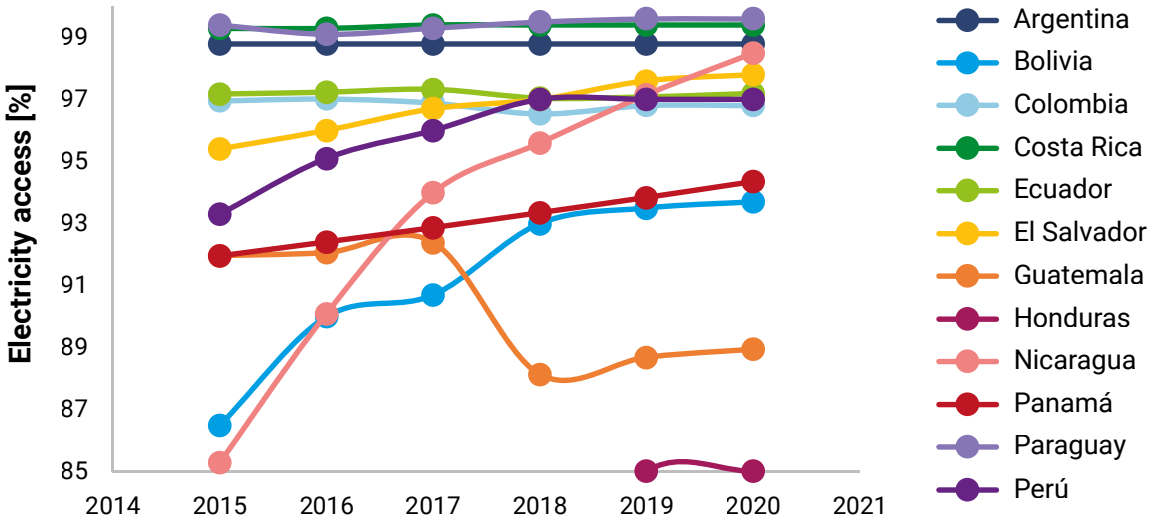
11. Perú, which has not provided tariff information to OLADE and therefore their numbers are not shown on the graph, has reported industrial tariffs in 2021 of 92 USD/MWh according to its national regulator. Furthermore, Ecuador and Argentina have recently shown high electricity tariff increases in the commercial and industrial sectors, showing industrial tariffs of 87 and 109 USD/MWh respectively. [OSINERGMIN 2021]
12. According to national statistical data and stakeholder consultation.
13. According to national statistical data and stakeholder consultation.

According to IRENA, the weighted average levelized cost of electricity (LCOE) in LATAM countries in 2020 was: USD 0.10/kWh for large hydropower; USD 0.059/kWh for onshore wind power and USD 0.078/kWh for solar PV [IRENA 2020; IRENA 2022]. Therefore, **there are concrete market signals that allow large electricity consumers to lower their costs by generating their own renewable electricity, or by purchasing electricity from a private generator.**

Decarbonizing off-grid generation: A regional priority

In the last two decades, most countries have made significant efforts in rural electrification, allowing for some improvement in electricity coverage rates. Even in countries with more than 95% electrification rate, **electricity access is one of the biggest concerns for the public sector,** according to interviews with national government officials. **Reaching 100% electrification poses significant challenges,** especially when providing electricity to isolated and poor communities.

Figure 4: Electricity access evolution per country (OLADE) * Honduras remains below 85% until 2019.



Different strategies are followed on this effort: expansion of the distribution grids, which sometimes poses high social and environmental risks, and the impulse of stand-alone electricity generation and microgrids, which in some cases are the only viable alternative to provide electricity to isolated communities. **Rural and isolated populations normally have low purchasing power, and due to the low profitability of the projects, the public sector is usually responsible for investing in its implementation.**

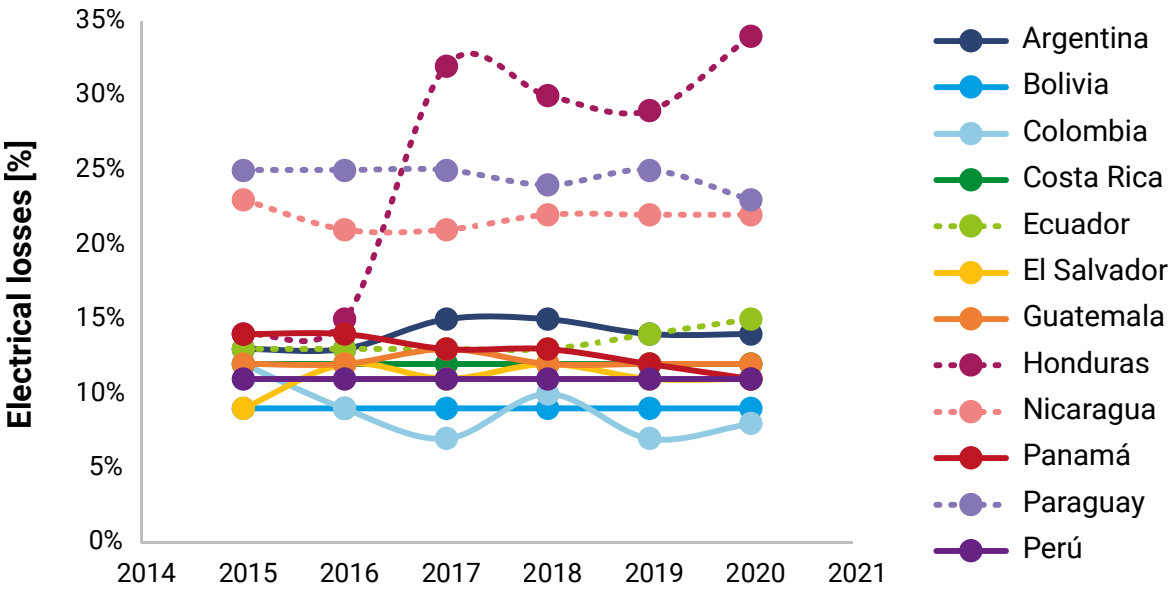
In Latin America, most isolated systems and microgrids are powered by polluting fossil fuels, such as diesel, bunker oil, and liquified petroleum gas (LPG), according to national electricity statistical data**. Therefore, the need to catalyze efforts in decarbonizing off-grid generation is evident.** To this end, novel technologies and business models have been created to overcome market and regulatory barriers, which are in early phases of implementation and would need a deeper involvement from the private sector to massively implement these solutions.

Efficiency of the power supply system is paramount to achieve development goals

Efficiency in power supply systems is another regional concern. Some countries in the region have historically failed to provide quality infrastructure services. Nicaragua, Honduras, and Paraguay had the longest System Average Interruption Duration Index[14] (SAIDI) and the highest System Average Interruption Frequency Index[15] (SAIFI) in 2019, far above the Latin America and the Caribbean average [IDB 2020]. **Due to the limited financial resources, electricity infrastructure and industrial machinery in the region are usually old and inefficient, which leads to high electricity losses and low energy efficiency at the economy level.**

Investments to increase energy efficiency and minimize electrical losses in transmission and distribution lines constitute one of the biggest challenges in the current regional energy system. Average electric losses ratio in the 12 analyzed countries is 15%, comparable with the average of lower-middle income countries in 2014. Average losses were 8% worldwide for the same year [World Bank 2021].

Figure 5: Electrical losses per country [OLADE 2021]



However, there is a gap between needed investments in energy efficiency and incentives for the private sector to develop and implement efficiency and modernization projects. As the cost of electricity losses is paid either by the national government or evenly by paying customers, distribution companies are usually not particularly concerned about lowering power losses[16].

14. average total duration of outages (in hours) experienced by a customer in a year.
15. the average number of times that a system customer experiences an outage during the year
16. According to national electricity market structures (stakeholder consultation and national reports) distribution companies' profits are linked to the maintenance of fixed assets and/or the amount of electricity supplied, and are not linked with quality or cost efficiency indicators.

Investments in grid expansion and modernization is required, as well as in the efficiency and flexibility of the distribution systems in almost every analyzed country. According to stakeholder interviews, **even though national governments could benefit from energy efficiency measures through the reduction of electricity subsidies, they are focusing their resources on higher priority sectors, such as health and education.** Additionally, these investments represent a considerable amount of capital which is not currently available for national governments in the region.

Distributed generation and other distributed energy resources (DERs), along with innovative business models, are needed to boost incentives for the private sector to finance and invest in these technologies, ultimately helping to modernize and decarbonize the grid, improve energy access and quality of service.

The uptake of investments in renewable energy in Latin America as an opportunity for gender equality

At a global level, women occupy only one-in-five jobs in the oil and gas sector and one-in-three jobs in the renewable energy sector [IRENA 2019]. In addition, according to data from almost 2,500 publicly listed energy firms, women make up just under 14% of senior managers (representation is strongest in utilities), compared with 16% in 30,000 non-energy firms [IEA 2021c].

In Latin America, while women are hired in increasing number in the renewable energy generation sector, their occupations remain largely non-technical and with limited responsibilities. They amount to almost 50% of non-qualified employees in the renewable energy generation section, while only 36% of the STEM (science, technology, engineering and math) employees [IADB 2022].

The gender gap also extends to decision-making positions amongst which women represent slightly above 20%. As technologies improve fast in this sector, its labor market remains largely deprived of a gender perspective, an example of that being the absence of a gender policy in a majority of companies operating in the sector (almost 70%) [IADB 2022].

Main factors hindering gender equality and mainstreaming in the renewable energy sector [IRENA 2019]:

Perception of gender roles: *One pervasive assumption is that jobs in energy domain require more physical strength than most women possess, the importance of which has been much reduced by mechanisation and automation of many tasks. Other misperceptions are based on doubts about women's technical competencies. The inherent bias is that women are deemed less competent to hold technical jobs than their male counterparts, even with the same or superior qualifications and work experience.*

Women's participation in science, technology, engineering and math (STEM) fields and misperceptions of career pathway: *Driven by perceptions and misperceptions, only a low percentage of female students choose STEM fields. Gender imbalances among STEM students carry through to gender imbalances in STEM jobs – in the renewable energy sector as elsewhere. IRENA's survey*

finds that women occupy 28% of STEM positions. While these percentages are close to the average share of 32% across the entire workforce, they are much lower than in administrative jobs.

Lack of career information: *An enduring disadvantage that women and girls face in comparison to their male counterparts is the lack of readily accessible information about employment in non-traditional occupations, including those in the energy sector. Personal networks are critical for entering and succeeding in many professions. But women have more difficulty accessing such networks on par with men in nontraditional occupations and thus are at a disadvantage in receiving timely information about job openings. Careers in renewables are generally still not promoted through formal channels such as career counsellors, student employment advisors, job centres, recruitment sessions and career fairs.*

Prevailing hiring practices and unequal access to career entry points: *In most countries, securing a trade apprenticeship remains an unregulated process, with informal networking still the norm. This often translates into a barrier to women's entry into and advancement in these fields. The preference for male recruits in these sectors is very much a "chicken and egg" problem– women often lack the necessary training and skills for many jobs, but these jobs had traditionally not been designed with women in mind and are therefore not particularly attractive to them, resulting in a smaller pool. Thus, when it comes to selection, managers, who are much more likely to be men, are less likely to regard women as suitable candidates.*

As investments increase, the clean energy sector is expected to grow in the decades to come, over 40 million jobs are expected to be created specifically in this sector [IRENA 2021b]. Accompanying it in becoming increasingly gender sensitive and inclusive stands for an opportunity to mainstream gender and support a better representation of women in those millions of new jobs. There is a need to consider related sectors such as public policy making, labor market knowledge management and business as an ecosystem of the renewable energy sector to link up energy transition and gender equality effectively [Ravillard et al. 2021], starting for example by the systematic collection and public dissemination of gender related information in the sector [IADB 2022].

Ensuring that gender quality is factored in decision-making processes requires a certain level of awareness as well as available information on ender both in the public and private sector, which could be provided by gender assessments and trainings. Providing access to education to professionals in the renewable energy sector regarding gender equality, its benefits and ways to embed it in corporate policies is also a tool to raise awareness and trigger the adoption of gender sensitive approaches in the recruiting space [IRENA 2019].

Transparency is key in such efforts to ensure that they do not suffer from bias, are fair and provide a sufficient level of comfort to be effective and allow for evidence-based reporting. Governments are particularly well placed to support such educational initiatives at a sector level, providing incentives and resources to the private sector, for instance through specific gender targets for specific sub-sectors or categories of positions [IRENA 2019]. In turn, this would acknowledge the positive impact of women's presence in the renewable sector, as in other sectors, with respect to productivity, profitability and performance [McKinsey

& Company 2020]. Private sector stakeholders at the sub-national, national and regional levels are also key actors with the ability to drive investment decision making processes through a gender sensitive approach at their own level.

In terms of energy access, Latin America scores higher than other developing regions, although firewood and charcoal are still very much common for females in indigenous communities and rural populations. This leads, in fact, to millions of deaths linked to household air pollution generated by such fuels, of which a large majority are women, being in charge of house chores [IADB 2022]. In this context, pursuing the energy transition through a gender sensitive approach is all the more critical to capture such shortcomings and ensure women have access to new technologies, clean energy, digitalization of energy systems and related opportunities [IADB 2022]. Beyond only benefitting from energy transition efforts, by making sure additional investments in renewable energy are planned and implemented through a gender sensitive approach, women can be active stakeholders and provide their direct contributions into the renewable energy value chains through technical and policy making positions.

2.3. Snapshot of private investments for clean energy

Profound electricity sector reforms introduced in the 1990s throughout the region boosted the inflow of private capital investments, which now coexist with state-owned enterprises (SOEs), which were the only players in the sector prior to the regulatory reforms.

As many countries recognize the benefits of attracting Foreign Direct Investment (FDI), clear rules have been established for the bidding process, as well as to promote and protect investments. World Bank data shows that LATAM is one of the regions receiving highest net foreign investments (FDI) in the world (2.3% of the GDP, compared with an average of 1.4% worldwide). However, **the vast majority of foreign investments are currently in more stable and experienced markets such as real estate, construction, oil and gas, and mining sectors** [World Bank, statistics].

According to the IEA and backed up with research and interviews conducted in the region, **private capital flows are not flowing at an adequate speed in the clean energy sector to bridge the gap between investment needs and actual implementation.**

Regional developers and private equity funds[17]

Traditional private equity (PE) firms (local and regional) are widely present in the analyzed countries (family offices, local holding groups, international and corporate PE firms). They are engaged in the most important sectors of the national economy, such as agribusiness, food, services, tourism, real estate, among other sectors, in which local PE has had a predominant role in the region for decades.

Despite being **historically traditional and risk averse, these companies are generally eager to assume some inherent country risks,** such as currency and regulatory risks, owing to their familiarity to the country's way of doing business, and because this risk is shared with their other businesses in which they have more experience.

17. Summary of information gathered from research and stakeholder interviews.

However, with large energy corporations gaining market share **in the large-scale renewable energy sector, it has started to become unattractive for private local companies,** largely owing to their traditional businesses delivering higher margins with similar risk profiles. High transaction costs and high perceived risks are other reasons for lack of interest in energy sector. Opportunities often include smaller project investments in distributed and energy efficiency sectors.

There is a general willingness to enter the renewable energy sector, as these family offices consider it a strategic sector to maintain long-term competitive advantages – including social aspects of investments such as local job creation. **Local and regional PE firms still need specific financing and technical assistance tools to increase their participation in the clean energy market.**

Local project development companies and end users, specifically large electricity consumers, have also shown willingness to invest in new renewable generation projects. However, development companies and small investment funds, especially SMEs, are often poorly funded and, when possible, invest their own limited resources to develop new markets and create new business models. **Project pipelines end up being developed slowly and to be of lower quality than what is required, even if they possess the adequate technical expertise to scale-up.**

In some cases, **development companies rely on early-stage investments from large consumers to develop their own projects, which constitutes a clear barrier to increasing the speed of implementation.** Large consumers do not normally operate in the energy sector, and do not have the experience or capabilities to analyze projects, create new business models or implement energy technologies.

In the end-use sector, a combination of factors is expanding the interest from big industrial, agricultural companies, and SMEs to invest in renewable energies and energy efficiency, including environmental and social guidelines from parent companies, highlighting the potential of investments in the clean energy sector.

With additional financing available, those types of investors would be more capable to offer renewable energy projects without capital commitments from customers, through innovative business models incentivizing the participation of local equity firms in the energy sector. This represents a **tremendous potential for the region coupled with the abundance of natural resource,** provided that barriers both in terms of financing and regulatory frameworks are overcome.

Regional venture capital funds[18]

Higher risk-taking investment firms in Venture Capital (VC) markets in the LATAM region are at an early stage of development in terms of activity. The volume of VC funding available in these countries is lower than other middle-income countries at a global level and has a lower level of development than other sources of funding. In some countries, such as in Colombia, Perú and Argentina, VC funds are rapidly growing, but are largely focused on high-return, scalable high-tech projects. During the study, an example of a venture capital-backed energy company has not been found in any of the countries analyzed.

18. Summary of information gathered from research and stakeholder interviews.

The PE and VC markets in the LATAM region have encouraging room for growth in the decades to come, owing to the low penetration and size of this market, but also because of relatively new regulations for investor protection and newly government-implemented incentives attempting to attract private capital to the region. Furthermore, most countries in the region have recently created public offices and agencies for investment promotion such as PROPANAMA and PROCOLOMBIA, which have been actively working in the energy sector, with relatively small impact to date.

Global oil companies[19]

Large oil & energy corporations are also present in a significant majority of countries. These firms have been investing for decades in the energy sector, especially in countries with oil and gas potential such as Argentina, Colombia, Perú, Ecuador, Bolivia, and Guatemala. Due to corporate pledges relating to climate change, most of these traditional energy corporations have **energy transition agendas** at the global level, and some of them **have recently become active players in the clean energy market.** They have the advantage of having great expertise in energy markets, financial resources, and access to convenient financing in traditional banking. However, the high risk and lower reward perception of these companies, still prevents them from providing large investments in clean energy infrastructure.

Despite the attractiveness of the energy market, both regional and international project developers and investors **perceive high financing and regulatory risks that would need to be overcome** in order **to mobilize more capital into the renewable energy and energy efficiency market in the region.**

19. Summary of information gathered from research and stakeholder interviews.

3. The regulatory and policy environment for clean energy

3.1. Status of the electricity and energy efficiency regulatory framework in Latin America

Since the late 1980s, market structures in the region have switched from vertically integrated markets, mainly controlled by centralized, state-owned companies, to more liberalized markets, with increasing participation from the private sector, particularly in electricity generation, and in some cases, distribution and commercialization. Regulatory frameworks were shaped to design and structure a linear electricity model, with centralized generation, natural monopolies in transmission and distribution grids, and passive consumers. National governments were (and in most cases still are) in charge of short- and long-term electricity planning.

Thanks to a period of cheap oil prices during the 1990s and early 2000s, literature research show that regulatory frameworks have focused on encouraging short-term electricity cost reduction and have resulted in an increased use of petroleum derivatives to cover present and future electricity needs in most countries in the region. **By the mid-2000s, with the impact of increasing oil prices in a heavily oil-dependent energy sector, countries started encouraging cleaner technologies through new regulations.** However, most of the analyzed countries adopted specific regulatory frameworks to support the uptake of such technologies from the 2010s onwards.

Currently, most countries in the LATAM region show clear commitments to decarbonize their economies, especially their energy sector where they **have put in place different initiatives to foster the implementation of renewable power projects in their electricity grids,** such as public auctions, net-metering regulations, and large-scale power purchase agreements (PPAs) [IADB 2019; IRENA, IEA, REN21 2018].

The current status of regulation and policy in three different subsectors are presented below: Utility-scale generation (large-scale projects connected to national electricity grids), renewable distributed generation (smaller-scale projects for self-consumption, connected in distribution lines), and energy efficiency (projects to reduce electricity consumption and to decarbonize the end-user sector).

Utility-scale generation

In Latin America, the introduction of non-conventional and modern technologies for renewable energy has followed a development path according to regulatory frameworks established in the 1990s and early 2000s. **The centralized planning process for electricity generation contracting and grid expansion has led to the development of centralized, large-scale power plants in most countries in the region.**

The first renewable projects in the region were large hydro projects, designed to utilize the natural resource of large rivers by building basins. These projects would also serve to store water for irrigation and other needs during dry seasons. Countries with high geothermal

and biomass resources, such as Argentina, Guatemala, El Salvador, and Nicaragua, have complemented hydro projects with large-scale biomass combustion and geothermal plants, whose scale and size allowed to reach competitive generation costs.

When non-conventional renewable technologies became mature enough to be able to provide commercially viable solutions for electricity generation (during the 1990s and early 2000s), technologies such as wind and solar PV were still expensive compared to large hydro and thermal power generation. To be able to cut costs and gain economies of scale, the renewable energy market was developed as a continuation of the business-as-usual electricity market, with large-scale facilities and centralized operations. Furthermore, most of the national regulatory frameworks for smaller-scale generation were not yet in place.

During the mid-2000s, there was a rapid adoption of schemes for renewable generation facilities under a bidding process run by central governments around the world. These schemes were designed to acquire electricity from long-duration contracts from privately-owned renewable power plants, at a fixed or pre-determined price (called Power Purchase Agreements or PPAs), in order to provide the projects enough collateral for structuring project financing [IADB 2019].

This PPA auction mechanism was widely adopted in the LATAM region as well, where specifically **Costa Rica, Nicaragua, Brazil, Argentina, and Perú were pioneers in releasing the first publicly organized auctions to purchase renewable energy from private independent power producers (IPPs).** This scheme has been implemented by more countries in the late 2010s and has helped many countries in the region to achieve their first commitments on renewable energy penetration in the electricity markets [IADB 2019].

Up until 2021, all the analyzed countries, except from Nicaragua and Paraguay, have conducted renewable energy auctions to award long-term PPAs to private IPPs in the past [OLADE 2021]. However, most of the countries have either discontinued or paused the auction mechanisms. Only 3 countries (Colombia, Ecuador, and Guatemala) have announced new auctions to award PPAs from large-scale renewable projects.

From the information gathered at different interviews with the public sector of the analyzed countries, only Costa Rica and Honduras have officially stated that they plan to have large-scale renewables auction in the future; however, they have not specified the date of the auctions and characteristics of the process are not yet defined.

Figure 6. Countries with history of large-scale renewable energy auctions in LATAM region. Source: OLADE 2019 and updated by the author.

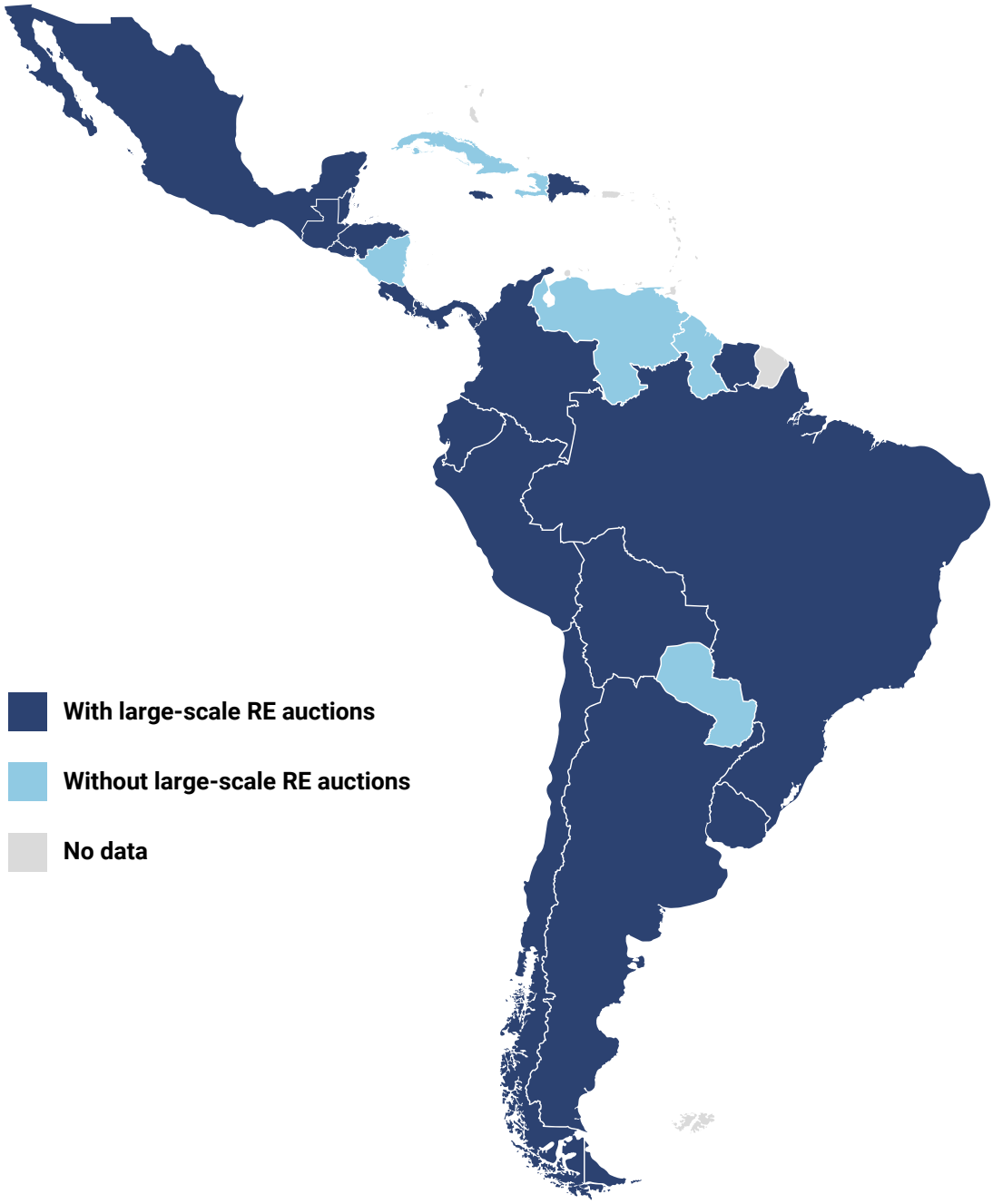


Table 5 shows a summary of the structure of large-scale renewable energy generation market, and the role of the private sector in the generation and distribution subsectors for each target country as in June 2022:

Table 5. Summary of the characteristics of large-scale renewable energy generation in the target countries, as of June 2022. [Elaborated by the author based on country-specific information from research and interviews]

	Generation subsector	Main private renewable generation companies	Main buyers	Contract types	Average contract length	Private introduction into generation	Distribution
Argentina	Mainly private	NEOEN, JEMSE, Genneia	CAMMESA, large consumers	PPA	20 years	1991	Mainly private
Bolivia	Public	-	ENDE	*N/A*	*N/A*	*N/A*	Public
Colombia	Private	ENEL, Celsia, Mainstream, EDF, EPM	Distribution companies	PPA	15 or 20 years		Private
Costa Rica	Mainly Public	Corporacion Multi Inversiones, Acciona, Globeleq	ICE	BO / BOT	Up to 20 years	1990	Mainly Public (through ICE)
Ecuador	Mainly public	Solarpack, Grupo Cobra	CELEC	PPA with BOT (concession)	20 or 25 years	1996	Mainly public (through CNEL)
El Salvador	Private and Public	Cassa, Neoen, Ventus		PPA	20 years	1996	Private and Public
Guatemala	Private and Public	Ormat, Onyx, Grupo Centrans	Distribution companies	PPA	15 years	1996	Largely privatized
Honduras	Private and Public	Coorporacion Multi Inversiones, Terra	ENEE	PPA	Up to 30 years	1994	Mainly Public
Nicaragua	Private and Public	Grupo Centrans, Globeleq, Momotombo	ENEL	PPA	Up to 30 years, avg 27	1992	Mainly Public, (through TSK)
Panamá	Private and Public	AES, ENEL	Distribution companies	PPA	Highly variable		Private
Paraguay	Public	-	ANDE	*N/A*	*N/A*	*N/A*	Public
Perú	Private and Public	ENEL, ENGIE	Distribution companies	PPA, concessions	15 years		Mainly private

Note: PPA: Power purchase agreements; BO: Build and operate (through public concessions); BOT: Build, operate, and transfer (through public concessions, the asset is transferred to the public sector when the concession/ contract expires).

Due to the characteristics of the renewable energy market development explained above, large-scale and **utility-scale plants connected to transmission lines represent more than 90% of the renewable power installed capacity in the region in 2022.**

PPA schemes for renewable energy are mature in some countries and are reaching certain market and technical limitations in 2022, which are discussed in details in following sections.

Renewable distributed generation (RDG)

As illustrated in Table 6, **all analyzed countries, except for Paraguay, have updated their regulatory frameworks to allow the connection to the grid of small renewable projects, especially for behind the meter, net metering, or self-consumption systems.**

In the case of Honduras and Perú, the regulation is not yet under implementation, however it is being discussed at the executive level and planned to issue regulation from 2023 onwards. In all other countries, the regulation is in place and under implementation.

Regulatory frameworks for distributed generation have adopted different shapes in each country, and in most cases, they are relatively recent. This poses challenges for its implementation, as the electricity market has historically been conservative and stable in terms of regulation and is not characterized by rapid change and innovation.

RDG regulation requires significant changes in the structure of the electricity market to be made, switching from a lineal, mono-directional market (from generation to consumption) to a distributed resources market, in which limits between generation, distribution and consumption are less clear. Sectorial regulatory institutions have made efforts to catch up with these technologies and to implement the new regulation proposed by the government, with different levels of success.

In Latin America, different RDG frameworks include:

- The most basic regulatory scheme allows **small-scale, distributed generation projects to be connected to the grid.** This basic requisite allows prosumers (that is, electricity producers and consumers) to alternatively consume electricity from the grid and from the renewable energy system. This has been an important step in many countries, as electricity generation was a regulated monopoly, which didn't allow other players to generate or sell electricity to third parties or to the national grid.

- If the regulation allows to **exchange electricity with the distribution grid,** a bidirectional meter is usually installed. Depending on the regulation, energy injected to the grid can be sold to the distribution company at a fixed price (feed-in tariff); it can be used to net electricity consumption with generation (net metering), or it can be used to partially pay the electricity bill with the utility company, with injected energy not necessarily sold at the same price than consumed energy (net billing).

Table 6: Distributed renewable generation regulatory framework and current status, by country In 2022 [Elaborated by the author based on national regulations]

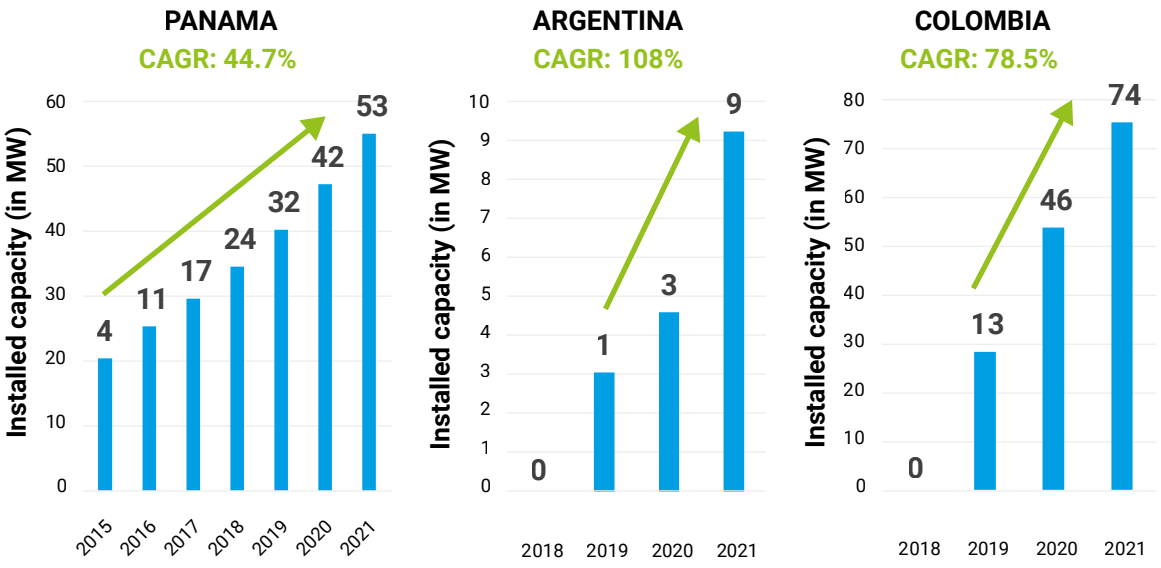
	Initial regulation in place (year)	Billing scheme	System size and injection limits	2021 installed capacity [MW]	Main sector by capacity
Argentina	2018	Net billing	Size up to contracted capacity, maximum size 2MW.	9,11	Commercial
Bolivia	2021	<500kWh net metering; >500kWh net billing	No limit	0,5	N/A
Colombia	2018	Net billing	Small-scale (<1MW); medium scale (<5MW). Injection limited by capacity at the connection transformer	36,4	N/A
Costa Rica	2010	Net metering	Up to 15% of maximum circuit demand	66,3	Commercial
Ecuador	2021	Net metering for small-scale; net billing for medium scale	Small scale up to 1MW, medium scale up to 10MW	N/A	N/A
El Salvador	2012	Net metering	Up to 20 MW	297 (2020)	N/A
Guatemala	2014	Net billing	Size up to contracted capacity, maximum size 5MW.	40,3	N/A
Honduras	*2014*	General Law passed; billing and metering not yet implemented.	N/A	30	Industry
Nicaragua	2017	Feed-in tariff (price: 80% of lowest spot price)	Size up to contracted capacity or 5MW; with injection limitations (connection point)	N/A	N/A
Panamá	2008	Net billing	Up to 500kW for simplified authorization; up to 2.5MW with standard authorization.	52	Residential
Paraguay		N/A	N/A	N/A	N/A
Perú	*2006*	Law passed in 2006; not yet implemented	N/A	N/A	N/A

Passed and under implementation | Passed, not yet implemented | Not available

El Salvador has been the pioneer in RDG in the region, implementing since 2013 a regulatory framework that has led to the installation of near 300MW of distributed generation projects, almost 15% of their total national installed capacity. The market structure is clearly divided into three different types of generation: i. Distributed generation up to 20MW, whose objective is to supply electricity to the distribution grid; ii. Self-generation with excess power, whose main objective is to net the total monthly energy consumed and is allowed to inject electricity into the grid within a net-metering scheme ; iii. Self-generation without exchanges to the grid, whose objective is to partially generate the consumed electricity with smaller projects [Superintendencia General De Electricidad Y Telecomunicaciones [SIGET] 2021].

Most of the regulatory frameworks in the region have firstly adopted feed-in tariffs and net metering schemes. Subsequently, other markets such as Panamá, Colombia, and Argentina, for example, present more complex schemes (net billing). Even if these regulations are very recent, they have shown some progress in terms of systems installed.

Figure7. Installed capacity for distributed generation in Panamá, Colombia and Argentina. Source: UNEP, 2021.



According to research and interviews, most analyzed countries are currently making efforts to make the distributed generation mechanism simpler, showing increasing appetite from the public sector to give participation to private investors in the electricity generation market. More countries are establishing a public office specifically dedicated to shape the distributed generation sector, which shows the engagement from the public sector with this model. Usually, the distributed generation sector was managed by electricity or energy efficiency directors.

It is expected that the speed of adoption of RDG will increase significantly in all analyzed countries. According to the interviews conducted with development companies from the private sector, in most countries the current regulation is enabling the scale-up of distributed generation project implementation, and the market is gaining traction and attention in the region.

Energy efficiency (EE)

According to the International Energy Agency, energy efficiency offers some of the fastest and most cost-effective actions to reduce carbon emissions in transport, buildings, industry and agriculture [IEA 2021].

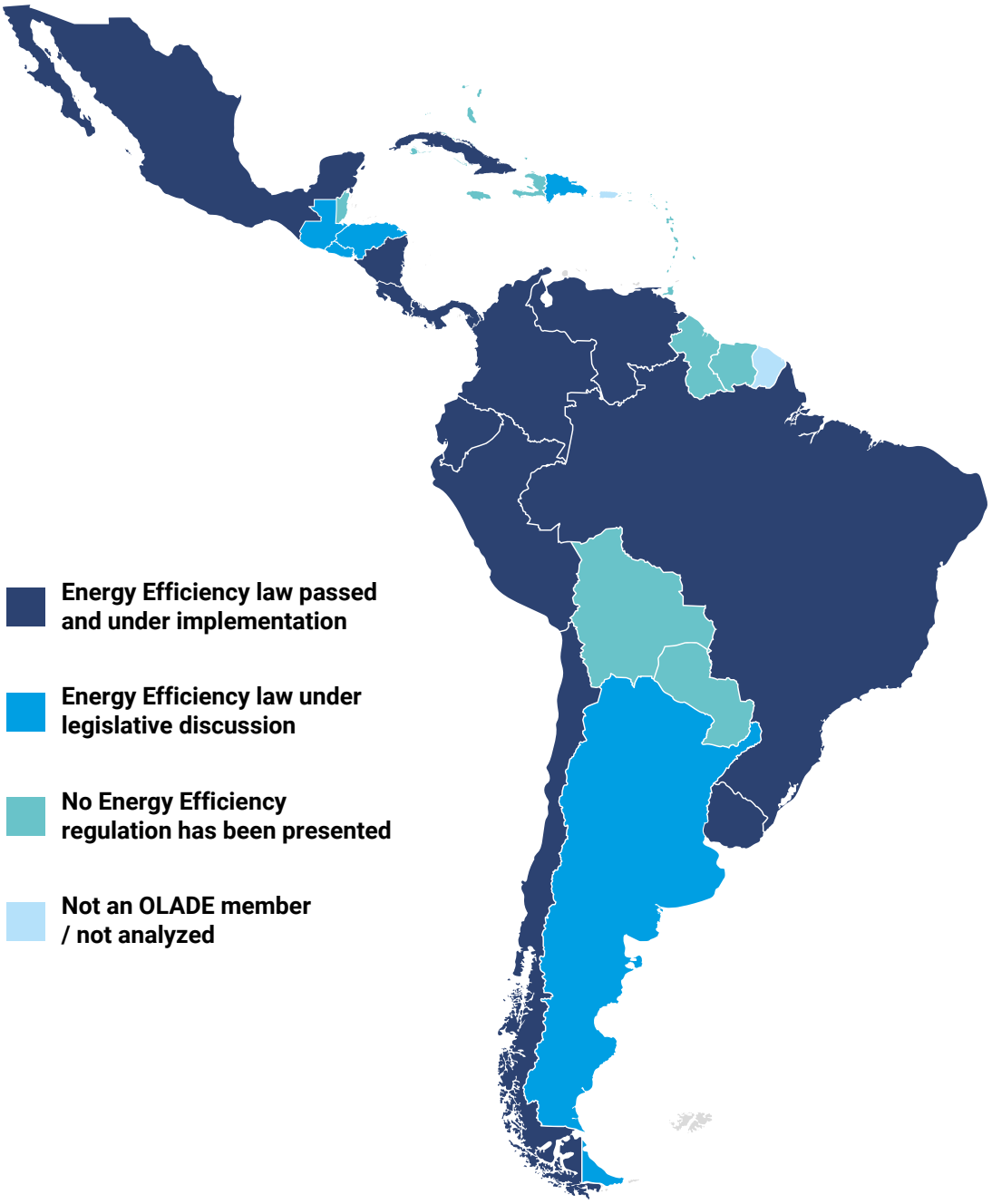
In Latin America, energy usage is widely different by country and sub-region, depending on the socio-economic development of each country. Factors such as quality of living, industrialization, and access to modern infrastructure are key to analyze energy efficiency status and potential. The region presents different indicators that shows the opportunity to improve energy efficiency in all sectors of the economy:

- In Central America, 40% of the primary energy consumption was accounted in the residential sector in 2019 [OLADE 2019], due to the use of firewood and inefficient technologies for cooking, heating, and hot water. Electrification and modernization of energy sources for buildings, including the access to electricity in vulnerable communities, would have a strong impact in energy efficiency, while providing access to energy and equipment such as modern appliances, communication devices, etc.
- In South America, the residential sector accounts for only 15% of primary energy consumption in 2019. In this sub-region, the effect of energy efficiency in industry (31% of primary energy usage) and agriculture (7%), through modernization of manufacturing technologies, agricultural machinery, and access to efficient and clean sources of energy generation, are the more relevant aspects to improve energy efficiency [OLADE SieLAC, n/d].
- In the transport sector, access to modern infrastructure such as roads and ports, improvement of public transportation services, and the electrification and modernization of shipping fleets (urban and merchandise) present an opportunity to boost energy efficiency in the most-energy consuming subsector in the region (38% of the total energy consumption in Latin America, 2019). [OLADE SieLAC, n/d].

Latin America shows an enormous potential for energy efficiency actions across all sectors of the economy. The combination of aging industrial and electricity grid systems, with the necessity of switching to cleaner energy sources and to provide access to modern equipment to vulnerable population, explain the presence of different actions and initiatives taken by the region's public and private sectors, from appliance standards and behavioral changes in cooking and heating, to grid modernization incentives and electricity self-generation systems.

Many countries have recently adopted new regulations regarding energy efficiency. The following map shows the status of development and implementation of energy efficiency laws in the LATAM region [OLADE 2021c]. Additionally, a summary and highlights of each national energy efficiency regulation can be found in Table 7.

Figure 8. Status of implementation for Energy Efficiency regulation in Latin America and the Caribbean in 2021. Source; OLADE.



Currently, **there are significant differences in energy efficiency laws between different countries,** which show the variety of technologies, implementation needs, and ways to incentivize energy efficiency that are present in the market. Each country has focused on particular needs and has committed more or less budgetary resources to this regulation (especially in terms of fiscal incentives and tax exemptions for particular activities and projects).

At the national level, most countries have set energy efficiency labelling and minimum efficiency standards for appliances; most countries have LED lighting programs to switch traditional electric bulbs for public lighting. In some cases, efficiency programs in public buildings have been established, such as in Panamá.

National-level energy efficiency programs have been set up to reduce energy intensity at the economy-level, most of them attached with NDC commitments. El Salvador, Guatemala, Bolivia, and Colombia are examples of national governments committing to energy efficiency goals in order to reduce carbon emissions.

Table 7: Energy efficiency regulatory framework summary for the reported countries in 2022. Same colors applied for each country, according to Figure 8.

Country	Description
Argentina	Draft Energy Efficiency law under discussion. EE declared of national interest. Existing EE program for buildings, Efficient Argentina Award, EE in public lighting plan, EE labeling and minimum EE standard for appliances.
Bolivia	National Energy Efficiency Program, including programs to shift to LED lighting, Ecoefficiency National award, EE labeling for appliances, minimum energy performance standards for HVAC (non-binding).
Colombia	PROURE EE program, defined sub sectorial targets, energy auditing, EE award, Building EE code, "Apagar paga" program, mandatory energy labels. Financing mechanisms available: Discounted "green" mortgages, Energy services agreements, Vendor credit and/or leasing, Partial risk guarantees, among others.
Costa Rica	Law for the Regulation of the Rational Use of Energy (1994 – Mod. 2010), National Energy Conservation Commission, EE Laboratory accredited under the INTE-ISO/17025 standard, aggressive plans to shift to LED, mandatory minimum energy performance standard, Galardón Verde Prize, plans to encourage demand managing through tariff signals
Ecuador	EE law, Defined sub sectorial targets, EE award, mandatory energy labels and minimum energy performance standards. Green or energy efficiency bonds.
El Salvador	Promotes EE through NEP, plans to double the rate of improvement in energy efficiency over the next decade, EE law and EE plan planned, PESAE memorandum, Energy Efficiency Trust Fund, EE prize, Green Retrofit Marketplace platform, EE labeling
Guatemala	Draft Law on Energy Efficiency, the National Energy Efficiency Plan 2019 – 2032, specific targets for each sector, Green Retrofit Marketplace platform, minimum energy performance standards and labeling for HVAC and refrigerators (non-binding)

Honduras	Drafts of the Law for the Rational Use of Energy presented in 1997, still not approved. Mandatory use of fluorescent lamps and tubes in State institutions, Green Retrofit Marketplace platform, minimum energy performance standards and labeling for refrigerators (non-binding)
Nicaragua	EE law, minimum energy performance standards for refrigerators, lighting equipment, HVAC (Mandatory), binding energy savings obligations for public buildings, EE national prize, EE codes for new residential buildings. Industry ISO 50001 standard
Panama	Defined sub sectorial targets, Energy auditing, Building EE code, EE award, mandatory energy labels and minimum energy performance standards. Financing mechanisms available: Discounted "green" mortgages, Vendor credit and/or leasing, Partial risk guarantees, among others.
Paraguay	EE incorporated into national energy policy and the National EE committee has been created. Also available: Biomass energy consumption calculator for SMEs, labeling for sustainable buildings and appliances, UNDP Portfolio of EE and Sustainability Initiatives in the Private Sector
Peru	EE law, Mandatory energy efficiency labeling

To incentivize the private sector engagement in end-user energy efficiency initiatives, there are two main different structures for its implementation that have been identified, according to interviews with the public and private sector:

- On the one hand, many countries have set **mandatory efficiency targets for particular sectors, or to certain consumers based on their location and size.**
- On the other hand, there are countries that are trying to **incentivize energy efficiency through tax benefits** for companies who implement certain activities, such as efficiency certifications (ISO 50.001 or similar), which include energy audits and energy efficiency scenarios. Some countries promote the replacement of older HVAC and process equipment with tax exemptions and fiscal credits that can be used for income tax.

Additionally, there have been identified non-financial incentives in place in different countries, such as energy efficiency prizes. These incentives, however, usually have the objective to highlight successful cases and increase the awareness of energy efficiency technologies and their benefits.

National energy efficiency codes for buildings and industries have been proven to be a successful way to increase investment initiatives in the energy efficiency sector. In the region, Colombia, Argentina, and Panamá have established Building EE codes. In some countries, compliance to these efficiency codes is voluntary; however, **it has been identified that there is an increasing appetite to comply with these regulations for different reasons,** including corporate mandates, increased property value, and operational cost reductions.

Additionally, different circumstances such as energy shortages, high unavailability, and instability of electricity grids, have made private sector players in countries like Nicaragua, Honduras, and Paraguay to be increasingly interested in energy efficiency technologies. Public sector initiatives in these countries have also been seen, in a way, to reduce shortage risks and reduce the need for public investments in distribution grids. Public sector initiatives include new regulation and energy efficiency guidelines for utility companies and publicly owned industries and buildings.

In sum, **there is clear appetite for central governments to incentivize energy efficiency activities across a wide variety of sectors and through diverse programs,** mainly due to electricity challenges at the grid level, **but also from the private sector to lower costs and increase energy security.** However, as the regulations are relatively recent, they are sometimes broad, non-mandatory, and difficult to implement and track the results.

In general, incentives such as tax benefits have been more successful in increasing interest from the private sector. Although, private investments in energy efficiency are not scaling-up with the required speed, mainly due to the complexity of the regulation, the insufficient and difficult to implement monetary incentives (according to interviews to the private sector), and mandatory activities that are difficult and expensive to implement by the private sector (such as mandatory certifications).

3.2. Regulatory, market and policy barriers for clean energy adoption

Flexibility of market structures to allow clean electricity implementation

All analyzed countries have developed regulatory frameworks to catalyze the adoption of renewable energy technologies during the past two to three decades, in order to develop cleaner energy resources, reduce their GHG emissions and to become more independent of fluctuations in fossil fuel prices [IADB 2019]. The particularities of each country lead to different regulations in terms of incentives, targets, and implementation strategies.

Despite their particularities, the analyzed countries can be divided into two groups, considering their approach to electricity markets:

i. Countries with high presence of public investments, or heavily regulated markets by the national government: (Perú, Paraguay, Bolivia, Ecuador, Costa Rica)

Common characteristics of this group of countries are the following:

- Strong and strict market regulation by the national government. In some cases, electricity generation and sale are considered "strategic activities", meaning that only the public sector is allowed to perform this economic activity.
- Public sector authorities or state-owned companies either monopolize or have a strong presence in the electricity generation market. Therefore, public investments in the electricity sector are much more relevant than private investments.
- Permits, licenses, and concessions are difficult to obtain for private companies to implement generation projects, and the national government performs strict market control with the discretional issuance of these concessions for particular projects or technologies.

In Bolivia and Paraguay, electricity generation is almost 100% public. Investments are made by ENDE and ANDE, respectively, which are public authorities dependent on the national government. These institutions are strongly linked to the public sector authorities, and in these cases, they also control the vertically integrated electricity market and elaborate national generation and transmission expansion plans. In Paraguay, ANDE also serves as the electricity system operator. Almost 100% of their investments are made with national public budgets, with occasional utilization of international financing (usually backed-up with resources from the national treasury).

In Costa Rica, the national public company ICE monopolizes a great part of the electricity market, in both generation and distribution activities. Even if ICE has organized public auctions and purchases electricity from private companies, the planning and execution of these projects are controlled by ICE. Methodologies to contract PPAs with ICE include concessions for the natural resource, and some of the projects are contracted under a BOT concession (build, operate, and transfer), in which after the concession period, the asset is transferred to ICE's property. Moreover, some of the PPA projects from private parties are currently expiring and ICE has announced that PPAs will not be renewed. Even if Costa Rica has been historically a trusted country in terms of debt payments and institutional stability, all these conditions add risk and sometimes constitute a barrier for private players to develop private renewable projects.

In Perú, the private share in the generation subsector is large, but the Peruvian government has the authority to award concessions for natural resource exploitation (including wind and solar). Moreover, the Peruvian sector has had four renewable energy auctions in the past, which have been very successful, contracting 5% of the total generation matrix from wind and solar projects (which was the objective set by law). The project development sector has experienced a great development during the years 2009-2017, and many projects have been developed. However, the national public authority (Osinergmin) has not planned any new auctions for renewable energy, and development companies are trying to develop new business models to make their projects bankable.

Ecuador has also been a historically closed market for the private sector in electricity generation. In 2019, the Ecuadorian government has started opening its electricity market, and new auctions have been announced, including a 500-MW renewable energy generation auction. Still, the PPA concession includes as in other countries, the transfer of the generation asset to the Ecuadorian public electricity company (CELEC) when the concession expires.

ii. Countries showing a well-developed, mature market, with large international players already established and doing business in the country, (Colombia, Guatemala, Panamá, Argentina)

Common characteristics of this group of countries:

- They have a clear division among different activities in the electricity sector: Generation, transmission, distribution, and consumption. In most of these countries, the generation market is open to the private sector, and the national regulator oversees control and supervision activities, such as assuring market competition and establishing economic generation rules. The regulator is often in charge of elaborating the generation strategies and national expansion plans.
- The system operator is an independent institution, in some cases operated by a private company.

This group of countries has a clear renewable energy framework and has had successful large-scale renewable energy auctions in the past, with notable activity from private development companies.

Argentina for example has encouraged the introduction of renewable energies through the RenovAr programs which offered a robust guarantees mechanism with the participation of the World Bank and 20-year USD contracts. These tools improved stakeholders' confidence and as a result, hundreds of players participated in the bidding process, far exceeding the available quotas.

Furthermore, where rules allowed electricity customers to purchase power directly from a third party such as Argentina through the MATER, more renewable projects were installed. At the beginning, private companies had to accomplish a renewable share by law, but nowadays in most of the countries renewable energy ends up being cheaper than the one they can purchase from the market. Thus, there is a genuine interest from private companies to buy renewable energy in order to become more competitive.

Even though some countries such as Colombia, Ecuador, and Guatemala have an open bidding process now, the tendency shows that there will not be more large-scale biddings for the next few years. Saturated transmission lines and the need for more firm capacity disables the instalment of intermittent generation.

Large-scale renewable energy generation projects are not able to advance if the efforts are led by the private sector only and will necessarily need support or engagement from the public sector. In some cases, large consumers are free to contract electricity from private generators**. Alternative business models for renewable energy contracting are possible without the engagement of the public sector in some countries.**

Another common barrier in the region is that regulatory frameworks for intermittent generation in some countries, such as Perú, Ecuador, and Guatemala, require contracting firm capacity in order to participate in public biddings organized by distribution companies, especially for large-scale projects. Public auctions performed by the national system operator or distribution companies to assure long-term contracts to supply electricity and power demand, combine both capacity and energy purchases in some countries, constituting a limitation for the participation of several renewable energy technologies.

Regulatory barriers of this type constitute a barrier mostly for technologies that provide intermittent sources of electricity, such as wind and solar PV. Other renewable technologies such as hydro, geothermal, and biomass, have more opportunities to participate in the electricity bids if they can provide firm capacity.

The bidding process currently being held in Guatemala has three different types of contracts offered to distribution companies. Two of them (peak demand shaving and firm capacity contracts) provide benefits to traditional thermal power technologies, as well as biomass, large-scale hydro with reservoir, and geothermal (which currently have other challenges, to be elaborated below). The third type of contract offered, which is a long-term energy contract, has the conditions to award intermittent renewables such as solar, wind, and small hydro. **Due to regulatory restrictions, therefore, only 40MW will be awarded for long-term PPA, compared with 235MW for the first two types of contracts[20].**

20. Comisión Nacional de Energía Eléctrica (CNEE) Resolution 118-2022.

In countries where this current regulatory barrier is present, the inclusion of electricity storage, such as batteries and other technologies, into renewable energy projects show an opportunity to overcome these regulatory barriers, and potentially to provide other grid services to local distributor (back-up capacity, secondary regulation). However, **regulatory frameworks for innovative technologies such as grid-level energy storage (either stand-alone or coupled with a renewable energy source) are not yet developed in the region.**

Costa Rica, for example, has set in its newest regulation for the renewable energy sector, the possibility for renewables and storage projects to provide grid stability services (primary and secondary backup, and frequency regulation) to distribution companies[21]. El Salvador and Colombia are other markets which are deploying pilot projects for renewables and storage projects.

Even if there are some positive signals in the region, and a good appetite from the private sector to develop renewables combined with storage projects, **an enabling regulatory framework would be needed, allowing these projects to provide firm capacity and ancillary services, and therefore increasing the profitability and lowering costs of these technologies.**

Centralized contracting schemes limit the participation of the private sector in electricity markets

At the grid level, and especially for large-scale projects, the **"Corporate PPA" is a business model that has been growing exponentially worldwide, where large corporations and private companies can purchase their electricity and power needs from private generators or IPPs.** In the LATAM region, this model has already shown its potential in countries with more advanced regulation, such as in Chile, and more recently in Argentina.

However, **the regulatory framework for corporate PPAs is still absent or very limited in the LATAM region, which presents different barriers for deregulated, private contracts.** In most cases, renewable projects are required to have a capacity back-up contract, which cannot be offered by intermittent renewables such as wind or solar. This is the case for Perú and Ecuador.

One of the main barriers for the Corporate PPA business model is that **in most countries, the national electricity grid does not provide tools to lower curtailment risks for private projects.** Incorporating private projects in the national electricity expansion planning would help decrease most of the perceived risks for large-scale project interconnection, which are currently associated with curtailment and transport capacity.

Argentina has implemented an innovative way to provide "dispatch priority" for private renewable projects, through quarterly auctions run by the national system operator (CAMMESA). By making the interconnection capacity of each node publicly available while being able to reserve dispatch capacity (through an insurance bond or a fee), renewable developers have a clear regulation to sign corporate PPA's with large consumers and no curtailment risks. They can use the national grid as back-up, purchasing electricity from the grid when the renewable project is not generating[22]. **Transparent regulatory procedures to secure the interconnection and dispatch capacity of private projects are still absent in most of the analyzed countries, presenting highly perceived risks for private investors in the renewable energy sector.**

21. According to interviews with the national electricity company ICE.
22. CAMMESA – MATER regulation. Available at: https://cammesaweb.cammesa.com/mater/

Decentralized, medium-sized projects that supply electricity to utility or distribution companies (or cooperatives) still do not have a clear and allowing regulatory framework in most of the analyzed countries. Chile's government has deployed a similar initiative in the early 2010s[23], helping the Chilean electricity market to dramatically increase the share of renewable energy generation, while avoiding big expenditures in building or reinforcing the national transmission network.

Interviews with stakeholders from both the public and private sectors have shown that there is, in most of the 12 countries, appetite to replicate the Chilean model. Perú, Ecuador, Honduras, Colombia, and Argentina all exemplify this. However, these models are still under consideration.

In Perú and Bolivia, distribution companies are also allowed to generate their own electricity up to a defined percentage of the regulated customers' consumption (between 10% and 20% in different countries). This enabling regulatory framework could boost the implementation of renewable energy projects at a distribution level, providing a business model for local distribution companies and cooperatives around the region, which are able to decarbonize their generation matrix. **However, most electricity purchases in the region are still centralized by national governments.**

At the consumer level, for small and medium scale projects, there are additional barriers induced by centralized regulation in the electricity sector. In most countries, national regulatory framework divides consumers into **regulated consumers**, residentials and smaller commercial and industrials, and **non-regulated customers**, usually large industries.

In some countries, non-regulated consumers are allowed to purchase electricity from a free market, including price negotiations in some cases. In Costa Rica and Honduras, for example, all the electricity must be purchased by the state-owned generation company. Nevertheless, large consumers can negotiate the contracts and are permitted to implement self-generation projects. On a more common structure, as is the case in Argentina, Ecuador, Colombia and Peru, there exists a highly deregulated market for large consumers, which can negotiate contracts with private generators and pay a price for the use of transmission lines if needs be.

Usually, **the possibility to become a free agent has limitations** such as having a minimum peak power demand or a minimum threshold of energy consumption. Smaller consumers must usually oblige to being regulated consumers, while tariffs are set by the electricity regulator (public sector). This way, **there is a limitation for smaller users to access the electricity market by generating their own electricity, or to be able to negotiate electricity tariffs with private generators.**

23. Chile was pioneer in promoting medium-scale renewable generation projects, from 1MW to 9MW of installed capacity (called PMG and PMGD). With this model, electricity was provided to a local distribution company or large consumers, and the excess or all the electricity generated could be injected into the medium voltage network and sold to the distribution company. In 2022, Chile had more than 2.4GW of medium-sized renewable energy projects, which helped to achieve an impressive 31,1% of renewables penetration in the national grid.

Reliability and size of the electricity grid

According to IRENA, **national transmission and distribution grids will need expansion and reinforcement to meet growing electricity consumption and enable more efficient and reliable system operation** [IRENA 2022]. In this sense, the capacity to incorporate new clean energy projects into national grids is directly affected by the serious challenges that the region faces regarding grid modernization and integration.

In most of the countries analyzed, national high-voltage transmission grids are already saturated, or rapidly reaching saturation, resulting in limited available capacity to transport new electricity generation. Therefore**, there is an existing or near-term limitation to incorporate large-scale renewable projects into the grid.**

One of the main reasons why most of the national transmission lines are reaching their limits is the high capital expenditures needed to upgrade or build new transmission lines. In almost every country analyzed, these investments are usually made by national governments with usually very limited public resources – especially after the COVID-19 crisis.

Additionally, new transmission lines commonly involve very complex projects that are often difficult to execute. Though there are in the region several announced plans to build new transmission lines or to reinforce existing ones, this process not only takes up a long time, but also faces many socio-environmental barriers. The geography of many countries in the region, with the presence of large forest covered lands and environmentally protected areas, must be considered in the design of new transmission lines, which increases the complexity and cost of these works.

Besides the ability to incorporate new generation, the absence of robust high-voltage transmission networks also affects two very important indicators for an electricity grid: reliability and flexibility. Latin American networks are characterized by large-scale generation facilities, connected to high-electricity consumption areas (mostly cities and large industries), which are connected through large transmission lines.

The dependence on a single transmission line to supply the needed electricity generation lowers the reliability of the grid. **The limited diversity of generation sources affects the flexibility of the grid. Diversifying and decentralizing electricity sources, as well as increasing generation close to where the consumption is, are current challenges** that might help the regional grid to increase its performance in the region.

Moreover, the utilization of new renewable energy sources, such as wind or solar, usually demands the building of new transmission systems in previously unexploited locations. This is the case of Panamá, where the most consuming sectors are located in the eastern part of the country, and the highest renewable potential (wind, solar) is located on the western part of the country. Another example is Argentina, where the greatest solar potential is located in the north-west, the greatest wind potential in the south and almost 60% of the demand is concentrated in the Buenos Aires area, located in the East. Due to its extension (3700km between extreme North and South points), Argentina requires very long transmission lines to connect them. As existing lines are almost reaching their maximum capacity, very large public investments are needed in order to take advantage of the highest wind and solar potential.

The status of medium-voltage distribution lines also plays an important role in the viability of expanding the distributed renewable generation model. According to interviews from relevant stakeholders in the energy sector, it is common in most analyzed countries to have distribution grids that are poorly maintained, with low investments to renovate and reinforce lines, and equipment. This factor is even more relevant due to the increase in electricity consumption in the region.

Because of the structure of the distribution grid business model, in which they often get paid on a fixed return on assets operated and maintained, **distribution companies have generally low incentives to increase the level of service and to expand and modernize the grid.** That is why the LATAM region presents higher electrical losses at the distribution level than average. As the cost of losses is paid either by the national government or evenly by paying customers, distribution companies are usually not particularly concerned about lowering power losses.

As new distributed generation regulation is developed, the capacity of distribution lines to deal with consumers injecting electricity to the grid poses a major concern, as most grids were not prepared for this change. In addition, distribution companies can be reluctant to the RDG model as it represents increasing complexity and loss of relevance, due to self-generation projects, as potentially reducing electricity demand. Even if this reluctance is backed by the status of the distribution grids, risk aversion to change is high among distribution companies.

Consumers, on the other hand, are concerned about the continued increase in electricity demand and the limited investments in the distribution sector leading to an increase in electricity shortages and poor service, reducing the reliability of the supply. For many consumers, especially in the commercial and industrial sector, the decrease in reliability produces a great risk to their business models[24].

As previously mentioned, Honduras, Nicaragua and Paraguay are the countries with highest energy losses. In these countries, the reliability of the electricity service is a challenge. Both the frequency of outages and the average duration are well above the regional average, which is further exacerbated by the rapid growth in electricity demand.

The installation of small, distributed generators would reduce the peak demand and the grid utilization rate, and therefore diminish technical losses. Therefore, **the status of distribution lines is contributing to increasing the awareness from consumers about the importance of electricity supply reliability,** and therefore to be more interested in electricity self-generation.

Development of additional regional interconnection

Almost all analyzed countries have been working to integrate their electricity systems in order to make better use of the energy resources and infrastructure available, and to reduce electricity costs. However, **additional large-scale investments and planning for regional interconnection systems would be required to increase the potential of deploying clean energy projects in the region.**

The regional electricity market (MER) interconnects the six analyzed countries in Central America. The current regulatory framework has also established a number of institutions in charge of different aspects of the strategy, planning and operations of the regional system, which works similarly to a national electric grid.

However, certain drawbacks in power infrastructure limits the ability to buy and sell electricity between different national systems. Especially in Nicaragua, the transport capacity is currently limiting the electricity exchange between the northern countries (Guatemala, El Salvador, and Honduras) and the southern countries (Panamá and Costa Rica). As a result, electricity generated from clean energy sources in Costa Rica

24. According to interviews conducted with development companies, private sector associations and SMEs.

is experiencing impediments flowing into neighboring countries such as Honduras and El Salvador, where the electricity demand is not met. The need for backup sources of generation is encouraging these countries to build fossil fuel generation infrastructure to provide capacity and energy during low production periods.

A similar situation occurs in the Andean region, where a high-voltage line (Machala – Zorrito) connects and is able to exchange electricity between Ecuador and Perú. However, the capacity of this interconnection line is limited, and below the high potential of interconnection between these two countries. Furthermore, a grid interconnection between Ecuador and Colombia (Jamondino – Pomasquí) is in place, with higher power infrastructure, but still below the potential. Perú, Ecuador and Colombia have different hydrological cycles, and therefore a strong power interconnection could lead to lower needs of backup thermal generation, and the development of more clean energy projects.

Electricity subsidies

A strong barrier to implementing renewable energy and energy efficiency projects are electricity subsidies, which are being implemented in the region at both generation and consumer level. **Subsidies and price controls are currently discouraging new investments in clean technologies in the region.**

At generation level, countries such as Argentina and Bolivia have strong subsidies schemes in place, that artificially lowers electricity prices, sometimes below generation costs. This way, profitability for new clean energy generation projects is not enough to compete with subsidized generation. Moreover, in Bolivia, the combination of electricity consumption growth and subsidy schemes (for thermal plant generation and for consumption), has resulted in the amount of natural gas available to export to other countries being significantly diminished, creating a consequential threat to its public accounts (Bolivia's budget is highly dependent on natural gas exports).

At the consumer level, many countries have heavily subsidized tariff structures for the residential sector, that makes self-generation projects economically unattractive. Even if setting up subsidy schemes might be a proven measure for national governments to boost strategic sectors, to assist lower-income communities, and to gain competitiveness on their exported products, **poorly implemented subsidies schemes can be a strong market signal against the implementation of renewable energy generation and energy efficiency measures at consumer level.**

In countries where there are off-grid micro and mini-grids, especially serving isolated communities but also industries that are disconnected from the grid, the public sector usually regulates electricity generation and tariffs, in order to partially cover the higher generation costs, while establishing minimum requirements for quality and availability. Currently, **minigrids in the region use mainly high-cost fossil-fuel power generation, such as LPG and diesel. As these high costs are subsidized, renewable generation cannot compete in the off-grid market.**

As mentioned before, and according to interviews with public sector officials, national governments are increasingly concerned about the high cost and relatively higher importance of energy sector subsidies in their public budgets. Electricity subsidies have been increasing in all countries in the region, and in some cases, such as Argentina, Honduras, and Panama, is becoming a very significant expense to national administrations. In general, all countries in the region are trying to minimize the use of electricity subsidies and exploring various ways to decrease its burden for national budgets.

Natural gas initiatives

Some countries in the region such as Panamá, Guatemala and Bolivia have recently installed large-scale Natural Gas power generation projects (combined cycle), with the purpose of rapidly increasing generation capacity. Mentioned countries are trying to decrease the share of use of liquid and other more expensive fossil fuels, such as diesel and LPG. However, these large-scale projects are becoming a significant portion of national installed capacity, which can discourage the development and installation of new renewable plants, and at the same time increase the dependency for imported sources of energy, and the need for big infrastructure projects to be able to import natural gas (such as LNG regasification plants).

The consideration of natural gas as a "transition fuel" is challenging the most compelling environmental and social aspects of the renewable energy transition in many countries. Even if the deployment of combined cycle thermal power generation plants would certainly help to partially decarbonize the electricity system in the short term, this is only true for countries which have a particularly heavy presence of liquid and solid fossil fuels for electricity generation. As it has been described above, this is not the case for most countries in the LATAM region, in which participation of thermal generation is complementary (and sometimes marginal) to hydro, geothermal and nuclear plants. **The utilization of more natural gas in Latin and Central American electricity matrixes would not only delay the implementation of renewable energy projects but would also increase the carbon intensity of their electric generation** in the longer term in most countries [UNEP 2022b].

Permitting and concession schemes are difficult to navigate

Another regulatory barrier for large-scale renewable projects is the issuance of licenses and concessions to exploit natural resources. This is especially relevant in larger-scale projects, such as geothermal and hydro projects. For this reason, in most of the analyzed countries, the national government through public companies are the owners of the majority of hydro (with reservoir) and geothermal projects.

This is true also in markets in which the private sector has a strong participation, such as in El Salvador. In this country, all the geothermal and hydropower plants belong to two different state-owned companies: La Geo and CEL respectively. **In most countries, water and geothermal resources are considered strategic resources, hence there is minimal effort from private companies to develop projects in these technologies.** There are few exceptions including Nicaragua, where all the installed geothermal plants belong to private companies [IRENA 2020b].

For large-scale projects from other technologies, such as wind and solar, most countries have deployed complex permitting schemes, with many stakeholders involved from different sectors of the national and subnational government. One of the most important perceived risks from project and pipeline development companies is the ability and time required to issue project permits, including environmental and social authorizations, interconnection studies, and grid authorizations.

In smaller-scale projects, there are also **common regulatory barriers that are currently present in the target countries,** mentioning:

- **Technical complexity for permitting and authorization procedures.** In most cases, prosumers (end users) do not have the technical expertise required to smoothly obtain the necessary interconnection permits. This leads to some end users being

discouraged from installing newly distributed generation projects. Not only present in the residential sector, this challenge also exists in the commercial and industrial sectors, especially SMEs, which often do not have technical personnel with expertise in electrical engineering.

- **Longer processing times for authorizations.** As regulation for distributed generation is relatively recent, the public sector is in some cases still refining their internal procedures for analyzing the information provided and issuing authorizations needed, according to the current regulation. This leads to longer times to obtain authorizations and periodic changes in regulation trying to adapt the process with the expected outcome and time. In some instances, the permits necessary to interconnect a DRG project are needed by many different stakeholders at different levels of the public administration (local governments, sub-national or regional governments, utility companies, firemen, etc.), increasing the chance of having delays in the permit processing.

Socio-environmental barriers for large-scale projects are rising in the region

Large-scale hydropower and geothermal plants are often complex from the environmental and social perspective, even though they present many advantages as a high-quality and abundant source of energy. Achieving social acceptance is fundamental in the implementation of these sorts of projects. **Public opinion regarding the social and environmental impact of renewable energy projects can influence public sector decision-makers and slow down (or even prevent) the adoption of clean energy projects. This is especially true for large-scale hydro, wind, and geothermal projects.**

The region has recently seen some level of activism against large-scale projects. Many examples were found during the literature research. In El Salvador, indigenous communities have stopped the construction of the Nahuzalco II hydroelectric plant in the Sensunapán river, whereas, in Argentina, the geothermal project Copahue couldn't be tendered by the national government, as there was no support from local communities to execute the project. In Colombia, the Guajira peninsula is home to one of the highest wind and solar resources in the country. However, social conflicts arising with the local indigenous community for the construction of a high-voltage transmission line is discouraging developers, which are siting their projects outside this region.

These protestations are spreading to different countries, with **large-scale projects are building some resistance from the population, especially the ones affecting vulnerable and indigenous communities. Therefore, political efforts are switching away from large-scale projects due to public opinion matters.** Such issues need critical analysis and careful consideration to ensure all stakeholders' interests are catered to and that interventions demonstrate strong levels of country and community ownership, regardless of scale.

During the interviews, **stakeholders from the public sector in different countries have shown resistance to develop and implement projects which have a level of sensitivity in the socio-environmental arena:** projects in or near protected areas, with high level of modification of the original landscape, in or near highly vulnerable communities. The main reason is the difficulty and cost of obtaining environmental and social permits and authorizations. But other **very relevant reasons are the effects of public opinion of the public sector (governments), and the private sector (consumers).**

Figure 9. Summary of main regulatory and policy barriers found in LATAM region.

Energy market structural challenges

- Strict market control from the public sector and state-owned companies in some countries.
- Market design barriers to sell renewable electricity without firm capacity.
- Regulatory innovation needed (for medium-scale projects and energy storage).
- Reliability and size of electricity grids (transmission and distribution) prevent rapid scale-up of private investments.
- Slow development of regional grid interconnections limits the clean energy trade potential between countries.
- Permanent, inefficient electricity subsidies at generation and consumption levels block incentives and awareness of the importance of clean energy projects.
- Natural gas initiatives as a transition fuel is challenging the case for new renewable generation.

Centralized contracting schemes in place

- Corporate PPA market not allowed or poorly developed in most countries.
- Centralized planning discourage private generation projects (subject to curtailment and other interconnection barriers).
- Regulatory frameworks don't allow or limit distribution companies and consumers to freely purchase and negotiate electricity in some countries.

Complex permitting and concession schemes

- Complex permitting and authorization procedures for large-scale projects.
- Resource concessions under strict control of the central government (water, geothermal).
- Recent regulations in distributed energy causing delays, complexity and lack of clarity in procedures in some countries.

Socio-environmental challenges are increasing policy barriers

- Impact of public opinion in the deployment of new renewable generation projects.
- Resistance for larger-scale projects with environmental and social impacts.

4. The clean energy financing barriers

4.1. Limited expertise and risk understanding for clean energy projects

While the 12 countries have been taking steps towards the adoption of renewable energy technologies, the ability to unlock new sources of capital and financing constituted one of the most difficult challenges to overcome.

The ability of financial institutions (national banks, commercial banks, and local development banks) **to manage, and successfully navigate through, project financing processes in the clean energy sector is still one of the most evident barriers to attract the capital needed to expand the implementation of these technologies.**

While banks are increasingly exposed to climate change risk and commitment to net zero or similar emission reduction targets, they have limited experience and expertise in assessing risks specific to renewable energy and energy efficiency transactions, resulting in difficulties in financing such projects.

The magnitude of the task ahead is quite complex for national and regional financial institutions. Currently, the financing sector is required to build new expertise in assessing risks and financing relatively novel equipment (such as solar panels, wind turbines, etc.), as well as the integration of new systems (such as microgrids, intermittent power generation plants, and rooftop solar systems) and the evaluation of new business models (such as pay-as-you-go electricity or energy service companies, ESCOs).

Table 8. Examples of common risks that constitute barriers to mobilizing capital in the LATAM region. Source: Adapted from IEA 2021b.

Category	Risk/barrier	Examples
Policy and regulations	Regulatory uncertainty	Unexpected changes in regulatory frameworks, retroactive mechanism modifications.
	Breach of contracts	Interruption of concessions, permits and contracts with the public sector.
Enabling infrastructure	Grid infrastructure	Limited robust transmission and distribution lines, which can cause supply interruptions.
	Grid flexibility	Distribution grids unprepared to receive rapid electricity flow changes and new players.
Project preparation	Licensing and permitting	Unexpected delays in permitting processes, unclear procedures to obtain concessions.
	Technology performance	Uncertainty of performance of new technologies or new uses for mature technologies.

Business model	Revenue streams	Variability in electricity prices and volumes, payment delays or interruptions.
	Off-taker risks	Changes in the capacity of the off-taker to purchase and to pay for the electricity.
Financial markets	Macroeconomic stability	Unexpected changes in market rules for private investments, new taxes, inflation, currency.
	Financial conditions	Variability in interest rates, increase in cost of financing, unclear project financing processes, access to guarantees.

While business developers and investors in the clean energy sector have the challenge to deploy capital in new markets and develop business models and projects in frontier markets, **most financial institutions have been relying on their traditional risk assessment models.**

The inadequate understanding of the underlying technologies in the sector, ultimately linked to the limited track record of commercial projects, as well as few initiatives for pilot projects, make it difficult for financial institutions to technically and financially assess project risks associated with clean energy projects.

Consequently, on-balance sheet financing is prominent in the region. While evaluating risks for structuring a project finance in the region, **the quality and characteristics of the sponsor has been usually more important than the quality and characteristics of the project.** The traditional risk assessment conducted by financial institutions in the region gives much more importance to the risk of loan repayment by the sponsor, than the quality of the asset or the possibility of generating revenue which is given by the characteristics of the project.

According to interviews conducted in the financial and development sectors, in the 12 surveyed countries, most financial institutions end up financing projects based on the sponsor's credit history, due to lower perceived risks, and rejecting or critically delaying financing to new sponsors. This unavailability of off-balance sheet financing induces a major barrier to project development and implementation at the scale and speed necessary for decarbonization in the energy sector.

This effect is even more evident when new or foreign players are seeking to finance their projects. Startup companies and SMEs which are innovating in the renewable energy sector usually do not have the financial experience and project track-record required to mitigate or alleviate the risks perceived by financial institutions.

Hence, **banks tend to perceive higher risks and therefore provide shorter tenures, higher interest rates, and ask for asset-backed guarantees** (such as mortgages and other in-balance sheet guarantees) **for smaller and new sponsors.**

In a typical infrastructure project finance risk assessment, income and savings generated by the financed project would secure the repayment. Instead, most financial products currently offered by national banks **focus on corporate guarantees to close financing deals.**

In this sense, **larger companies such as energy corporations, large investment funds, and multinational companies, have been gaining a competitive advantage against smaller companies, which usually experience difficulties complying with the collaterals demanded by the financial institution in order to close financing.**

On the other hand, **increasing the understanding of the financial sector on climate risks is also of paramount importance to improve credit risk assessments and asset valuations for clean energy projects.** In some countries there have been strong efforts to generate internal capacity to perform climate risks assessments, led by banking associations and incorporating technical assistance from international organizations. More experienced international banks have also been increasingly contributing with creating new mandates and policies for Latin American branches.

There has been advancement on including climate-related risks in risks assessment projects for financing, and from the public sector to create and define official taxonomies to characterize and define which type of projects are defined as green, sustainable, and social projects. However, **there is still significant room for improvement, both in private bank engagement and in the speed of implementation of these measures, that would certainly increase the appetite for commercial banks to finance projects in the clean energy space.**

Due to the regional investment and financing culture, the perception of early-stage ventures risks, and other cultural aspects, Latin America has particular characteristics in their approach to risk assessment. In this sense, **the correct allocation of risks among the different stakeholders while creating innovative business models and novel financial structures, is of paramount importance to lower the overall risk of renewable energy and energy efficiency projects in the region,** and therefore to increase the possibilities of fundraising and the success of the projects in the different stages.

A **summary of different risks that can be found in renewable energy project development is presented below, divided by the stage in which each specific risk is more present and relevant.** Additionally, the perception of each of the three stakeholders analyzed in these sections are presented, taken from the different interviews and research conducted in the 12 countries.

Table 9. Summary of risk perception of relevant risks present in the region for different stages of renewable energy (RE) and energy efficiency (EE) projects. Source; Elaborated by the author from information gathered during interviews and literature research.

Likelihood of perceived risk: High Moderate Low

Type of risk	Sector perspective in LATAM		
	Commercial banks	Equity investors	Development companies (DevCo's)
Early-stage development risks			
Technology and project maturity	Usually, financial institutions have high perceived risks for new technologies, even if they are commercially proven.	Usually do not have internal expertise and rely on third-party assessments, such as independent engineers, or financial institutions.	DevCo's are usually experienced with RE and EE technologies, having the opportunity to lower risk perception for financial institutions and investors.
Regulatory uncertainty	Risk shared among all stakeholders, due to the effect of potential changes in regulatory matters that could affect ability to sell electricity, retroactive changes in concessions, and changes in tariff and subsidies schemes.		

Innovative business models / markets	Banks usually assign a very high-risk to unproven business models or new markets	Local investors are very conservative. This could differ from international investors with more experience in other markets.	Eager to take risks, however they might need technical or legal assistance for creating new models and accessing international markets
Later-stage development risks			
Macroeconomic risks affecting project financing (interest rate, currency)	Are more used to using guarantee and hedging schemes to partially mitigate currency risks and are more familiar with portfolio risk management.	Local equity investors are more familiar with macroeconomic risks. However, this could be a struggle for international investors.	DevCo's struggle to mitigate macroeconomic risks, especially smaller companies that would require complex guarantee schemes
Commercial/Off-taker risks	Depending on the credit rating of the off-taker, banks and investors can either be very confident or very concerned about off-takers. Usually hedged with real guarantees.		DevCo's can't usually absorb off-taker risks, and usually rely on investors' assessment.
Licensing and permitting	These stakeholders are usually unfamiliar with project development activities and assign a high risk for concession and permits issuance, especially from the public sector.		Are more familiar with permitting processes, but it usually involves public offices which still poses considerable risk.
Construction/Operation risks			
Construction risk / Technology performance	Due to the limited internal track-record and expertise in technical matters of technologies, financial sector usually overstates construction/ operational risks.	As equity investors are not generally familiar with asset operations, they follow the risk assessment from banks, and outsource operations to DevCo's.	DevCo's usually have expertise in building and operating renewable energy projects and are willing to take operational and performance risks.
Loan/capital repayment risks	Technology risks and low track-record of operators make banks very concerned about the capacity of loan repayment, which increases financial costs.	Are usually more eager to take risks than financial institutions, especially with long-term contracts.	Trusting in their designs and technology, DevCo's are confident about the capacity of the project to repay loans.

Likelihood of perceived risk: High Moderate Low

4.2. A risk-averse banking sector with limited innovation in financial products

In the 12 surveyed countries, the financial sector has historically been risk-averse in terms of product offerings and financing processes. Following the needs of the market, and owing to their risk profile, **financial institutions have a longer history in traditional consumer and retail banking than in project finance or infrastructure finance.** Especially, private commercial banks that have been focusing on traditional consumer loans and mortgages for the past decades.

Commercial banks in the region are almost entirely dedicated to retail banking, with a proven and smooth risk assessment in place, and commercial strategies that prioritize relationships and cross-selling with established customers. The growth of consumption and the increase of the purchase capacity in the middle class during the past decades, allowed commercial banks to grow their business without the need to innovate and create novel product offerings or adding complex financing structures.

The limited interest in developing infrastructure finance products by private banks has limited the availability of debt in the region and has constituted a real barrier to finance projects and pipelines in the clean energy sector.

Table 10. Three most common type of financing structures in the 12 countries and its main characteristics. Source: Elaborated by the author based on information from interviewees.

Type of financing	Description	Tenor	Guarantees
Retail banking; corporate lending	Traditional financing, for individuals and companies	<5 years	Personal guarantees, on-balance sheet guarantees
Real estate financing	Longer-term financing used primarily to finance real estate assets.	15+ years	Mortgage (real guarantee from the underlying asset), other personal guarantees
Project finance	Utilized to finance long-term, capital-intensive projects	Between 7 and 15 years	Non-recourse (no physical guarantees from the sponsor). Project income and equipment serve as guarantee.

The limited know-how and experience in managing risks in the clean energy sector is combined with limited commercial and financial incentives for banks to switch their attention to infrastructure finance, and to invest resources in creating novel products and guarantee structures to grow their business in the energy sector.

There are some positive signs regarding some commercial banks' increasing appetite for more innovative business models in renewable energy and energy efficiency. Two relevant examples[25] are the international commercial bank BBVA, and Grupo Bancolombia, a regional financial institution, two of the major players in the banking sector in the region. These two groups are creating similar products that suit the needs of these projects, including a 7 to 10-year tenure loan for renewable energy projects, which is still very uncommon for commercial banking in the region (which usually have products up to 5-year tenure).

Other financial groups such as Davivienda are making efforts to incorporate technical expertise to their risk assessment teams, which will allow them not only to analyze and assess clean energy projects, but also to iterate and improve product offerings in following years. Grace periods for construction and the inclusion of insurance products are some of the improvements that would have to be made in current offerings in order to accelerate its adoption.

On the energy efficiency front, Colombia is a country with comparatively more financing mechanisms available: "green" mortgages with lower interest rates for energy efficient buildings; credit lines specifically designed for energy services agreements (pay-for-performance contracts); vendor credit and leasing for energy efficiency equipment for the residential, commercial, and industrial sectors, are novel financing models which are slowly taking the stage in the region, making a proof-of-concept for other countries [RISE web].

More recently, the possibility to issue ESG-linked securities (green, social, and sustainable bonds) are pushing this appetite further, as these instruments are seen as an alternative to attract low-cost capital, and therefore increase financial institutions' lending base and expand their business.

However, such initiatives do not suffice to meet the vast investment needs in the renewable energy and emergency efficiency sectors in the 12 analyzed countries and limited investment-ready projects continue to hinder the upscaling of such innovative approaches.

In this landscape, with limited innovation in financial products and guarantee structures, larger development companies, such as multinational energy corporations and utility companies, are better prepared to execute clean energy pipelines. These companies usually have better access to low-cost capital, expect lower project margins, and are therefore more competitive in more traditional markets.

Therefore, larger DevCos tend to focus their efforts on mainstream, mature markets, outcompeting smaller ones. As smaller project development companies usually need higher returns in order to compensate their higher capital costs, they have to make efforts to explore novel business models, especially on smaller scale projects. As a result, distributed generation (smaller and self-generation projects) and energy efficiency projects become a natural market for smaller developers. Many smaller DevCos, like Enertiva in Central America (Honduras, Costa Rica, El Salvador, and Guatemala), started their project development activities in the large- and utility-scale development market. Once the market became more mature, larger companies started entering the market, and Enertiva consequentially shifted from large-scale to distributed generation projects, in search of maintaining margins and market share.

25. Information gathered from interviews with development companies and financial institutions.

For smaller developers, project development cycles are usually limited to their own financial resources and human capabilities. This creates a drawback in contrast to large companies that have the resources to develop projects more quickly, and even to carry out acquisitions and mergers with local companies to capitalize on them.

Specifically for energy efficiency projects, one of the main barriers that developers are facing in order to increase availability of financing is the monetization model, which is different and more complex than other types of projects. Securing loan repayment for energy efficiency is a particularly challenging topic, because generally, the return of investment takes the shape of "avoided electricity costs", and are therefore not able to be identified and channeled for loan repayments (and secured). Accordingly, development companies, investors and financial institutions are working on the creation of innovative ways to secure project repayment through leasing, indirect financing (that is, financing projects through developers, which can absorb part of the repayment risks in exchange for selling the equipment), and other types of guarantees.

Table 11. Financial mechanisms currently utilized to finance energy efficiency programs and projects. Source: Adapted from World Bank.

Financial mechanisms for mature markets, with access to commercial financing	Financial mechanisms for lower market maturity, with presence of public financing
Energy services companies, project financing (ESCO's)	Grants
Equipment leasing and vendor credit lines	Concessional financing and blended finance (grants + co-financing)
Traditional commercial financing	Energy efficiency revolving funds
Partial risk guarantees for EE projects	Utility (on-bill) financing
Credit lines with development banks	Public companies, centralized ESCO's

Smaller, local DevCo's usually have the technical expertise and the commercial reach to develop early-stage projects, however they lack funding from traditional financial institutions to continue key activities in making projects bankable, especially legal, financial, and commercial activities to reach out to off-takers and sign Corporate PPAs. Moreover, companies that work in smaller markets usually oversee the difficult task of creating new markets and business models.

For this, the engagement of both public and private sector banking is key. Providing the financial sector with technical assistance and understanding these kinds of projects and their associated risks, as well as the awareness of the benefits of these projects, can help with increasing the appetite for new product offerings.

Consumer and retail banking still has room to grow in the region, owing to the projected increase in consumption from a growing middle class and expected improvements in living conditions, combined with a risk-averse private banking sector. Therefore, there is a need to **make larger-scale infrastructure financing available to local and regional players instead of global companies in order to fill the gap between capital needs and the current quasi monopoly of global players in product offering.**

4.3. National and sub-national development banks have historically financed state-owned companies and priorities set by the public sector

On the other hand, local development banks (LDBs), which are mostly state-owned, have historically been in charge of financing most infrastructure projects in the region. Usually, most of the local development banks in the region have a long history in financing projects led by the national government, and have therefore been focused on financing the public sector or state-owned companies.

Particularly in the energy sector, public sources of financing (public banks, national treasury) **were in charge of financing the vast majority of infrastructure projects in the region:** generation facilities, transmission and distribution lines were owned by national and subnational governments, and therefore **private financing was not typically utilized in the execution of these kinds of projects.**

According to interviews conducted, existing private sector-led projects funded by national development banks were historically focused in other areas, such as real estate, agriculture, and SMEs development, where low-cost financing is also needed to promote social and economic development projects.

Currently, there is a need for further engagement of LDBs in the clean energy sector to increase the availability of financing alternatives for private sector projects. As described in the following chapter, some LDBs in the region are taking the lead and establishing innovative credit lines for private renewable energy and efficiency projects, such as BICE in Argentina, and BANHPROVI in Honduras. However, the potential of LDBs in providing products with enabling financial conditions, such as longer tenure, lower interest rates, and grace periods, is key in providing SMEs, smaller development companies and investors with access to financing.

4.4. The early-stage financing gap in renewable energy and energy efficiency

As project and pipeline development companies perform different activities to de-risk projects and remove background barriers, the project is increasingly more prepared for investment and financing. During the project origination phase and early-stages of

development, which are lower-cost and higher risk, DevCos are usually the ones who invest resources to internally finance these activities with their own funds, sometimes with the help of venture capital funds, angel investors or grants.

As the project moves on, later-stage activities, such as legal and financial due diligence, full project technical documentation, and concessions and permits, require more capital, but projects are not yet prepared for financing. As investors and financiers seek larger, ready-to-invest opportunities, this creates an evident gap and can stop or severely delay project development.

Even if financing activities for clean energy projects have been more active in recent years, they have been mostly focused on construction finance. Financing earlier-stage projects is still a challenge for development companies.

According to research and interviews conducted, most of the available credit lines for clean energy and energy efficiency projects do not include early-stage activities, such as design and pre-feasibility studies, which often need to be concluded before the disbursement of the credit, as these studies are usually used by financial institutions for risk assessment activities.

Some construction financing programs include a small percentage of the loan for pre-financing activities, however the disbursement of this allocation comes after the financing is closed, leading to the same financial burden faced by developers. Developers have to invest in high-risk activities by themselves and with their own funds, and sometimes with traditional sources of funding, such as working capital funding, which is usually short-term and at high-interest rates in most countries.

Specific financial products for early-stage project development activities have not been found, with the exception of limited grants and technical assistance programs from multilateral institutions. The absence of early-stage financing is, according to the interviews conducted in the region, the main limitation for their growth.

The limited financial support for the design and pre-feasibility stage of clean energy projects is even more evident with smaller projects, such as distributed generation and energy efficiency. In smaller-scale projects, the early-stage development efforts represent a higher percentage of the total CAPEX compared to large-scale generation, making soft costs more relevant in a financial deal, and increasing perceived risks.

Distributed renewable generation and energy efficiency projects usually present low replicability and more technical complexity than larger-scale projects – every project has its own particularities. This characteristic has often made this subsector less appealing for investors, and especially for financial institutions, as they have to conduct risk assessment for smaller projects and therefore, transaction costs per unit of resource deployed increase significantly.

Furthermore, as development and multilateral banks seek higher-ticket projects, smaller project financing is channeled through commercial and local development banks, which in most cases offer less convenient financing conditions, and are less prepared to analyze technically complex projects.

Several DevCos are working in this sector using their own technical and financial resources to develop smaller-scale projects.

The effect of this early-stage financing gap is that **small development companies and investment funds, especially SMEs, are often poorly funded and, when possible, invest their own limited resources to develop new markets and create new business models.** High costs of technical pre-feasibility studies and energy efficiency assessments, for example, are identified barriers to increase DevCos activities in this sector.

Such limited resources reduce the speed of pipeline development as well as their quality, even if some DevCos possess the adequate technical expertise to scale-up.

At the regional level, **many credit lines specifically targeted to finance clean energy projects are not fully implemented or present a low rate of disbursement, due to limited projects that meet financing criteria,** which is often stricter than traditional credit lines (from local development banks). According to interviewed stakeholders, these credit lines from multilaterals are often very specific in their project scopes, have expensive precedent conditions to meet for the developers (such as environmental and social plans, feasibility studies and financial assessments from international consultants, among others), and complex and time demanding processes.

These factors discourage developers, especially smaller-scale ones, from accessing these credit lines. Moreover, in order to make first-tier banks more comfortable, these credit lines end up requiring guarantees and collaterals that do not match with the end objective of the credit line - to boost and foster the development of early-stage markets.

According to interviews conducted with various DFIs, they are generally aware that in order to increase the availability of projects that meet criteria, more efforts on earlier stages of the projects have to be made.

Many countries receive technical assistance packages from development institutions, especially for the renewable energy sector, however they are more focused on regulatory frameworks than in concrete pipelines and projects.

During in-country interviews, different TA packages have been identified for strengthening regulatory frameworks and develop sectorial strategic assessments in the public sector in Costa Rica, Honduras, Panamá, Argentina, Bolivia, Colombia, Ecuador and Paraguay. The IADB is the main provider of technical assistance in the region, which can be attached to a sovereign credit line. Additionally, other DFIs also offer TA programs for the public sector for special technologies or sectors of interests, such as Iceland's Ministry of Foreign Affair's technical program for geothermal energy in El Salvador.

Nevertheless, if available, most of these programs are focused on strengthening national institutional capacity, supporting sustainable agendas, decarbonization roads or national programs, and are not directly targeted to advance pilot or early-stage projects. As result of the research conducted, **only a few alternatives for TA exist in the Latin America region in the financial and development sectors.**

4.5. Summary of financial barriers for clean energy in Latin America

Figure10. Summary of main market and financial barriers found in LATAM region.

Limited expertise and risk assessment capabilities in the financing sector

- New, complex risk assessment needed for new technologies, business models, and systems in the clean energy space.
- Limited track record from financial institutions in infrastructure financing for private projects.
- Banks focused on quality of sponsors, rather than in quality of projects.
- Sub-optimal risk allocation between banks, equity investors, and development companies.

Traditional banking sector, lacking innovation in financial products

- Most financing institutions focused on traditional markets, such as consumer finance.
- Limited incentives from commercial banks to migrate to infrastructure financing.
- Limited innovative financial offerings or guarantee structures focused on clean energy projects.
- Local development banks have historically financed state-owned companies and priorities set by the public sector.

Early-stage financing gap is preventing more projects to reach bankability in the region

- Limited financial support for design phase and pre-feasibility studies.
- Current offerings are focused on construction finance.
- DFI financing has difficulties to achieve precedent conditions.
- Technical assistance focused on regulatory frameworks, with few alternatives for the financial and development sectors.

5. Recent initiatives and gaps in financing innovation

5.1. Innovative business models for clean energy financing by developers

Despite barriers, the clean energy market in the 12 surveyed countries has been exploring newer or less common business models mainly to mitigate the absence of the traditionally used public tool to finance and deploy renewable energy projects; large scale public tenders to award PPAs. In such a business case, off-takers (electricity buyers) from a traditional PPA would be the national system operator, utility companies, or state-owned energy companies, and would often be backed by the national government via a guarantee, resulting in reduced risks. However, most of the 12 governments have stopped resorting to this business model and no new large scale PPA is planned in the near future.

As a result, **companies are developing more innovative ways to enter the renewable energy space, especially for medium and small-scale renewable energy generation.** The main innovations in these models are the ownership structure, in which a third-party can develop, own, and finance an asset providing energy to an off-taker, and the repayment structure. These new business models come with new challenges which, if not adequately addressed, may impede their development and potential impact.

Examples of more innovative business models found in the surveyed countries are:

- **Corporate Power Purchasing Agreement (Corporate PPAs):** Corporate PPAs, which are PPAs signed by an independent power producer (IPP) and an off-taker, which is usually a large private consumer. Due to the high demand from private companies to comply with corporate decarbonization mandates, and to become independent from the national electricity system, Corporate PPAs, a business model, has been growing exponentially worldwide, and also in the surveyed countries. This business model is, however, more complex and has additional risks which have to be overcome by DevCos in order to reach project bankability. Credit history of the off-taker, guarantees provided by technology suppliers, and independent renewable energy resource assessments become important to mitigate risks.
- **Energy Services Companies (or ESCOs):** A service or development company that provides energy services to end consumers including the design, procurement and installation, and operation and maintenance of equipment, while their revenue is directly tied with energy produced or energy savings achievements. Additionally, ESCOs usually provide or arrange financing mechanisms, with their own equity or with third parties (financial institutions). In the energy efficiency space, project financing is particularly complex, largely owing to monetization models and the technical complexity and limited standardization of projects. Creating innovative business models such as ESCOs will be key to secure financing and catalyzing investments in the sector
- **Solar PV rental:** A development company that owns the distributed generation equipment that gets installed to provide renewable electricity to a final consumer, in exchange for a fixed amount associated with the capital costs, which is usually lower than the cost of electricity consumption.

- **Leasing:** A developer that finances the cost of purchasing and installing the generation system to a final consumer, usually with no upfront expenses, in exchange for a fixed monthly fee. After the leasing period, usually 7 to 10 years, the consumer can keep the generation system.

Table 12: Financing structures for distributed clean power Source: IEA 2021.

Ownership structure	Consumer payment options	Financing options
Consumer	Direct purchase by consumer	Balance sheet Loans from banks
Third-party developer	Rooftop rental Equipment leasing PPA/shared savings contract	Developer equity/debt Loans from banks Refinancing
Utility/community	PPA with utility Solar or green tariff	Regulated rate of return Green bonds

Local developers, previously focused on large scale projects, such as Enertiva (that operates in Honduras, El Salvador, Guatemala, and Costa Rica) are trying to enter or have already entered the distributed generation market seeking for better margins and less competition from large energy corporations. **The switch from developers to focus on the development of new business models, including smaller-scale projects, is a common tendency in the region. Developers with high technical and business skills are entering previously unattractive markets due to project scale and complexity.**

These business models, in which a private company owns several generation facilities in third-party locations, potentially allows **for aggregate small-size projects to be financed as portfolios of projects. This project aggregation model unlocks several benefits to the developer** reducing the risk perceived by financial institutions, thus improving financial conditions.

In the off-grid sector, in which rural populations normally have low purchasing power and lack financing guarantees, DevCos are innovating and creating new business models to deploy renewable energy projects. Even if the public sector continues to be the largest financier for off-grid renewables in lower-income communities, within countries such as Guatemala and Colombia, the Kingo Company offers prepaid distributed renewable energy to off-grid consumers thanks to the collaboration of key investors such as IDB, Engie, FMO and Proparco.[26]

26. Information obtained from interviews with relevant stakeholders in the region.

CASE STUDY: ERCO Energy (Colombia)

Innovating in renewable energy business models and financing structures to improve access to distributed generation for SME's (Leasing) (https://www.ercoenergia.com.co/)

- ERCO Energía is a Colombian startup company, which started in 2011 with the initiative of two university students with a vision: by 2025, the distributed energy resources (DER) market would revolutionize the energy landscape in Colombia and the region. Starting as a solar rooftop installer, today is an end-to-end distributed generation company, with more than 170 employees, more than 1,900 projects implemented, and expanding its presence to the USA and Panama.
- ERCO Energía, initially funded with own resources of the co-founders, has built a reputation as good and reliable technology providers which started in Antioquia region but scaled to the rest of the country. They submitted their business plan to a corporate venture acceleration program from EPM, one of the largest utility companies in the country, which injected capital and provided technical assistance to scale-up the company at national level. With that capital, ERCO built their first innovative business model, which consisted in financing small-scale solar rooftops with leasing, and signing PPA's with commercial and industrial consumers, which was a novel way to structure distributed energy financing.
- Because of the quick scale-up, ERCO Energía has become one of the top distributed solar operators in the country, and is still innovating in more complex business models, such as community solar, which could exponentially increase their total addressable market. ERCO is close to closing their A-round with a PE fund from the US.

However while third-party ownership has grown in some markets, **local developers are often undercapitalized, rely on high degrees of costly equity and do not possess the required resources to develop investment-ready projects.** Third-party ownership is also often hampered by local regulations regarding ownership and market access [IEA 2021].

Increasing third-party ownership could help unlock investment, and the potential to aggregate projects into larger transaction sizes, through securitization**, could also help improve off-balance sheet and debt financing options, as well as the ability to refinance portfolios to free up capital for reinvestment** [IEA 2021]. **These models need large amounts of capital, both equity and debt, in charge of development companies, IPPs and other structures.** This innovative approach to financing infrastructure is giving the opportunity to private investors to enter infrastructure markets in LATAM, that were historically dominated by the public sector.

Currently, the infrastructure-as-a-service model is gaining traction around the world and is expected to grow in order to build the infrastructure needed to decarbonize the energy sector. This **constitutes an opportunity for both public sectors (which will have more resources to invest in other sectors such as education and health), and for the private sector**, increasing the total addressable market reaching sectors that previously could not enter.

CASE STUDY: GoSolar (Costa Rica)

Innovating in renewable energy business models and financing structures to improve access to distributed generation for SME's (https://www.gosolar.co.cr/)

- GoSolar is a Costa Rican company, founded by a Wall Street veteran and a local partner, which is currently dedicated to the design, financing, installation and operation of solar projects. This company started in 2013 when the only financing options available were traditional banks, that did not allow maximizing savings for customers in Costa Rica. The company grew slowly but steady for the first years, and the first projects were funded by the founders with their own capital, to prove the quality and reliability of the systems.
- In a one-of-a-kind partnership, GoSolar got a direct credit line from DFC - US Development Finance Corporation in 2015, to be able to provide 10-year, no-upfront-capital financing to their customers. This partnership was one of the first direct credit lines to private companies for DFC, which usually channel their financing options through first-tier commercial or development banks.
- In 2021, GoSolar is responsible for the development of 35% of the distributed generation solar project market in Costa Rica. The financing model used gained a lot of traction from commercial and industrial end users, which could benefit from energy savings from day one, as the loan payment is (by market strategy) smaller than the energy bill.
- According to GoSolar executives, "International organizations and multilateral corporations have to change their financing model and provide direct loans to project development companies directly. These companies end up implementing more projects, at lower costs and with lower risks, and faster than traditional banks. They can act as project aggregators and select the best projects, decreasing risk perception from banks"
- GoSolar has partnered with the WRB SERRA fund in a second round of financing. Currently, GoSolar is working on finalizing the first 20MW of distributed generation projects (more than 230) in Costa Rica and is seeking investors and technical assistance to expand their business to other target countries in the region, such as Panamá and Colombia.

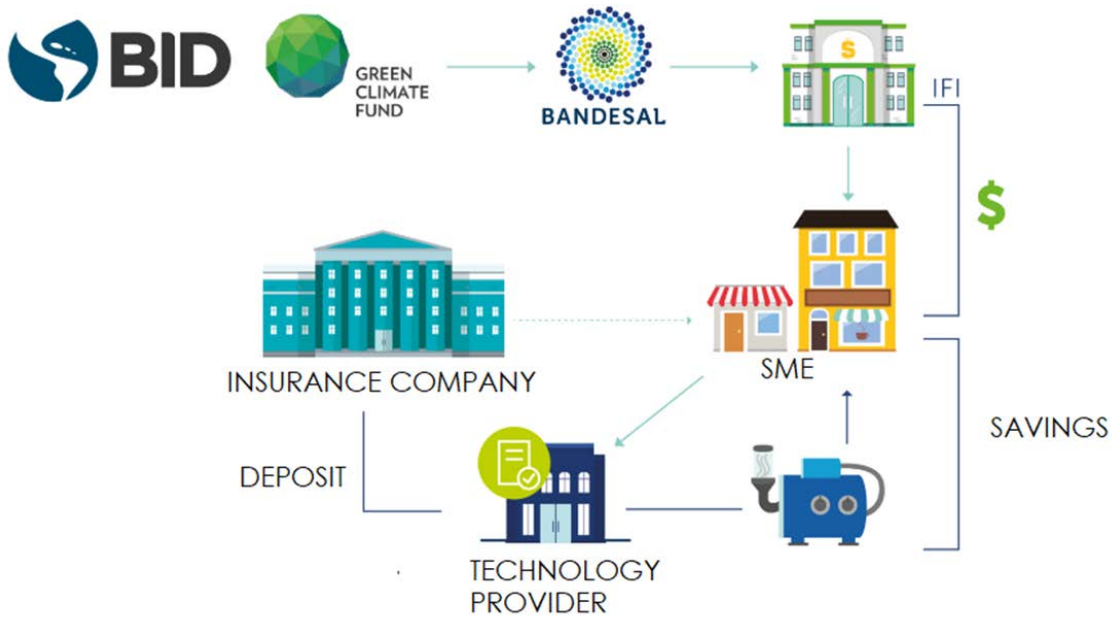
5.2. Guarantees and insurance products

Loan guarantees can also be another important innovative tool to help overcome the financial gaps in the 12 surveyed countries, by mitigating some of the most important perceived risks from financiers and investors, such as completion risks and off-taker liquidity risks. Dedicated insurance products and loan guarantees especially dedicated to mitigating risks for clean energy projects presents an attractive business opportunity for insurance companies and financial institutions in the 12 analyzed countries. Nevertheless, no private initiative for insurance or guarantee offerings has been identified in the 12 sample countries, highlighting the potential for innovation.

Development banks traditionally took up this role and have been very important to structure proven and successful loan guarantees and insurance products in the clean energy space. A good example of such an initiative is in El Salvador, where a credit line was launched in 2020 by BANDESAL (local development bank), supported by the IDB and the GCF to fund technological renovation of capital equipment in SMEs. To participate in the financing program, sponsors (SMEs) had to choose the Energy Savings Insurance (ESI) model. The ESI model focuses on developing an innovative scheme of guaranteed energy performance that mitigates project risk and generates investor confidence. The ESI Model includes a contract for the supply, installation, and maintenance of equipment for generating a stipulated amount of energy or energy savings over a specific time period; validation by an independent body; insurance coverage that backs the savings or the guaranteed energy generation; and project financing by IDB and BANDESAL.

Intermediary Financial Institutions (IFIs) and SMEs that accessed financing from the Program were able to enjoy the benefits of the technical cooperation projects executed by BANDESAL and the IDB.

Figure 11: ESI model [BANDESAL ENERGY EFFICIENCY LINE FOR SMES]



The IDB also structured a similar program in Colombia, with BANCOLDEX, the local development bank, and Seguros SURA, which is a renowned insurance company active in the LATAM region. The insurance program, called "Seguro de cumplimiento de eficiencia energética" (as energy efficiency accomplishment insurance) has provided Colombian SMEs the ability to guarantee the energy savings provided by DevCos. The program included project technical assessment and a standard purchasing and financing format.[27]

CASE STUDY: CANATURH (Honduras)

Example of a sectorial corporate chamber willing to make efforts to scale-up renewable energy and energy efficiency deployment (https://canaturh.org/)

- CANATURH is the chamber that aggregates private sector companies in the tourism sector in Honduras, including travel agencies, restaurants, hotels, airport services, transportation, exhibition centers, and tourist attraction centers, among others. It has more than 130 active members and is an active participant of national and regional private sector chambers related to investments in the tourism sector, which is one of the largest sectors in Central America.
- CANATURH has been a pioneer in many initiatives in the energy sector, including good practices in energy consumption, adaptation to climate change, and the incorporation of clean energy for their members. It has been executor of several technical assistance programs with international organizations such as IDB, USAID and UNDP. According to CANATURH, "the tourism sector has both a need and an opportunity in the clean energy sector, to mitigate electricity and water supply risks, and to align with sustainable practices in tourism and to propel Honduras as a preferred destination for tourist seeking this kind of experience".
- The "energy efficiency project for the tourism sector" funded by UNDP, has allowed several companies to perform energy efficiency audits and generate investment plans to decrease consumption and incorporate distributed renewable energy. However, from 30 audits only 4 companies implemented their plans, mainly with their own resources. Access to financing was a struggle for these companies, that were not able to find accessible products for their initiatives (high interest rates, guarantees such as mortgages were unacceptable). Also, a limited trust from technology providers was a barrier, which according to them might be mitigated through a "preferred vendor" vetting system from these trusted institutions.
- To improve access to financing to their members, CANATURH created a cooperative bank to provide guarantees and funding necessary. Currently, they could not find a partner to provide adequate concessional financing yet to scale-up the program. They identified a misalignment between technical assistance and financing programs to continue developing the clean energy projects for the sector.

27. According to interview with BANCOLDEX.

5.3. The levier of blended finance

The role of central banks and national development banks has been historically important to finance infrastructure projects in the region. National budgets for infrastructure financing, however, have been decreasing due to limited budget resources in the past few years, mainly due to the increase of indebtedness ratios in most Latin-American countries, and also for the need of national governments to respond to other more pressing needs, such as the health and social assistance sectors.

Multilateral development finance institutions (DFIs) are playing a very important and unique role in Latin America, financing national government clean infrastructure projects and private renewable energy and energy efficiency projects through national and local development banks. In the context of limited capital flows into the renewable energy sector in developing regions, the international community has been making efforts to innovate and create novel financing models that could bridge the funding gap to achieve the Sustainable Development Goals (SDGs).

Regional DFIs such as the Inter-American Development Bank (IADB) and the Central American Bank for Economic Integration (CABEI), and global DFIs including the World Bank (WB), KfW Development Bank, PROPARCO, the Dutch Entrepreneurial Development Bank (FMO) and International Finance Corporation (IFC) account for the bulk of the financial instruments deployed in financing energy projects in Latin America. This occurs in coordination with national DFIs such as BICE in Argentina, BANDESAL in El Salvador, BANHPROVI in Honduras, among others, who have also been important in providing funding for the energy transition in the region.

A relevant and successful example of a DFI-backed credit line is the loan for Green SMEs supported by CABEI, KfW and the EU, which is currently available in most Central American countries, and has a technical assistance component. The particularity of this program is that part of the TA package was directed to project sponsors to help make projects bankable, and another part was directed to intermediary financial institutions (usually a local development or commercial bank) to strengthen their capabilities in this type of financing. CABEI's management team in Central America mentioned that, during the execution of the program, they realized that most of the projects lacked a more robust technical pre-feasibility study and identified a need for assistance in the project design, and therefore they adapted the program to fit the needs of the projects. According to CABEI, this measure resulted in being a determinant for the success of the credit line.

As one of the most utilized financial structures combining public and private sector capital, **blended finance has gained importance to scale-up investments in renewable energy and energy efficiency in the LATAM region.** By improving the risk-return profiles of investments without distorting functioning markets, blended finance has been incentivizing private capital in emerging and frontier markets, while DFIs are successful in directing capital flows towards projects that help DFIs to reach particular goals and development metrics [International Development Finance Club [IDFC] 2019].

Table 13. Blended finance tools relevant for overcoming typical barriers in the LATAM region. Source: Adapted from IDFC 2019.

Instrument	Type	Description	Risks/barriers addressed
Direct debt or equity investment	Catalytic capital / First-loss funding	Capital used for demonstration, that will suffer the first economic loss of the project, and catalyzes investment in market conditions.	By improving risk-return profile, can catalyze the participation of more risk-averse investors.
Guarantees	Loan guarantees	Provides an extra layer of protection for investors (against capital losses or performance).	Off-taker risks, completion risks, credit risk, etc.
Insurance	Political risk insurance / business insurance	The insurance provider promises to provide financial compensation in the instance of an event that results in a financial loss.	Political risks, macroeconomic risks, completion risks, operation risks, etc.
Hedging	FX and currency hedges/swaps	Contractual instruments to help manage currency risks faced by an investor or borrower.	Foreign Exchange risks.
Securitization	Asset pooling	Process of transforming a pool of illiquid assets into tradable financial instruments (securities).	Scale and time horizon risks, off-taker risks, credit risks.
Grants	Technical assistance (TA) for project preparation	Non-reimbursable portion of the agreement, to contribute to capacity building.	Access to capital, capacity development, transaction costs, etc.

Colombia is one of the most promising markets for the implementation of an innovative business model for PPA contracting, especially corporate PPAs. However, **in order to help developers finance the first demonstration projects, a blended finance initiative was utilized by Matrix Renewables, a Spanish project development company, to finance the "Solar de los Llanos 3" project,** with a total capacity of 82MWp**, in one of the first project entirely financed for Corporate PPA's.** The total financing was 24.5M USD, with an 8.4M USD subordinated loan from Climate Investment Funds (CIF).

Blended finance was also very important to design innovative loan guarantees in the clean energy sector. For example, a 50M USD blended finance mechanism has been under implementation in Ecuador since 2021, where C2F (Canada's Climate Fund) has provided 10M USD in credit guarantees to Produbanco, one of the largest private commercial banks in the country, to support projects in the low-carbon and climate resiliency markets. The guarantee backed Produbanco's issuance of a sustainable bond (50M USD), which included implementation technical assistance from IDB Invest, and technical assistance for verification from Sustainalytics.

As an example of political risk insurance backed by DFIs, the FODER trust in Argentina can be highlighted. Funded by the World Bank, it helped improve financial conditions for the RenovAr program in the context of a high-risk environment. The structure of the FODER trust was a mixed fund, including both payment guarantees and political risks insurance. These guarantee structures were based on mitigating macroeconomic risks, through a fund that is structured in a way to partially or totally cover the payments from public sector off-takers, as well as some events of expropriation and changes of background regulations that could affect the ability of the project to repay the loan. In the case of FODER, it covered a 6-month payment, if the payment delays exceeded 90 days, and established a put option to sell the project to the fund at a pre-established price.

DFIs are therefore very important to help overcome risk and risk perception from commercial banks, investors, and other participants in the clean energy market in the region. Through innovative financing mechanisms, DFIs are paving the way for new business and financing models in the region.

5.4. Current mechanisms and gaps

There have been different mechanisms and programs led by development finance institutions that have been trying to de-risk RE and EE investments and projects, from earlier stages to later stages (including construction stage), with different levels of success. These interventions have been implemented with different goals, providing a variety of tools such as technical assistance, non-reimbursable capital (grants), reimbursable capital (debt, equity), etc.

This section presents identified relevant programs that have been or are currently involved in the de-risking of renewable energy or energy efficiency projects in the region, focusing on different stages of the projects (early or later-stage), different technologies (wind, solar, energy efficiency, low-carbon energy), and end users (SMEs, gender focus, etc.).

Technical Assistance | Concessional loans / Grants | Guarantees

Program	DFI	Debt / Equity provision	Subcategory
Green Retrofit Marketplace ***2020 (ongoing)*** Connects technology providers, banks, and end users in order to promote energy efficiency. It aims to overcome the limited awareness of the benefits of efficient technologies informing end users about available technologies, tentative savings, and financing mechanisms. *Honduras, Costa Rica, Guatemala, El salvador*	UNDP	-	EE
Green Finance LAC Platform (GFL) ***2016 (ongoing)*** Developed for National Development Banks, financial institutions of the private sector and players of the financial market for sharing information and knowledge about green financing. *Argentina, Colombia, El Salvador, Paraguay, Perú*	IADB	-	RE, EE, Storage
CEFF-CCA ***2016-2017*** The Clean Energy Finance Facility for the Caribbean and Central America was available to investors and project developers and sponsors from public and private sectors interested in early planning support to structure bankable opportunities for financing or insurance in clean energy projects. *Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panamá*	US government	-	RE
CAREC Operated by Energy Through Enterprise. Finances the execution of the projects, the construction phase, and the equipment purchase. Does not finance initial development stages. *Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua*	Energy Through Enterprise	Debt	RE, EE

Technical Assistance Concessional loans / Grants Guarantees

Program	DFI	Debt / Equity provision	Subcategory
Renewable Energy Integration Program (REI) ***Since 2021*** REI program aims to increase the flexibility of energy systems to enable the smooth integration of higher shares of intermittent renewable energy generation into developing and emerging countries' energy mix, through consulting and project funding.	CIF	-	RE, EE, Storage
Scaling Up Renewable Energy Program in Low Income Countries (SREP) Supports investments for renewable energy or energy efficiency projects in low-income countries. Both private and public companies can access to Grants and Concessional loans. Also provides technical assistance, including support for planning and pre-investment studies, policy development, legal and regulatory reform, business development and capacity building *All analyzed countries*	CIF - operated by WB	-	RE, EE
Clean Technology Fund (CTF) The CTF is empowering transformation in developing countries by providing resources to scale up low carbon technologies (renewable energy, energy efficiency, and clean transport). It works with 5 multilateral development banks, and provides loans, grants, guarantees, equity, and local currency financing at reduced market rates to reduce risks and attract investments. *All analyzed countries*	CIF - Operated by WB – Donors: Australia, France, Germany, Japan. Spain, United Kindom, Unated States, Sweden	Debt	RE, EE, clean transport
AFD ***Since 2016*** Provides grants to assist countries in their economic and infrastructure development projects, with an emphasis on sustainability project objectives. Developing different initiatives for the public sector in Bolivia and Argentina. *Bolivia, Argentina*	AFD	-	RE

Technical Assistance | Concessional loans / Grants | Guarantees

Program	DFI	Debt / Equity provision	Subcategory
JICA ***Since 2017*** Official development assistance grants and loans, and technical assistance. Worked in different projects in Bolivia, Costa Rica, Paraguay, among others. *All analyzed countries*	JICA	Debt	RE, EE
GEEREF NeXt 2017-2020 ***2017-2020*** Catalyzing private sector investment for renewable energy and energy efficiency projects across the developing world. Operates either indirectly via specialized funds, or directly via investments into the beneficiary projects themselves. *Costa Rica and Guatemala*	GCF - Accredited entity: EIB	Equity	RE, EE
Helping Argentina finance a major move to renewables ***2016-2019*** Catalyzing long-term private investment in sustainable energy in Argentina. The GCF investment will be provided in loans, with the option for refinancing guarantees to encourage the participation of local and international banks. *Argentina*	GCF - Accredited entity: IADB	Debt	RE
Scaling up investments by Argentinian SMEs ***Since 2018*** This project focuses on SMEs providing opportunities to promote investments in biogas, biomass and increasing energy efficiency. The project will focus on breaking down market barriers in these sectors. *Argentina*	GCF - Accredited entity: IADB	Debt	RE, EE

Technical Assistance | Concessional loans / Grants | Guarantees

Program	DFI	Debt / Equity provision	Subcategory
Global Subnational Climate Fund (SnCF Global) ***2020 – On going*** The Fund is designed to overcome project-level barriers and limitations in attracting private investment that leads to chronic underfunding of bankable mitigation and adaptation projects at the sub-national level *Panamá, Costa Rica, El Salvador, Guatemala, Honduras and Ecuador*	GCF - Accredited entity: CAF	Equity/ Debt	Mitigation and adaptation projects
REGIO fund ***2021-On going*** Through 50 million EUR Equity Investment, the REGIO fund will support the ecological transition by financing green bonds issued by private companies based in emerging countries in Africa, Asia and Latin America. *Colombia and Perú*	PROPARCO	Equity	RE, EE
Green SME initiative ***2016-On going*** MIPYMES Verdes. For projects that aim to reduce SME energy consumption by 15%, and/or renewable energy projects with a maximum installed capacity of 5 MW. Also, a non-reimbursable loan is available for technical assistance. *Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica*.	CABEI, KfW, EU	Debt	EE, RDG
Climate Finance Accelerator (CFA) The CFA works with middle income countries by helping to identify challenges and blockages that prevent project financing and creating a pipeline of 'investment ready' low carbon projects. Colombia, Perú	UK Government		RE, EE
Climate Investor One (CIO) Early-stage development, construction financing, and refinancing to fast-track renewable energy projects in developing countries. Ecuador	GCF	Equity/ Debt	RE, EE

The analysis of current mechanisms and programs in place, as well as the interviews conducted during the project, highlight a variety of **lessons learned and needs for potential DFI interventions in the Latin America Region:**

- Many ongoing programs offer technical assistance of different sorts; however, **these TA programs are often unattached to actual needs of development and investment companies to de-risk projects and sponsors and develop capital and debt markets.** One of the main aspects of these TA programs highlighted by developers is that they are not suitable to fund and develop market proof-of-concepts or pilot projects, but instead are more focused on sectorial or market assessments. Even if these activities are helpful to frame the problem or to study possible solutions, the renewable energy and energy efficiency markets are sometimes mature markets, that would need more implementation to validate and showcase their business models and technology solutions.
- Other TA programs are often **attached to a pre-established equity or debt commitment, that many developers are not ready to commit to, due to the limited maturity of the solution or project.** This leads to many projects, especially in the early-stage, being left out of these kinds of programs due to an absence of "enough proof-of-concept" or any prior track-record.
- As mentioned before, **some of the credit lines specifically designed to advance implementation of renewable energy and energy efficiency solutions, do not offer the early-stage support needed** to reach financial closure of the projects, but instead have strict requirements that are often prohibitive for developers and investors, especially SMEs with lack resources to conduct a full due diligence for these credit lines. Concessional finance is often funneled through lower interest rates and longer tenors, which are also needed, but for different kinds of projects (projects showing less profitability due to market or limited maturity of technology). Developers in the LATAM region claim that many financial institutions have enough funding to implement the projects, but they do not involve themselves in project preparation phases due to internal limitation regarding time and resources, and therefore reject projects that suit the requirements, but are not yet prepared for financial closure.
- Only a handful of the identified programs provide **technical assistance and capital provision for guarantee programs** to back-up private sector investments. One of the main identified causes for the limited access to financing from SMEs and small development companies is the insubstantial collateral necessary to access financing programs. This barrier could be overcome with a guarantee structure facility to provide collateral to these companies, usually underserved by traditional banking.
- **Many ongoing programs focus on projects rather than sponsors and project portfolios, both for TA and for concessional funding.** An opportunity to assist developers and investors in earlier stages might include the possibility to fund or get TA from activities that are usually prior to a particular project development; this is, market assessments, business model preparation, sectorial assessments, legal and marketing efforts, financial support for project preparation. Especially in the LATAM region, there exists a multitude of companies that are constrained in an earlier stage of pipeline preparation, and do not receive enough attention or support from financing institutions and large investment funds to reach full potential of their development skills.

6. Proposed interventions to close the gap in clean energy investments

In the context of a saturating grid, limited interconnections and low levels of energy efficiency, sectors such as distributed generation, mini-grid, energy efficiency and storage are becoming increasingly critical. Investments in these sectors are critical for commercial players, especially SMEs, as international energy companies focus on large scale renewables and local funds/developers struggle with high transaction costs and risks. Despite ongoing initiatives, local funds/developers lack financial and technical resources in the early stage of project development and struggle to develop a high-quality pipeline.

Investment and project development companies, according to research and the interviews attended during the study, have most appetite to understand, develop, and invest in such newer clean energy business models.

1. Provide capacity building to local private sector stakeholders on key sectors

One of the main challenges faced by local fund managers, project developers and SMEs struggle in developing project in the targeted sub-sectors relates to their technical capacity to proficiently navigate regulations, policies, technologies to ultimately identify project opportunities.

Relevant policies and regulations are recent and often lack implementation track record, while permitting and authorization procedures remain complex and lengthy. The identification of adequate business models and matching technologies for the targeted sub-sectors is another obstacle that hinders the development of such project by local private sector stakeholders.

Gathering information and intelligence about applicable regulations, policies and standards for targeted sub-sectors along with matching innovative business models, types of applicable technologies and a mapping of technology providers would result in regional fund managers, project developers' and SMEs' increased capacity to identity and develop projects in the targeted sub sectors. This also constitutes an opportunity to spawn regional peer-learning activities and to push regional private sectors stakeholders to enter new geographies and clean energy sectors across Latin America.

Local financial institutions have also often not adjusted their risk assessment framework to adequately evaluate the potential financial and environmental benefits of proposed projects in the targeted sub-sectors and have limited internal capacity to, resulting in high interested rates, short tenures and limited to no access to long term capital. Providing them with tailor-made trainings to adjust their risk assessments and develop relevant financial products for the targeted sub-sectors would unlock the provision of later stage capital.

2. Provide financial support to bridge the early-stage development gap for key sectors

The early development stage is critical in projects in targeted sub-sectors as it lays out the foundation of the project's financial and technical viability as well as the sponsor's ability to attract investors. However, local project developers and fund managers have very limited financial resources for project development and struggle to bring clean energy projects to financial close. The supply of financial products for early-stage project development activities is very limited, with the exception of limited grants and technical assistance programs from multilateral institutions. The absence of early-stage financing is, according to the interviews conducted by UNEP in the region, the main limitation for their growth. The limited financial support for the design and pre-feasibility stage of clean energy projects is even more evident with projects such as distributed generation and energy efficiency as early-stage development efforts represent a higher percentage of the total CAPEX compared to large-scale generation, making soft costs more relevant in a financial deal, and increasing perceived risks.

Providing financial resources for pipeline and project developments costs in eligible sectors would push local fund managers, project developers and enterprises into the targeted sub-sectors, reduce transaction costs as well as perceived risks and spawn the development of pipeline of bankable projects, mainstreaming a market that is now very difficult to enter. The provided financing would be covering activities including fund raising efforts, strategy development, pre-feasibility studies, environmental and social policies/ management framework, gender, financial modelling, feasibility studies, environmental and social impact assessments, amongst others. Considering the income generating objective of the undertaking, the provided financial resources would be repaid upon successful financial close of individual projects.

Supporting local investment and development companies at the portfolio level rather than project level only would facilitate the scale-up of medium and small-scale projects in renewable energy generation and energy efficiency by:

- Increasing track record of local investment and development companies in developing, financing and implementing clean energy projects.
- Increasing their ability to assess and select the "best" projects in terms of risk, profitability, technical viability, etc.
- Enhancing their ability to absorb part of the technical and financial risks of the projects, such as performance of the equipment and the system.
- Facilitating their access to financing through on balance sheet financing, pipeline level financing to lower transaction costs and allow for smaller ticket financing.

3. Leverage the diversity if policy and regulatory frameworks and market maturity across the region

The 12 surveyed countries represent a very heterogenous group in terms of market maturity for targeted sub-sectors, policies and regulations in place if any at all, access to technology providers and intelligence on relevant business models.

By providing technical and financial support to local fund managers, project developers, enterprises and financial institutions, the development and implementation of projects in targeted sub-sectors in different countries will generate valuable lessons learned, best practices and draw a portrait of what has and has not worked both from a policy and project development side.

Documenting such intelligence and bringing both regional public and private stakeholders together to enter into a dialogue would pave the way for informed replications of successful attempts and potential policy making or revisiting processes. Peer to peer learning amongst local private sector stakeholders would encourage synergies, cooperation across different geographies and sub-sectors.

Figure 12. Relationships between causes, challenges, effects, and potential interventions for creating project aggregators in the LATAM region.

Causes

- Limited attractiveness of projects in targeted sub-sectors (high transaction costs, smaller tickets, complexity of projects, limited business model validation).
- Limited access to capital and traditional financing for development companies (especially SME's) for early-stage activities, due to limited track record (balance sheets), guarantees or collateral.

Challenges

- Limited access to capital and traditional financing to invest in targeted sectors for local project developers or fund managers.
- Limited funding for early-stage project development outside main revenue streams.
- Limited technical capacity to explore new markets and develop new business models.

Effects

- Larger development companies and energy corporations end up gaining market share, due to the perception of lower risk for their projects (larger track-record, more assets in the region).
- Smaller companies are discouraged to making investments to develop new projects, and sometimes end up transferring their projects to larger companies to increase chance of success.
- Slow development of smaller-scale renewable energy and energy efficiency project portfolios.
- Limited innovation in new business and financing models for smaller-scale projects.
- Gender gap in leadership roles for SME's and investment companies.

Interventions

- Creation of a facility to increase the assistance for project aggregators, which can develop pipelines of projects in targeted sub-sectors at lower costs and faster, including:

  1. a knowledge platform to build up awareness & capacity of local developers, fund managers, SMEs, and financial institutions on distributed generation, mini-grid, energy efficiency and storage.
  2. a financial mechanism to provide repayable grants to:
     - local funds and developers to overcome financial barriers to bring distributed energy generation and storage projects to financial close.
     - SMEs to partly cover energy efficiency and mini-grid upfront costs.

Benefits

- Allow economies of scale for project financing that are adapted to targeted sub-sectors.
- Capacity of local project developers and fund managers is strengthened in targeted sub-sectors.
- The early stage development financing gap is bridged for local project developers, fund managers and SMEs.
- Catalyze private investments in targeted sub-sectors.
- Empower large enterprises and SMEs become active players in the clean energy space.
- Increase the rate of success of available climate-related credit lines, due to the increase of available high-quality project portfolios.
- Spawn peer to peer learning amongst local private sector stakeholders and encourage synergies as well as cooperation regionally.

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Annex A – List of stakeholders interviewed

Main country	Name of Institution	Type of Institution	Reference Name	Position
Regional/ Global	French Development Agency (AFD)	Development Finance Institution (DFI)	Carla Baltzer / Alexia Levesque	Project Manager (Energy) / Director of AFD in Bolivia
Regional/ Global	USAID	Development Finance Institution (DFI)	Maggie Messerschmidt	Senior Managing Consultant, Climate Resilience
Regional/ Global	ACDI/VOCA	Consultancy	Leonardo Jose Morazan Rivera	Especialista en Sistemas de Mercado
Regional/ Global	ICF Climate Center	Consultancy	Maggie Messerschmidt	Senior Managing Consultant, Climate Resilience
Regional/ Global	Electricité de France (EDF)	Global Energy Corporation	Paul Duclos / Patrick Blandin	PM EDF Perú / EVP Finance North and South America
Regional/ Global	IDB - IDB Invest	Development Finance Institution (DFI)	Alexander Vasa	Financial Institutions Senior Specialist
Regional/ Global	CIFI	Regional Financial and Investment Institution	Nicolas Giancola / Ivan Nuñez	Manager - Business Origination / Head - Portfolio management
Regional/ Global	UNEP Finance Initiative (UNEP FI)	International organization	Johan Lopez	Latin America and Caribbean Network Coordinator

Regional/ Global	UNEP United for Efficiency (UNEP U4E)	International organization	Roberto Borjabad García	Program Officer
Regional/ Global	Corporación Andina de Fomento (CAF)	Development Finance Institution (DFI)	Nicolas Mendioroz / Roman Velez	Direction of Structured Finance - Infrastructure / Director of Impact Investments
Regional/ Global	Central American Bank for Economic Integration (CABEI)	Development Finance Institution (DFI)	Astrid Ibarra	Executive Country Director Guatemala
Regional/ Global	Organización Latinoamericana de la Energía (OLADE)	International organization	Alfonso Blanco	Executive Director
Regional/ Global	KfW	Development Finance Institution (DFI)	Emiliano Detta	Deputy director
Regional/ Global	Centro Regional de Energía Renovable y Eficiencia Energética del SICA (SICREEE)	International organization	María Eugenia Salaverria	Program Officer
Argentina	National Energy Secretariat	Public sector (Energy)	Mariela Beljansky	Secretariat of Electric Energy - Director of Renewable Energies
Argentina	Undersecretary of international finance for development - Presidency	Public sector (Finance)	Leandro Gorgal / Federico Azpiroz	undersecretary / advisor
Argentina	Ministry of Economy - Secretary of International Economic and Financial Affairs	Public sector (Finance)	Maia Colodenco	Secretary of International Economic and Financial Affairs
Argentina	Agencia Argentina de Inversiones y Comercio Internacional	Public sector (Agencies)	Juan Usandivaras	CEO

Argentina	CADER - Cámara Argentina de Energías Renovables	Renewable Energy and EE Chamber	Juan Manuel Alfonsín / Martín Dapelo	President / Coordinator of Financing Group
Argentina	Banco de la Nación Argentina (BNA)	Commercial Bank	Alejandro Basile	Department Manager – Private sector
Argentina	Banco de Inversión y Comercio Exterior (BICE)	Local development bank	Santiago Griffin	Digital Banking Manager
Argentina	Zonda Capital	Private Equity / VC fund	Juan Pablo Garavaglia	General Partner
Argentina	Impactlatam	Private Equity / VC fund	Dani Tricarico	Founder-CEO
Argentina	Sumatoria Asociación Civil	Private Equity / VC fund	Matias Kelly	Founder-CEO
Argentina	Windsol Consulting	RE/EE project developer or IPP	Mariana Mayora	Engineering Director
Argentina	Luft Energía	RE/EE project developer or IPP	Doris Capurro	President
Bolivia	Ministry of Hidrocarbons and Energy - Vice-Ministry of Electricity and Alternative Energy	Public sector (Energy)	Claudio Zambrana Fernandez	General Director of Alternative Energies
Bolivia	Grupo Conectar	Private Equity / VC fund	Claudio Macello	Commercial and Marketing Manager
Bolivia	Orlando Cuellar - Oil and Gas & Renewable Energy	RE/EE project developer or IPP	Orlando Cuellar	CEO
Colombia	Ministerio de Minas y Energía	Public sector (Energy)	María Carolina Garzón Sanchez	International Affairs Group Advisor
Colombia	Presidency - National Planning Direction (DNP)	Public sector (Finance)	MARIA DEL PILAR RESTREPO ORJUELA	Climate Finance Coordinator
Colombia	Colcapital (Private Equity and VC Agency)	Public sector (Agencies)	María Andrea Villanueva	Deputy General Director
Colombia	PROCOLOMBIA (Investments and Export Agency)	Public sector (Agencies)	Natalia Saade Ortega	Senior investment advisor

Colombia	FENOGE	Public sector investment fund	Katharina Grosso Buitrago	Executive Director
Colombia	Finance in Motion	Private Equity / VC fund	Matías Gallardo	Senior Sustainable Finance Officer
Colombia	Erco Energía	RE/EE project developer or IPP	Luis Fernando Gomez	CFO
Colombia	Grenergy Renovables	RE/EE project developer or IPP	Alejandro Ospina	Country Manager Colombia
Colombia	SER Colombia	Renewable Energy and EE Chamber	Germán Corredor	President
Colombia	ACOSOL	Renewable Energy and EE Chamber	Miguel Hernandez Borrero	President
Colombia	Grupo Bancolombia	Commercial Bank	David Becerra Díaz	Leasing - Energy solutions leader
Colombia	BBVA	Commercial Bank	Andrés García	Global Client Coverage - Managing Director
Colombia	Bancoldex	Local development bank	María Fernanda Manrique Diaz	SUSTAINABLE DEVELOPMENT LEADER
Costa Rica	National Electricity Commission (CNE)	Public sector (Energy)	Francisco Gomez Buenos	Advisor to the National Energy Director
Costa Rica	Ministry of Environment and Energy	Public sector (Energy)	Francisco Gomez Bueno	Advisor to the National Energy Directorate
Costa Rica	Grupo CMI (Corporación Multi Inversiones)	Private Equity / VC fund	Sean Porter	Director of Development and New Business
Costa Rica	GoSolar	RE/EE project developer or IPP	Luis Gabriel Chaves	General Manager
Costa Rica	ICE - Instituto Costarricence de Electricidad	Public Company	Kenneth Lobo Mendez	Director of Planning and Sustainability + Director of the Regional Operator (EOR)
Costa Rica	ACESOLAR - Solar Energy Association	Renewable Energy and EE Chamber	Victor Vega	Director

Ecuador	Ministry of Energy and Non-renewable natural resources - Vice-Ministry of Electricity and Renewable Energy	Public sector (Energy)	Ing. Gabriel Arguello	Vice-Minister of Electricity and Renewable Energy
Ecuador	Ministry of Energy and Non-renewable natural resources - Direction of promotion for Energy Efficiency investments	Public sector (Energy)	Luis Enrique Manzano Villafuerte	Director of EE Project Management and Promotion
Ecuador	Direction of Investment Projects - Ministerio de Producción, Comercio Exterior, Inversiones y Pesca	Public sector (Finance)	Alfonso Alava	Director de Proyectos de Inversion
Ecuador	Undersecretary of Climate Change - Ministry of Environment and Water	Public sector (Finance)	Karina Barrera	Undersecretary of Climate Change
Ecuador	PWR Capital	Private Equity / VC fund	Rubens Romano	Infrastructure & Renewables Manager
Ecuador	Grupo GENERA	Private Equity / VC fund	Gino Pinargote Escudero	President
Ecuador	Novum Solar	RE/EE project developer or IPP	Pedro Gonzalez Orbegoso	CEO
Ecuador	Solararomo SA	RE/EE project developer or IPP	Iñigo Urizar Espinosa	General Manager
Ecuador	DeltaGlobal	RE/EE project developer or IPP	Xavier Enrique Ortiz Cabero	Senior Project Manager - Shareholder Partner
Ecuador	ELECAUSTRO (Public Company)	RE/EE project developer or IPP	Carlos Duran	Director of the Project Supervision Unit
Ecuador	CELEC (public Company)	RE/EE project developer or IPP	Marco Valencia	Director

Ecuador	Asociación Ecuatoriana de Energías Renovables y Eficiencia Energética (AEEREE)	Renewable Energy and EE Chamber	Eduardo Rosero	President
Ecuador	Banco ProCredit	Commercial Bank	Katarina Ždraljević	Head of Environmental Management Unit
Ecuador	Ecuador Development Bank (BDE)	Local development bank	Damian Ochoa / Ma. Alexandra Cabrera Cabrera / Alex Barreno	Infrastructure Manager
El Salvador	Consejo Nacional de Energía (CNE)	Public sector (Energy)	Carlos Alberto Nájera	Electricity Markets Manager
El Salvador	Direction of Renewable Resources Development - Consejo Nacional de Energía (CNE)	Public sector (Energy)	Herberth Josué Palacios	Renewable Resources Development Manager
El Salvador	Direction of Cooperation and International Affairs - Ministry of Enfironment and Natural Resources	Public sector (Finance)	Mayra Lourdes Argueta de Ardon	Cooperation and International Affairs Manager
El Salvador	Investments and Export Promotion Agency (PROESA)	Public sector (Agencies)	Javier Galdamez	Investment Director
El Salvador	Banco Agricola	Commercial Bank	Emperatriz Mayorga	Sustainability Manager
El Salvador	El Salavador development Bank (BANDESAL)	Local development bank	Mario Salazar / Maya Leon	President / Funding Manager
Guatemala	Electricity Planning Comission (UPEN) - National Commission of Electricity (CNEE)	Public sector (Energy)	Fernando Moscoso	Planning and Market Surveillance Manager
Guatemala	Ministry of Energy and Mines (MEM)	Public sector (Energy)	Gabriel Velazquez	Head of Energy and Mining Planning Unit

Guatemala	Direction of International Cooperation - Ministry of Environment and Natural Resources	Public sector (Finance)	Jenifer Andrea Calderón Cintora	International Cooperation Advisor
Guatemala	Ministry of Economy - National Competitiveness Program (PRONACOM)	Public sector (Finance)	Mariana Cordon Rosales	Investment Promotion Advisor for the energy and electronic sectors
Guatemala	Direction of Investments - Apparel Chamber of Commerce	Public sector (Agencies)	Karin de Leon	Energy/ Infrastructure Manager
Guatemala	Grupo Onyx	Private Equity / VC fund	Diego Donis Gonzalez	Gerente General División Energía
Guatemala	Grupo Centrans	Private Equity / VC fund	Gerardo Basterrechea	Director of Operations
Guatemala	Grupo G&T Contintental	Commercial Bank	Maria del Sol Mendez Duarte	Gerente de Administración de Riesgos
Honduras	National Energy Secretariat (SEN)	Public sector (Energy)	Gloria Alvarenga	Diplomatic
Honduras	Dirección Nacional de Planeamiento Energético y Política Energética Sectorial	Public sector (Energy)	Diana Solis	Direccion General de Electricidad y Mercados (DGEM)
Honduras	Ministry of Environment - External Cooperation	Public sector (Finance)	Karen Rico	Director of Climate Change
Honduras	Electric regulatory commission (CREE)	Public sector (Energy)	Wilfredo Flores	Commissioner - CREE
Honduras	Terra Inversiones	Private Equity / VC fund	Claudio E. Otero Munoz	Mg Director - Structured Finance and M&A
Honduras	IBS honduras	RE/EE project developer or IPP	Marvin Trochez	CEO
Honduras	Honduran Council of Private Enterprise (COHEP)	Private Investment Association	Lic. Santiago Herrera	Manager Economic Policy

Honduras	Honduran Banking Association (AHIBA)	Baking Association	Alejandra Stefan	Director
Honduras	Honduran Chamber of Tourism (CANATURH)	Tourism Association	Dr. Andrés Ehlrer	Vice-President
Honduras	BANHPROVI	Local development bank	Gabriela Chinchilla	Sub-gerente de Negocios
Nicaragua	Enertiva	Private Equity / VC fund	Alejandro Brenes	CEO
Nicaragua	ECAMI	RE/EE project developer or IPP	Max Lacayo	CEO
Panamá	National Energy Secretariat (SNE) - Direction of Electricity	Public sector (Energy)	Rosilena Lindo	National Director of Electricity
Panamá	National Energy Secretariat (SNE) - Direction of Energy Efficiency	Public sector (Energy)	Marta Bernal	Energy Efficiency Coordinator
Panamá	ProPanamá	Public sector (Agencies)	Carmen Gisela Vergara	General Manager - Ambassador
Panamá	Envalink	RE/EE project developer or IPP	Daniel Valencia	Manager
Panamá	Exagon Impact	Private Equity / VC fund	Marc Ricart	Managing Partner
Panamá	AYG Proyectos Y Servicios - Engineering and Energy Services	RE/EE project developer or IPP	Felix Linares	Project Manager
Panamá	Panamanian Chamber of Solar Energy (CAPES)	Renewable Energy Chamber	Federico Fernandez	President
Paraguay	Viceministry of Mines and Energy	Public sector (Energy)	Gustavo Cazal	Director of Alternative Energies
Paraguay	Itaipu Binacional	RE/EE project developer or IPP	Gerardo Blanco	Member of the Governing council
Paraguay	REDIEX - Red de Inversiones y Exportaciones	Public sector (Agencies)	Federico Sosa Otero	Director de Atracción de Inversiones

Perú	National Direction of Environmental Finance - Ministry of Environment	Public sector (Finance)	Emilio Medrano	General Director of Environmental Economics and Financing
Perú	Ministry of Energy and Mining	Public sector (Energy)	José Martín Dávila Perez	Vice Minister of Electricity
Perú	Dirección General de Electricidad (DGE	Public sector (Energy)	Juan Antonio Aguilar Molina	General Director
Perú	Ministerio de Economía y Finanzas	Public sector (Finance)	José La Rosa	Director of International Economic Affairs of the Directorate General for International Economic Affairs, Competition and Productivity
Perú	ProInversión - Agencia de Promoción de la Inversión Privada	Public sector (Agencies)	Rafael Ugaz Vallenas	Executive Director
Perú	Solarpack	Private Equity / VC fund	Iñigo Urízar Espinosa	Country Manager Perú
Perú	Garrigues	Legal firm	Diego Harman	Partner
Perú	Hernandez y Cía	Legal firm	Brendan Oviedo Doyle	Partner
Perú	Novum Solar	RE/EE project developer or IPP	Pedro Gonzalez Orbegoso	Director
Perú	Profuturo AFP	Institutional investment funds	Joswilib Vega Ugarte	Chief Investment Officer
Perú	Grupo Cobra	RE/EE project developer or IPP	José Maria Orejana Martín	M&A Engineer - International BD
Perú	Asociación Peruana de Energías Renovables (SPR)	Renewable Energy Chamber	Paloma Sarria	Executive Director
Perú	COFIDE	Local development bank	Carlos Linares	President


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