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Status of the off-grid renewable energy market in Latin America & the Caribbean

Imprints

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Contents

Abbreviations list

ABC Anchor-Businesses-Communities

AECID Spanish Agency for International Development Cooperation

AFD French Development Agency

AfDB African Development Bank

AMDA Africa Minigrid Developers Association

ANARSE National Regulatory Authority of the Energy Sector

ARE Alliance for Rural Electrification

BIO Belgian Investment Company for Developing Countries

CABEI Central American Bank for Economic Integration

CAF Development Bank of Latin America

CDB Caribbean Development Bank

CIF Climate Investment Funds

CNE National Energy Commission

COFIDES Compañía Española de Financiación del Desarrollo

COP25 25th United Nations Climate Change Conference

DFC U.S. International Development Finance Corporation

DFID Department for International Development of the United Kingdom

DRE decentralised renewable energy

EAS Energy Authority of Suriname

EBS N. V. Energie Bedrijven Suriname

EDH Electricité d'Haïti

EIB European Investment Bank

ENEE National Company of Electrical Energy

EPAR N.V. Energievoorziening Paramaribo

FMO Dutch Entrepreneurial Development Bank

FOSODE Social Fund for Electricity Development

GDP gross domestic product

GEF Global Environment Facility

GNI gross national income

GWh gigawatt-hour

H-REFF Honduras Renewable Energy Financing Facility

HFO heavy fuel oil

HNL Honduran Lempira

IDB Interamerican Development Bank

inhab. inhabitants

JICA Japan International Cooperation Agency

KfW Kreditanstalt für Wiederaufbau

km kilometre

km² kilometre square

kW kilowatt

kWh kilowatt-hour

LAC Latin America & the Caribbean

MFI micro finance institution

MNH Ministry of Natural Resources

Mtoe million tonnes of oil equivalent

MTPTC Ministry of Public Works, Transport and Communications

MUSD USD million

MW megawatt

NIO Nicaraguan Cordoba

O&M operations and maintenance

ODA official development assistance

OLADE Latin American Energy Organization

OPIC Overseas Private Investment Corporation

OSINERGMIN Organismo Supervisor de la Inversión en Energía y Minería

PERMER Proyecto de Energías Renovables en Mercados Rurales

PHARES Haiti Program for Access to Solar Energy in Rural Communities

PPA Power Purchase Agreement

PPP Public Private Partnership

PURE productive use of renewable energy

SDG-7 Sustainable Development Goal 7

SICREEE SICA Centre for Renewable Energy and Energy Efficiency

SNV Netherlands Development Organisation

Solar PV solar photovoltaic

SREP Scaling-up Renewable Energy in Low Income Countries Program

TWh terawatt-hour

U.S. United States

UNEP United Nations Environment Programme

UNIDO United Nations Industrial Development Organization

USAID United States Agency for International Development

USD United States Dollar

USTDA United States Trade and Development Agency

Introduction

The Latin America and the Caribbean (LAC) region has the cleanest energy mix in the world due to its vast renewable energy resources, with the potential to meet global electricity needs 22 times.

In recent years, higher gross domestic product (GDP) and a more equal distribution of economic resources, alongside robust policy and regulatory frameworks and remarkable electrification efforts of LAC governments and international funding partners, have been key in powering LAC's sustainable path towards universal electricity access. Nowadays, the region has achieved a 97% rate of electricity coverage, compared to 52.2% in 1990.

Despite the positive transition, **more than 18.1 million people in the region are still not covered by electricity infrastructure**. In addition, the high electrification rate of LAC contrasts with available data on the average consumption of electricity per capita in the region (2,087 kWh), which is significantly lower than the global average (3,131 kWh).

More than 18.1 million people in the region are still not covered by electricity infrastructure

Such data indicate that there is an **important affordability gap** between electricity coverage and the consumption of electricity services, thereby highlighting the existence of a significant market for electricity demand that has not been addressed yet.

In fact, the IDB estimates that **off-grid solutions would be the best fit solution to address at least 40% of the electricity access gap in LAC**. Out of those, 30% would be mini-grids and the remaining 70% would consist of standalone systems.[1]

Off-grid renewable energy solutions are particularly well positioned to power productive uses of renewable energy (PURE) in rural, isolated communities and thus access an untapped market of potential consumers who are currently unable to pay for the high electricity costs of the national grid.

Even in the case of heavily subsidised national grid tariffs, **the tariffs from off-grid renewable energy mini-grids can be similar and even cheaper** than the tariffs from the national grid, depending on initiatives put in place by the government. Furthermore, the modularity and flexibility that off-grid renewable energy systems provide allow them to be adapted to the specific needs of customers.

In addition, **off-grid renewable energy solutions have great potential to stimulate and diversify local economies by powering economic sectors** such as agriculture, food pro-

1 IDB & OLADE, Energy Access and Affordability Voluntary Action Plan for Latin America and the Caribbean, 2018: page 6

Off-grid solutions would be the best fit solution to address at least 40% of the electricity access gap in LAC

cessing and retailing, and thus help communities become more resilient to market shocks and unforeseen weather events.

By keeping the power on, guaranteeing essential services and enabling a much faster and cheaper recovery of the electricity grid when natural disasters strike, **off-grid renewable energy solutions can save lives, enable business activities and generate local jobs**. Local job creation may include both direct jobs (i.e. local technicians, installers, operators, etc.), as well as derived jobs enabled by reliable electricity access (i.e. rural entrepreneurs opening new businesses).

Furthermore, community-inclusive projects for off-grid electrification have a **great potential to reduce inequalities and empower vulnerable collectives**, such as women and ethnic minorities, if provided with the capacity and finance needed to access electricity services and increase their productivity.

Nevertheless, there are **only a few specialised off-grid renewable energy companies active in the region today**. The deployment of off-grid renewable energy technologies must rapidly increase to accelerate universal electrification and spur socioeconomic development in last-mile communities.

In light of the above, the Alliance for Rural Electrification (ARE) and the Inter-American Development Bank (IDB) have joined forces to develop a market assessment on the status of the off-grid renewable energy market in the LAC region. The publication provides international project developers, private investors and funding institutions with key insights into the needs, trends, challenges and opportunities in the LAC off-grid renewable energy market.

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1 Status of the off-grid renewable energy market in Latin America & the Caribbean

1.1 Overview of the regional off-grid renewable energy market

IN A NUTSHELL – LAC

ELECTRICITY ACCESS:

"**18.1 million people** without access to electricity infrastructure and **65 million people** underserved, despite being covered by the national electricity grid."

"Mexico, Colombia and Guatemala account for almost **25%** of the **total number of unelectrified people** in LAC"; **47%** of **unelectrified people** are spread between Haiti and Honduras."

"**Rural areas concentrate 90%** of the unelectrified people in the region."

"Total **electricity loss of 1,631,043 GWh** in 2018 alone, totalling up to **3,537,366 households** that could have been supplied throughout the year."

POWER SUPPLY:

"**Off-grid systems** are estimated to be the best solution to address at least **40% of the electricity access gap** in LAC. Out of those, **30%** would be **mini-grids** and the remaining **70% standalone systems."**

"LAC's renewable energy resources have the potential to meet **22 times global electricity needs.**"

"LAC has attracted **USD 35 billion of investments** —44% from international investors— allocated to non-conventional renewable energy sources over the **last five years."**

POWER DEMAND:

"**52 million people** are engaged in **rural income-generating activities**."

"**Agriculture** is the main sector in rural LAC, representing **52% of rural jobs."**

"**Family farming** sustains more than **60 million people** and generates **57-67%** of the region's **food production**."

"Caribbean countries import **up to 80% of their food** from Europe and North America, thereby increasing the need to **power local agri-food supply**."

"Tourism has an enormous potential for **economic growth and job creation** due to its **'multiplier effect'** in other economic sectors. The **tourism** sector currently employs **16.2 million people** in LAC."

"Other sectors with **economic potential** to be powered by off-grid renewable energy include artisanal **craft-making**, **carpentry and small-scale textile."**

ENABLING ENVIRONMENT:

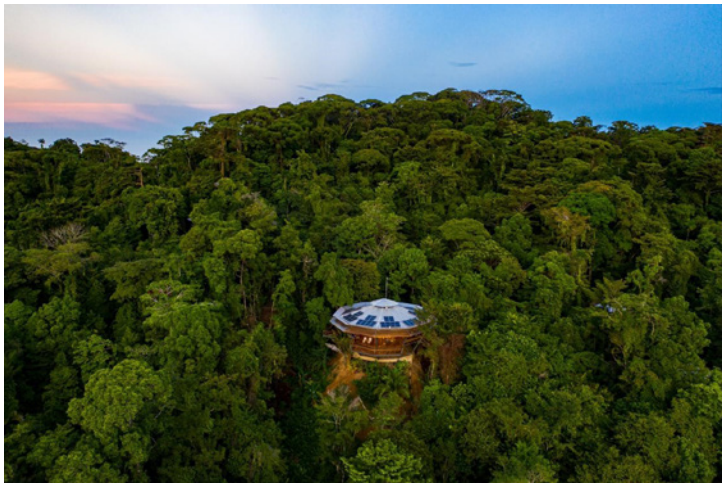
"LAC governments have started to create stable and enabling environments for DRE companies and international investors to support national electrification efforts, but **more international and national support is needed** to achieve **universal electricity access** in LAC by 2030."

The LAC region provides numerous business opportunities for off-grid renewable energy companies and investors.

From a demand perspective, the LAC region has a vast pool of potential consumers, comprising 18.1 million people without access to electricity infrastructure, as well as 65 million people who are underserved, despite being covered by the national electricity grid.

While the region benefits from a high electrification rate of 97% and has the cleanest electricity mix in the world, electrification rates have slowed down in recent years, particularly due to challenges in electrifying last-mile communities in rural settings. In addition, electricity consumption per capita remains notably low compared to other regions in the world, and the affordability and reliability of electricity services remains an important issue.

Off-grid systems can help address those challenges by bringing in innovative and cost-effective technologies adapted to customer needs, while also scaling up sustainable electricity demand and spurring local socioeconomic development.



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On the supply side, significant policy and regulatory progress spearheaded by national governments, as well as the development of innovative business and community-led models, are opening windows for international companies, private investors and international funding institutions to bridge the last-mile electrification gap, boost socioeconomic development in the region and accelerate the path towards universal electricity access by 2030 (SDG-7).

Nevertheless, key challenges remain to scale up the off-grid renewable energy sector. These include:

- The prevalence of geographical and socioeconomic constraints in rural areas, such as limited productivity, income-generating opportunities and access to markets;
- Low participation of private off-grid renewable energy companies and investors in LAC's electricity sector, as a result of limited policy and regulatory measures to support their participation in the market;
- Limited national resources and difficult access to international funding; and
- Lack of international communication and coordination efforts, as well as associated knowledge and capacity gaps, particularly around the design and implementation of concession agreements, technical standards, innovative technologies, cost-plus tariffs and community-inclusive business models.

Aware of the challenges ahead, many LAC governments are already taking significant steps to create stable and enabling environments for private actors and international funding institutions to support national electrification efforts. Yet, additional international and national support is needed to achieve universal electricity access in LAC by 2030.

1.1. Overview of the regional off-grid renewable energy market

The LAC region covers a surface of 20,397,602 km² spread across North, Central and South America. The region is comprised by 33 countries with a total population of 641,743,000 inhabitants and an average GDP per capita of USD 16,000.[2]

Indicator	Figure
Surface (km²)	20,397,602
Population (absolute numbers)	641,743,000
Share of urban population (%)	81
Share of rural population (%)	19
GDP USD 2011 PPP (MUSD)	10,240,594
GDP per capita (thou. USD 2011 PPP / inhab.)	16
GDP growth rate (2020, %)	-7.7
Rank in Human Development Index	0.77
Share of ODA in GDP (% GNI)	0.2
Electrification rate (%)	97.1
Total installed capacity (MW)	440
Total energy production (Mtoe)	989
Total energy consumption (Mtoe)	621
Consumption of electricity per capita (kWh / inhab.)	2,087
Energy use per capita (toe / inhab.)	0.97

Figure 1: LAC indicators [9, 10, 11, 12, 13]

Following several years of slow growth, LAC has been the region hit the hardest by the COVID-19 pandemic in proportion to its population size.[3] Even though LAC represents 8.4% of the world's population, it accumulated 31% of all COVID-19 related deaths globally as of May 2021.[4] The devastating effects of the pandemic have also been reflected in the region's economy, which experienced a 7.7% decline in its GDP growth in 2020[5] — the worst macroeconomic result since 1821.[6]

The IDB predicts a better result for 2021, with a projected GDP growth of 4.1% in 2021 and 2.5% per year beyond that.[7] However, extreme poverty and moderate poverty are expected to rise from 12.1% to 14.6% and from 11.7% to 14.6% by 2030 respectively,[8] thus having a negative impact in the affordability of energy services for vulnerable consumer groups and widening the electricity access gap further.

2 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 49
3 World Bank, The World Bank in Latin America and the Caribbean, 2021 [online]
4 Reuters, COVID-19 deaths in Latin America surpass 1 million as outbreak worsens, 2021
5 ECLAC, Statistical Yearbook for Latin America and the Caribbean 2020, 2021: page 32
6 IDB, Opportunities for Stronger and Sustainable Postpandemic Growth, 2021: page ix
7 Idem: page ix
8 Idem: page 8
9 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 49
10 ECLAC, Latin America and the Caribbean: Growth Projections for 2020 and 2021, 2020 [online]
11 UNDP, Human Development Report 2020. The Next Frontier: Human Development and the Anthropocene, 2020: page 244
12 World Bank, Net ODA received (% of GNI) - Latin America & Caribbean, 2019
13 Energy Hub, Access to electricity service, 2018 [online]

1.1.1. ELECTRICITY ACCESS

The region exhibits a high electrification rate of 97%, only behind Europe and North America. Major electrification progress in the rural context occurred between 1990 and 2012, when the electrification rate increased by 22 percentage points (from 65% to 87%). The positive trend has slowly continued until the present day and is strongly related to an increase in the overall average income per capita, as well as policy and regulatory developments. An additional factor is the continuous population decline in rural areas.[14]

The region faces electricity reliability problems that can pose a serious threat to essential services and economic activities

Despite the positive electricity coverage scenario in LAC, 18.1 million people in the region are still not covered by any electricity infrastructure and electricity consumption per capita remains notably low compared to other regions in the world, including Middle East & North Africa (MENA) and East Asia & the Pacific (APAC).[15]

Furthermore, the region faces electricity reliability problems that can pose a threat to essential services and economic activities. As an estimate, LAC experienced 6.3 non-programmed interruptions throughout 2017 with an average duration of 12.8 hours. Over the last four years, only Ecuador and Peru have reported a considerable improvement in this regard.[16]

The electrification challenges above are a result of persistent issues that need to be urgently addressed in order to meet SDG-7. Such challenges have caused large disparities within and between LAC countries, are largely explained by a predominant last-mile electrification gap in rural communities.

Some countries like Cuba, Uruguay, Barbados, Brazil and Chile benefit from a near 100% electrification rate (in relative terms), while other LAC countries present much lower rates of electricity coverage, notably Haiti (38.7%), Honduras (80.8%) and Suriname (90.3%).[17] However, it is important to stress that Mexico, Colombia and Guatemala account for almost 25% of the total number of unelectrified people in LAC (in absolute terms), despite their high rate of electrification, while 47% of unelectrified people are spread between Haiti and Honduras.

Such differences are also prominent between subregions, with Mexico (99%) and South America (97%) above LAC's average electrification rate, and Central America (93%) and the Caribbean below the same (90%) —the latter mainly due to the low electrification rate of Haiti.[18]

14 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 8

15 IDB, Más Allá de la Electricidad: Cómo la energía provee servicios en el hogar, 2020: page v

16 IDB, Zooming into Successful Energy Policies in Latin America and the Caribbean: Reasons for Hope, 2019: page 34-35

17 Energy Hub, Access to electricity service, 2018 [online]

18 Idem

Figure 2. Electricity access rates and absolute number of people without electricity in the region

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The differences across regions, countries and national territories can be attributed to multiple socioeconomic factors, such as population growth, income, type of settlement, ethnicity, gender, geographical and meteorological context as well as financial, technical and policy determinants on the supply side. Amongst them, the most significant disparities are driven by the urban-rural divide.

For instance, countries with a higher share of rural population are likely to bear lower rates of electrification and electricity access than their more urbanised counterparts, as rural areas concentrate 90% of the unelectrified people in the region.[19] That is the case for many Caribbean states (particularly Haiti), as well as Honduras, Suriname, Colombia, Guatemala and Mexico, to name a few.[20,21]

Country	Rural population (%)	Rural population (n_o)	Electrification rate (%)	People without access to electricity (n_o)	Households without access to electricity (n_o)
Haiti	44	4,934,129	38.7	6,819,511	861,605
Honduras	42	4,119,684	80.8	1,728,502	411,928
Suriname	34	197,111	90.3	55,642	10,072
Colombia	19	9,512,141	96.9	1,544,475	470,780
Guatemala	49	8,063,081	92.4	1,316,682	202,296
Mexico	20	24,948,670	98.8	1,577,388	330,274

Figure 3. Overview of countries with low electricity coverage[22] and high rural population[23]

Another critical factor in determining access to electricity is household income. Countries with lower income per capita are associated with lower access to electricity. This is the case of Belize, Bolivia, Colombia, Guatemala, Guyana, Haiti, Honduras, Panama and Jamaica. Furthermore, a recent study showed that, when the population in LAC countries was divided in five different consumer groups according to their income level, more than 20% of users in the lowest income quintile live without electricity in Bolivia, Guatemala, Honduras, Panama and Peru.[24]

19 IDB & OLADE, Energy Access and Affordability Voluntary Action Plan for Latin America and the Caribbean, 2018: page 6

20 Energy Hub, Access to electricity service, 2018 [online]

21 World Bank, Rural population - Latin America & Caribbean, 2019 [online]

22 Energy Hub, Access to electricity service, 2018 [online]

23 World Bank, Rural population - Latin America & Caribbean, 2019 [online]

24 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 11, 12

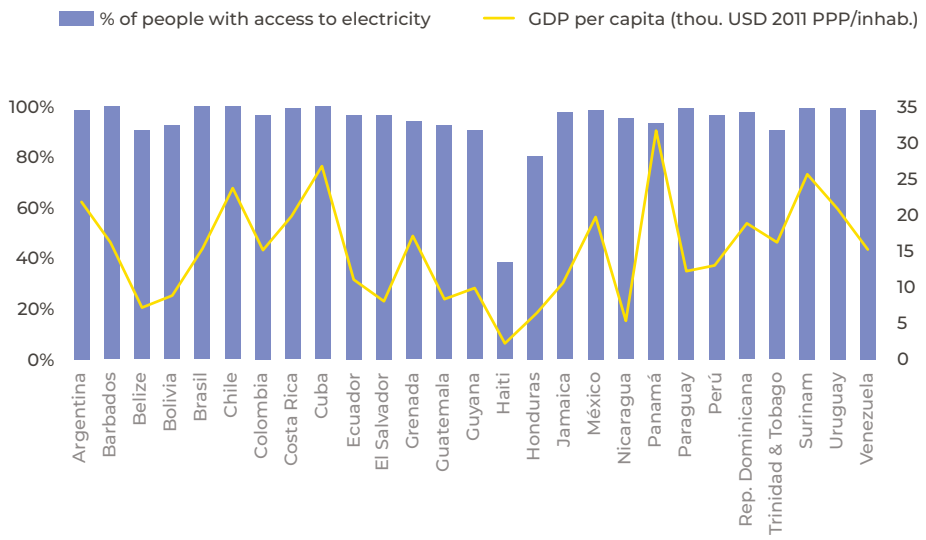

Figure 4. Electrification rate[25] compared to GDP per capita[26]

Nevertheless, as average income per capita increases and the expansion of the electricity grid slows down, the electrification gap for last-mile communities becomes clear.

Those are isolated communities marked by unfavourable geographical and demographic characteristics that impede the extension of the grid and require clean, affordable and reliable power generation solutions that can be adapted to specific settings. Some outstanding examples of countries facing severe last-mile electrification challenges are shown in figure 5.

Country	Rural electrification rate (%)
Haiti	14.3
Honduras	56.4
Suriname	72.0
Panama	79.6
Bolivia	80.0
Colombia	83.9
Argentina	84.9
Guatemala	85.6
Belize	85.6
Peru	89.0

Figure 5. Countries with the lowest rural electrification rates

Similarly, evidence shows that users with indigenous ethnicity as well as afro-descendants face more difficulties to access electricity services than other ethnic groups, despite accounting for 46% of the rural population in LAC.[27] In the case of gender, the differences seem to be small for certain electricity uses, such as lighting, refrigeration and cooking, yet they become apparent for services that support the inclusion of women in economic activities and in the job market.[28]

Lastly, the frequency and increasing impacts of extreme weather events in some countries, worsened by climate change, pose important barriers to develop a secure power infrastructure, to electricity access and to socioeconomic development.

25 Energy Hub, Access to electricity service, 2018 [online]

26 OLADE, Panorama Energético de América Latina y El Caribe, 2020

27 IDB, Más Allá de la Electricidad: Cómo la energía provee servicios en el hogar, 2020: page 41

28 Idem: page 40

1.1.2. POWER DEMAND

The high electrification rate of LAC contrasts with available data on the region's consumption of electricity per capita (2,087 kWh),[29] significantly lower than the global average (3,131 kWh) and the consumption per capita of other regions, such as North Africa (2,501 kWh) and the Pacific region (3,678 kWh).[30] Such data show an unequal access to electricity services in spite of high electricity coverage rates. The gap is clearly reflected in the low electricity consumption of countries like El Salvador, Jamaica, Colombia, Peru and Ecuador (1,200 kWh) compared to Chile, Uruguay and Argentina (3,000 kWh), which show a significantly higher consumption per capita despite sharing similar electrification rates.[31]

Such data indicate that there is an important mismatch between electricity coverage and the consumption of electricity services, partially explained by user affordability and grid reliability gaps, and thus evidence the existence of a significant market for electricity demand that has not been addressed yet.

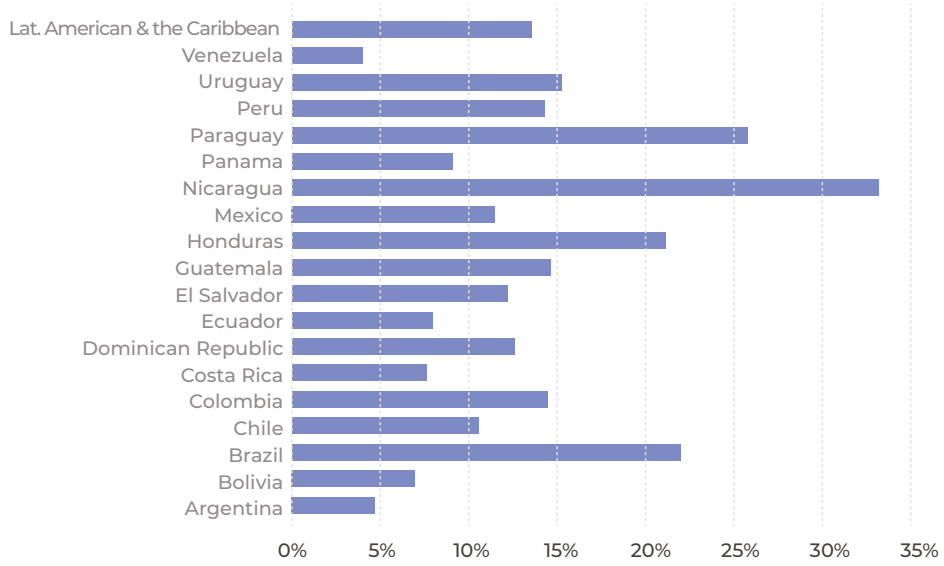

Figure 6. Percentage of households with difficulties to pay for electricity bills[32]

As investments in sustainable energy grow and electricity infrastructure expands, the affordability gap —both for accessing the electricity services and for acquiring the necessary appliances to make use of such electricity— becomes apparent.[33] In this regard, it is important to note that low electricity consumption in LAC is also strongly related to difficulties to access electricity appliances at the user-level. For this reason, electricity access efforts must look at user affordability for both energy services and appliances. Countries with the least affordable electricity tariffs, when comparing average income per month with electricity consumption per capita, are Haiti, Nicaragua, Guatemala, Honduras and El Salvador.[34]

29 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 49

30 IDB, Más Allá de la Electricidad: Cómo la energía provee servicios en el hogar, 2020: page v

31 Idem: page 10

32 Energy Hub, Households' difficulties paying the electricity bill, 2018 [online]

33 Idem: page 11

34 IDB, Más Allá de la Electricidad: Cómo la energía provee servicios en el hogar, 2020: page 13

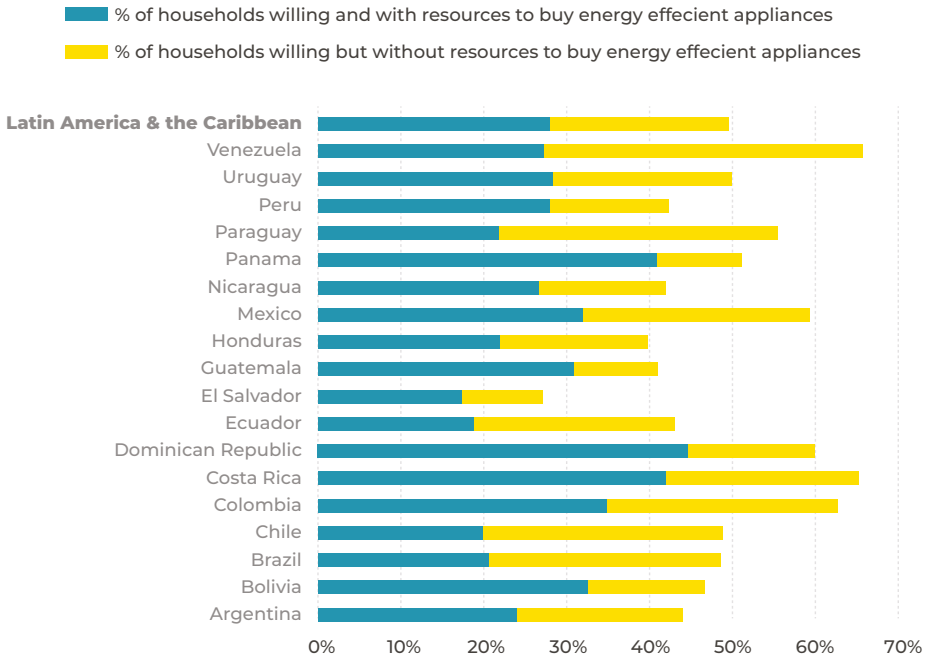

Figure 7. Percentage of households willing and with/without resources to buy electricity access appliances[35]

Off-grid renewable energy systems are particularly well positioned to address the affordability gap and access the untapped market of customers that do not have enough resources to cover the electricity tariffs of the national grid (see figure 7). Even in the case of heavily subsidised national grid tariffs, research shows that the tariffs from isolated mini-grids can be similar and even cheaper than the tariffs from the often subsidised national grid, depending on the initiatives put in place by the government. On top of that, the modularity and technological ease that off-grid systems provide allow them to be adapted to the specific needs and pockets of their customers.

The required tariffs of isolated mini-grids can significantly vary depending on the business model and technology of choice. In any event, government subsidies, together with smart grants, concessional loans and/or guarantee schemes with a mix of public and private sources can be strong enablers to scale up the implementation of mini-grid projects and ensure their sustainability as well as affordability.[36, 37]

Additionally, the creation of economies of scale resulting from the incorporation of productive use of renewable energy (PURE)[38] for income-generating activities, such as agriculture and tourism, together with a constant decrease in the price of off-grid system components, can reduce the required mini-grid electricity tariffs further.

In this regard, ARE has conducted extensive research to acknowledge the meaningful work of its members to bring electricity costs down in rural communities. For instance, TESVOLT

35 Energy Hub, Willingness to buy energy efficient appliances, 2018 [online]

36 ARE, Best Practices for Electrifying Rural Health Care Facilities with Decentralised Renewables, 2020: page 10

37 ARE, Decentralised Renewable Energy Innovations to Boost Agri-Sector Productivity & Address Global Food System Challenges, 2021: page 18

38 ARE & AEEP, The Productive Use of Renewable Energy in Africa, 2015

reduced the electricity costs for irrigation, from USD 0.19/kWh to USD 0.05/kWh,[39] of a Brazilian farm in Quirinopolis through the installation of a smart microgrid.[40]

Additional examples from off-grid renewable energy companies illustrate Anchor-Businesses-Communities (ABC)-type business models, whereby the main revenue source is rooted in 'anchor customers', thus allowing for lower tariffs for local businesses and households ranging from 0.20 USD/kWh.[41] Futhermore, other examples of Power Purchase Agreements (PPA) and Micro-Utility models prove that the required tariff can be even lower —i.e. Clean Power Indonesia, from 0.15 USD/kWh.[42]

Country	Residential tariff (USD kWh/month)	Commercial (USD kWh/month)	Industrial (USD kWh/month)	Electrification rate (%)	People without access to electricity (n_o)
El Salvador	From 0.09 to 0.15 (< 99 kWh/month) From 0.09 to 0.15 (from 100 to 199 kWh/month) From 0.09 to 0.15 (> 200 kWh/month)	From 0.08 to 0.165 (low tension) From 0.07 to 0.15 (medium tension)	From 0.08 to 0.17 (low tension) From 0.07 to 0.15 (medium tension)	97.0	199,290
Guatemala	0.25	0.15	0.15	92.4	1,316,682
Haiti	0.13	0.14	0.14	38.7	6,819,511
Honduras	0.14 (< 50 kWh/month) 0.18 (> 50 kWh/month)	0.18 (low tension) 0.14 (medium tension) 0.12 (high tension)	0.18 (low tension) 0.14 (medium tension) 0.12 (high tension)	80.8	1,728,502
Nicaragua	3.59 (0-5 kWh) 0.26 (16-500 kWh) 0.22 (> 500 kWh)	From 0.09 to 0.20[43]	From 0.09 to 0.15[44]	95.6	284,240

Figure 8. Electricity tariffs across selected LAC countries with the least affordable tariffs[45]

Thus, off-grid renewable energy can play a critical role, not only in powering livelihoods for families and entrepreneurs, but also in the form of government savings, enabled through a reduction in the major subsidies provided to national utilities.

39 From EUR 0.16/kWh to EUR 0.04/kWh = USD 0.194/kWh to USD 0.048/kWh (1 EUR = 1.21255 USD)

40 ARE, Decentralised Renewable Energy Innovations to Boost Agri-Sector Productivity & Address Global Food System Challenges, 2021: page 48

41 ARE, Private Sector Driven Business Models for Clean Energy Mini-Grids: Lessons Learnt from South and South-East-Asia, 2019: page 72

42 Idem: page 63

43 From NIO 32,587 to NIO 6.8984 = from USD 0.09 to USD 0.20 (NIO 1 = USD 0.03)

44 From NIO 30,195 to NIO 5.1521 = from USD 0.09 to USD 0.15 (NIO 1 = USD 0.03)

45 *Own elaboration based on the tariffs featured on the websites of the government and national utilities*

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In fact, the subsidisation of the national grid is a common measure to increase the affordability of end users, however subsidies constitute a high financial burden in the government accounts, and their efficiency, sustainability and opportunity cost are highly questionable.

For instance, heavily subsidised electricity tariffs of El Salvador and Honduras are still perceived as unaffordable, both by electricity users and when compared to the average income in the countries.[46] Such claims are supported by additional research showing that most subsidy schemes present important inaccuracies to target their beneficiary groups, thus failing to increase electricity affordability for around 31% of LAC's population.[47]

Besides electrifying last-mile communities and bridging the affordability gap, the flexible, independent and cost-effective nature of off-grid solutions provides an enormous advantage to address electricity reliability, disaster relief and economic diversification.

Off-grid renewable energy solutions, such as micro- and mini-grid systems are particularly relevant in the Caribbean region, largely comprised by small island states that are heavily reliant on imported fossil fuels and expensive, centralised electricity grids that are difficult to maintain and to repair when natural disasters occur.[48, 49]

Consequently, national energy systems in the Caribbean are extremely sensitive to disruptions in fuel transport and price volatility, as well as damages to the infrastructure of the national grid that are frequently caused by extreme weather events.

3,537,366 households could have been supplied
with the total amount of electricity lost in 2018

For instance, the estimated electricity loss of the Caribbean[50] in 2018 was 59,886 GWh out of a total electricity loss of 1,631,043GWh for the entire LAC region totalling up to 3,537,366 households that could have been supplied throughout the year.[51] In terms of losses out of the total electricity supplied, Haiti presents the highest rate in the region (59%), followed by Honduras (30%), Paraguay (24%) and Suriname (19%). Those rates are all higher than the average estimate of the region (16%) and way higher than the global estimate (8%).[52]

46 IDB, Más Allá de la Electricidad: Cómo la energía provee servicios en el hogar, 2020: page 13, 14

47 IDB, Zooming into Successful Energy Policies in Latin America and the Caribbean: Reasons for Hope, 2019: page 22

48 RMI, Solar under Storm, 2020 [online]

49 ECLAC, The Enhancement of Resilience to Disasters and Climate Change in the Caribbean through the Modernization of the Energy Sector, 2019: page 44

50 Barbados, Belize, Cuba, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Suriname and Trinidad & Tobago

51 Energy Hub, Electricity Losses as a Percentage of the Total Electricity Supply, 2018 [online]

52 Idem

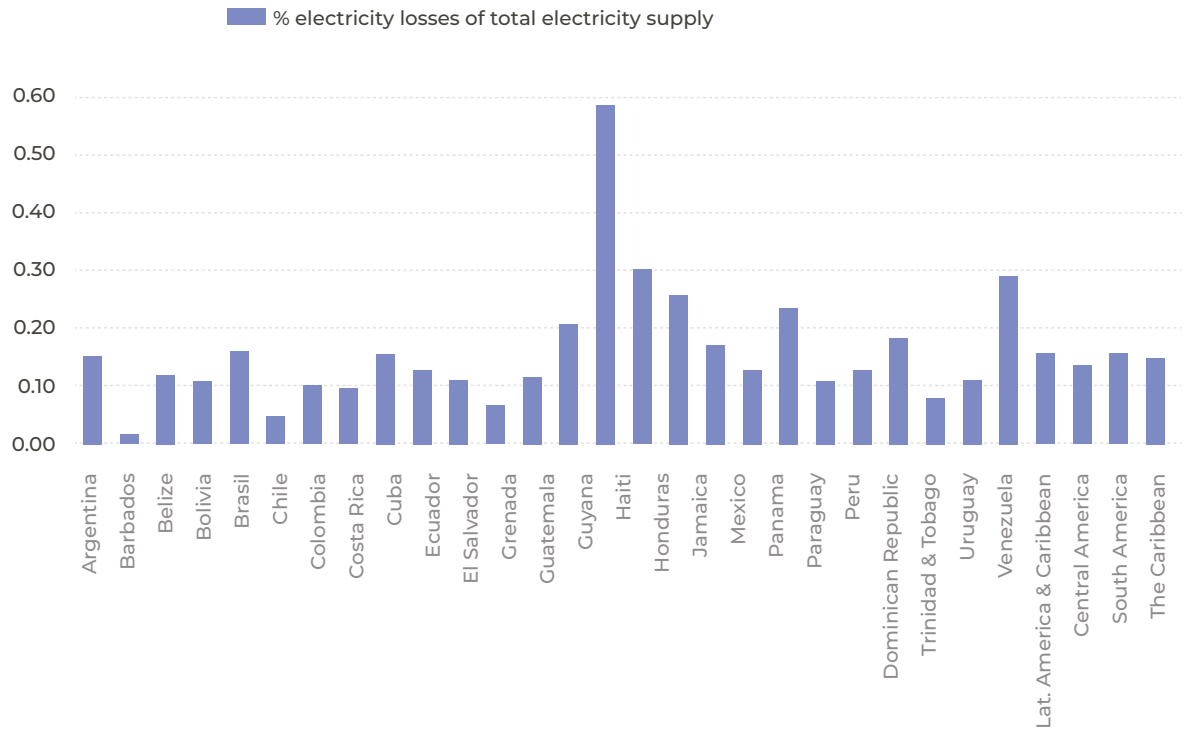

Figure 9. Electricity losses in LAC countries per country and per region[53]

Electricity disruptions also have a devastating impact in local economies, predominantly dependent on tourism, which accounts for 43% of total jobs in the Caribbean and up to 90% in Antigua and Barbuda,[54] a sector that is severely affected by interruptions in the power supply and transport. In 2017 alone, strong cyclonic activity costed the Caribbean region around USD 100 billion in economic losses and left many communities in the dark for months. [55]

By keeping the power on, guaranteeing essential services and enabling a much faster and cheaper recovery of the electricity grid when natural disasters strike, off-grid renewable energy solutions can save lives, enable business activities and generate local jobs. Local job creation may include both direct jobs (i.e. local technicians, installers, operators, etc.), as well as derived jobs enabled by reliable electricity access (i.e. rural entrepreneurs opening new businesses).

Off-grid renewable energy solutions also have a great potential to power agriculture and alternative economic sectors, and thus help communities become more resilient by diversifying their income-generating activities. Given that Caribbean countries currently import up to 80% of their food from Europe and North America, providing rural farmers with clean, reliable and affordable electricity to power local agri-food supply chains through the deployment of off-grid technologies is a key priority to ensure food security in the region.[56]

53 Energy Hub, Electricity losses as a percentage of the total electricity supply, 2018 [online]

54 ILO, Impactos en el mercado de trabajo y los ingresos en América Latina y el Caribe, 2020: page 35

55 RMI, Solar under Storm, 2020 [online]

56 SEforALL, The Recover Better with Sustainable Energy Guide for Caribbean Countries, 2020: page 6

Country	Renewable energy share of electricity generation (%)	Year
Antigua & Barbuda	15	2030
Argentina	18	2023
	20	2025
Bahamas	30	2030
Barbados	100	2050
Belize	85	2030
Bolivia	79	2030
Brazil	23	2030
Chile	70	2030
Colombia	70	2030
	100	2050
Costa Rica	100	2030
Cuba	24	2030
Dominica	100	-
Dominican Republic	25	2025
	70	2030
	100	2050
Ecuador	70	2030
Grenada	100	2050
Guatemala	80	2030
	100	2050
Guyana	90	-
Haiti	70	2030
	100	2050
Honduras	60	2022
	70	2030
	80	2038
	100	2050
Jamaica	50	2030
Mexico	30	2021
	35	2024
	38	2030
	40	2035
	50	2050
Nicaragua	90	2027
Panama	15	2030
	50	2050
Paraguay	70	2030
Peru	70	2030
Puerto Rico	20	2035
	100	2050
Saint Lucia	100	2050

Figure 10. Renewable energy targets of LAC countries[57, 58, 59]

57 REN21, Renewables 2020 Global Status Report, 2020: page 213

58 IRENA, Latin America and the Caribbean Announce Ambitious New Renewables Target, 2019 [online]

59 IEA, Country Profile. Panama, 2018 [online]

Small family farmers are often confronted with high electricity costs and unreliable grid infrastructure

In light of the benefits above, the Caribbean region has already increased its consumption of renewable energy by 6% since 2010, and it intends to escalate this figure further, from a current 12.3% to 40% by 2030.[60] An outstanding example is Barbados, which has set the objective of going 100% fossil fuel free by 2030, despite having an installed generation capacity largely composed by oil and diesel (more than 90% of its installed generation capacity). The country has installed 50 MW of solar energy so far, out of which 40 MW are distributed systems.[61]

The use of off-grid renewable solutions to boost local markets and enable socioeconomic development via PURE is also becoming a strategic priority across the rest of LAC.

Promoting PURE and providing capacity building for local market creation/expansion are key to ensure the sustainability of rural electrification business models, otherwise challenged by the low affordability of end users —37.3% of LAC's rural population lives in poverty and 15.5% in extreme poverty.[62] By stimulating the development of profitable activities, PURE can increase income levels and progressively unlock higher demand for electricity.[63]

The potential of off-grid renewable energy solutions to leverage PURE is well present across the whole LAC region, with 123 million people (around 19% of the total population)[64] living in rural areas and 52 million of them engaged in rural income-generating activities. In other words, rural employment supports 20% of LAC's population.[65]

Agriculture is the main sector in rural LAC, representing 52% of rural jobs,[66] 5.5% of the total GDP in the region[67] and 14% of global food production.[68] Within it, family farming comprises a large proportion, as it sustains more than 60 million people and generates 57% to 67% of the region's food production.[69]

In addition, LAC's population is projected to increase to 750 million people by 2030, while the combined regional and international demand for food produced in LAC is expected to scale up to 10,000 million people by 2050, therefore incentivising rapid growth in the

60 CARICOM, At CARICOM Energy Month Launch, 2020 [online]

61 Idem

62 ECLAC, Análisis de las Tarifas del Sector Eléctrico: Los efectos del COVID-19 y la integración energética en los casos de la Argentina, Chile, el Ecuador, México y el Uruguay, 2020: page 37

63 ARE, Access to Energy Services through Renewable Sources in Latin America & The Caribbean, 2017

64 World Bank, Rural population - Latin America & Caribbean, 2019 [online]

65 ILO, Sector rural y desarrollo local en América Latina y el Caribe, 2020 [online]

66 ILO, Desarrollo productivo es clave para enfrentar vulnerabilidad del empleo rural en tiempos de COVID-19, 2020 [online]

67 ECLAC, Statistical Yearbook for Latin America and the Caribbean 2020, 2021: page 34

68 UN, América Latina y el Caribe es clave para alimentar a 10.000 millones de personas en 2050, 2021 [online]

69 FAO, América Latina y el Caribe se Suma al Decenio de la Agricultura Familiar, 2019 [online]

agri-food sector.[70] However, the sector still depends on old, inefficient practices and has not been adapted to meet an increasing regional and global demand yet.

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Furthermore, small family farmers are often confronted with high electricity costs and unreliable grid infrastructure, which limits their productivity and hampers their economic growth. Thus, efficient appliances and off-grid electricity systems, particularly solar PV and biomass based, offer an enormous potential to modernise the sector and increase its productivity.[71]

Off-grid renewable energy solutions can also be critical to reduce gender gaps, as female-headed households are less likely to access resources (finance, productive use equipment and human capital), diversify their income-generating activities and thus increase their resiliency to economic shocks and natural disasters.[72] For instance, off-grid solutions can allow for diversification towards economic sectors that are complimentary to agriculture, such as craft-making and carpentry, rural tourism and hospitality, as well as within the agri-food value chain (i.e. food processing and hospitality).[73]

Agriculture is the main sector in rural LAC, representing 52% of rural jobs, and 5.5% of the total GDP in the region

Tourism is another sector with an enormous growth and job creation potential due to its 'multiplier effect' in other sectors and its important contribution to Latin America's GDP (8.7%) and total employment (7.8% or 16.2 million jobs).[74] The direct contribution of this sector to the Caribbean GDP is higher, at 11.8%, and can go up to 28.5% if its indirect contribution is included.[75]

70 UN, América Latina y el Caribe es clave para alimentar a 10.000 millones de personas en 2050, 2021 [online]

71 World Bank, Future Foodscapes. Re-imagining Agriculture in Latin America and the Caribbean, 2020: page x, 132

72 World Bank, Rural development in Haiti: Challenges and opportunities, 2014: page 17-26

73 ESMAP, Promoting Productive Uses of Electricity in Rural Areas of Peru: Experience & Lessons Learned, 2012: page 4

74 Monterrubio, C., Andriotis, K., & Stylidis, D., Introduction: Tourism Planning and Development in Latin America, pp. 1-7. CABI, 2020: page 3

75 ECLAC, Economic Survey of the Caribbean 2020. Facing the challenge of COVID-19, 2021: page 28

Sector	Common challenges	Opportunities for off-grid renewable energy
Agriculture, livestock and dairy production, fishery[76]	Reliable and affordable power supply Old agricultural practices with low mechanisation and productivity Soil erosion, deforestation and frequent droughts Lack of irrigation, limited access to capital Lack of clean and fresh water Limited access to markets and business knowledge Limited access to finance and productive resources (i.e. feedstock, machinery and human capital)	Reliable and affordable power supply Modernisation of productive equipment via access to off-grid powered efficient appliances and agro-processing machinery Reduction of seasonality and increased diversification of crops via improvement of irrigation methods through solar powered water pumps Access to fish aquaculture through solar powered aeration pumps and off-grid powered desalination systems Reuse of crop by-products and surplus for animal food and generation of bioenergy Economic diversification: improvement of cold chain (better storage of goods i.e. milk chillers), light processing (i.e. cleaning, milling, roasting and drying of grains and cereals), cooking, packaging and local retailing
Artisanal craft-making, carpentry and textile	Reliable and affordable power supply Old manual practices with low mechanisation and productivity Lack of lighting Limited access to markets and business knowledge Limited access to finance and productive resources (i.e. wood and other raw materials, machinery and human capital)	Reliable and affordable power supply Modernisation of productive equipment via access to off-grid powered efficient appliances, such as saws, drills, sewing machines, boilers, driers, etc. Increased diversification of crafts and raw materials due to improvement of treatment methods Reuse of wood by-products (i.e. pellets and generation of bioenergy)
Tourism	Reliable and affordable power supply Lack of infrastructure and basic services (i.e. roads and transport, clean water, communications network, lighting and electricity) Absence of complimentary sectors (i.e. hospitality, cultural and recreational activities, craft-making, textile and retail) Difficult access to national and international communication channels	Reliable and affordable power supply Improvement of transportation (i.e. electric vehicles, e-bicycles and e-scooters) and enhanced provision of basic services through efficient equipment (i.e. water pumps, electric heaters, cell towers, etc.) Support to the creation and development of local economic activities complimentary to tourism Improved access to internet and other communications channels for marketing purposes

Figure 11. Opportunities that PURE brings to rural economic sectors

76 Green Mini-Grid Help Desk, Mapping of Cereals, Fisheries and other Productive Use Businesses for Village Mini-grids, 2019

Country	Main Crops	Agriculture contribution to GDP (%)	Contribution to national employment (%)[77]
Haiti	Sugar cane, cassava, mangoes, maize, garlic, bananas, yams, avocados and chicory roots	19.3	29.0
Honduras	Sugar cane, palm oil, tomatoes, bananas, maize, watermelon, melon, cucumbers, coffee, pineapples, bananas and cabbages	10.7	29.5
Suriname	Sugar cane, cherries, bananas, cassava, rice, cabbages and cucumbers	9.7	8.1
Bolivia	Sugar cane, soy beans, potatoes, maize, sorghum, rice, bananas, tangerines, wheat and cassava	12.2	30.5
Brazil	Sugar cane, soy beans, maize, cassava and oranges	4.4	9.1
Chile	Grapes, apples, wheat, sugar beet, potatoes and tomatoes	3.5	9.0

Figure 12. Overview of main agriculture activities in countries with low electricity coverage and large share of rural population[78, 79, 80]

In summary, off-grid renewable energy systems are a key solution to reach the remaining 18.1 million people without access to reliable and resilient electricity infrastructure in LAC, as well as part of 65 million part of 65 million underserved users.[81,82]

More concretely, the IDB estimates that off-grid systems would be the best fit solution to address at least 40% of the electricity access gap in LAC. Out of those, 30% would be mini-grids and the remaining 70% would consist of standalone systems.[83]

1.1.3. POWER SUPPLY

The LAC region has the cleanest energy mix in the world due to its vast resources for power generation from renewable energy, with the potential to meet 22 times global electricity needs.[84]

77 World Bank, Employment in Agriculture (% of total employment), 2019 [online]

78 FAO, FAOSTAT, 2019

79 World Bank, Agriculture, forestry and fishing value added (% of GDP), 2019 [online]

80 World Bank, Agriculture, forestry and fishing value added (% of GDP), 2019 [online]

81 Heinrich Böll Stiftung, Panorama de la situación energética en América Latina, 2020 [online]

82 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 8

83 IDB & OLADE, Energy Access and Affordability Voluntary Action Plan for Latin America and the Caribbean, 2018: page 6

84 UNEP, Zero Carbon: The opportunity, cost and benefits of the coupled decarbonization of the power and transport sectors in Latin America and the Caribbean, 2020: page 25

Hydropower is abundant all-around LAC, while exceptional hotspots for renewable energy generation can be found in Atacama and Sonora-Chihuahua for solar energy, Patagonia, Atlantic Coast of South America, Isthmus of Tehuantepec and the Guajira Peninsula for wind power, the southern pacific coast of South America for marine energy and the Andes for geothermal.[85]

LAC's regional energy mix is characterised by a substantial share of renewable energy, currently making up to 56% (200 GW) of its power generation capacity.[86] This is mainly due to the predominant role of hydropower (44.7%; 196,584 MW) in LAC's electricity generation capacity, followed by wind (6.5%; 28,600 MW), thermal (4.6%; 20,425 MW), solar (3.1%; 13,515 MW) and geothermal (0.4%; 1,681 MW) amongst other. According to recent data, LAC generated 1,596 TWh of electricity in 2019 alone —5.9% of the total in the world.[87]

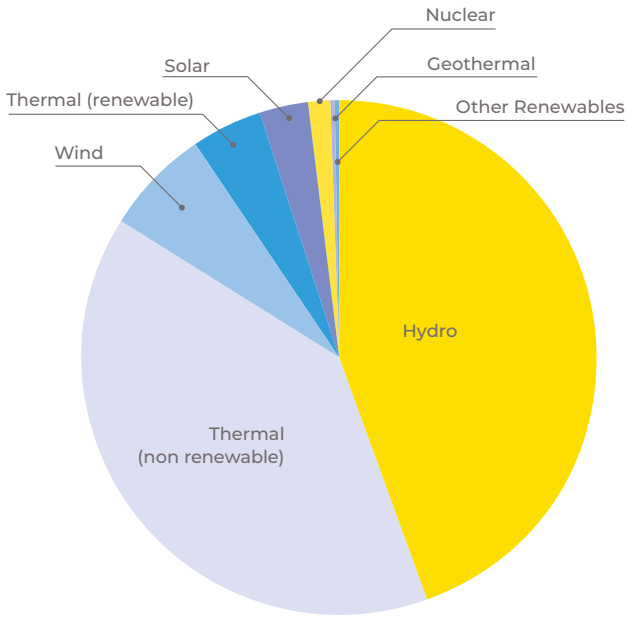

Figure 13. Installed generation capacity in LAC[88]

Furthermore, concerns over energy security, climate change impacts in hydropower generation and unequal socioeconomic development have propelled a positive trend towards cleaner, more resilient and diversified power systems. This trend has been stimulated by an investment flow of USD 35 billion, 44% of it coming from international investors, allocated to non-conventional renewable energy sources over the last five years, as well as robust renewable energy policies and well-structured auctions in Mexico, Brazil, Chile and Argentina.

Those four countries already hold a place in the Renewable Energy Country Attractiveness Index (RECAI)[89] and have accounted for 70% of the investments received in the region. In

85 Idem

86 IRENA, Regional Action Plan: Accelerating Renewable Energy Deployment in Latin America, 2020: page 1

87 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 50

88 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 50

89 EY, Renewable Energy Country Attractiveness Country, 2021 [online]

addition, other countries such as Colombia, El Salvador and Dominican Republic have put in place regulatory frameworks that allowed them to start attracting foreign investment since 2018.[90]

The positive trend above has also been driven by a sharp 80% decrease in auctioned prices for non-conventional renewable energy sources, notably solar PV and wind, between 2013 and 2019, even lower than the levelised cost of electricity of new fossil fuel projects in some countries. Good examples are solar PV prices in Chile, Colombia, Ecuador, Guatemala, Haiti and Uruguay, as well as wind prices in Argentina, Brazil, Mexico, Panama and Peru.[91] Falling prices have in turn resulted in a 400% increase in the installed generation capacity of wind sources and a 29,000% increase in the case of solar PV since 2012. Today, the combined installed capacity of both renewable energy types stands at 50 GW.[92]

Favourable regulatory policy frameworks, increased investments and declining renewable energy prices are also starting to pave the way for decentralised renewable energy (DRE) systems to play an important role in the LAC market.[93] DRE systems already have a strong presence in Brazil, Chile, Mexico and El Salvador. Other countries represented in figure 14, as well as Colombia and Peru, are implementing a series of reforms and nation-wide programmes to accelerate the integration of DRE systems, explained in the next section.

Country	Installed generation capacity (MW)	Systems installed (n_o)
Brazil	3,388.00	268,504
Mexico	965.00	130,000
Dominican Republic	120.00	-
Peru	117	-
Chile	52.00	6,000
Costa Rica	54.00	2,000
El Salvador	43.00	38
Panama	37.10	893
Guatemala	25.00	3,600
Uruguay	21.00	700
Argentina	1.90	193

Figure 14. Overview of countries leading on the adoption of DRE systems[94, 95, 96, 97]

As the electricity market evolves, the presence of DRE systems in the region's electricity mix is expected to increase significantly, based on the high number of projects that are already

90 UNEP, Zero Carbon: The opportunity, cost and benefits of the coupled decarbonization of the power and transport sectors in Latin America and the Caribbean, 2020: page 25

91 Idem: page 27

92 Idem: page 25, 26

93 Idem: page 25, 26

94 Energía Estratégica, Datos por país: En todos los mercados latinoamericanos crece la generación distribuida, 2020 [online]

95 IRENA, Evaluación del Estado de Preparación de las Energías Renovables. El Salvador, 2020: page 43

96 PTE, TRANSFORMA. Boletín Informativo: Proyecto Transición Energética (4). 2019: page 12

97 capevLAC, Generación Distribuida en Latinoamérica, 2020 [online]

underway.[98] This includes DRE systems in isolated areas disconnected from the national grid (off-grid systems).

National governments will also be key in accelerating the off-grid renewable electricity transition, from ensuring adequate policy and regulatory frameworks to the allocation of national resources as part of electricity access and rural development programmes that can attract further resources from international investors.

1.2. Enabling environment

LAC electricity markets are characterised by a relatively large participation of different private actors spread across a diversified electricity value chain, although state-owned companies still play a major role. The current structure of the market originated in the 1990s, as an attempt of LAC governments to address the electricity needs that the public sector, highly indebted after the financial crisis in the 1980s, was unable to meet.

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To do this, the governments initiated a process of privatisation and decentralisation of the electricity supply chain which attracted a significant amount of private capital. As a consequence, many state-owned utilities were divided into different companies within three main activities in the electricity market: generation, transmission and distribution.[99]

Between 1984 and 2011, the largest share of private capital within the average fixed capital formation for electricity infrastructure was found in Nicaragua (90%), while the lowest amount was shown in Mexico (10%) as well as Costa Rica, Ecuador, Paraguay and Uruguay, who did not implement liberalisation measures.[100] Nowadays, the majority of new generation capacity added to the electricity system is done through renewable energy auctions and long-term contracts.[101]

The structural changes in the electricity sector had a beneficial effect in terms of energy efficiency and quality, however they raised some concerns over the electricity coverage and the final price offered by the electricity companies to end consumers. This is partially explained by the fact that national utilities have a tendency to focus on urban markets, with

98 Energía Estratégica, Datos por país: En todos los mercados latinoamericanos crece la generación distribuida, 2020 [online]

99 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 15-19

100 IDB, Privatization, Institutional Reform, and Performance in the Latin American Electricity Sector, 2013: page 7-8

101 IDB, Avances en el diseño de políticas y marcos regulatorios para las energías renovables en América Latina y el Caribe para Generación Distribuida, 2019: page 5-7

higher income-levels, consumption capacity and lower electrification costs, thus leaving a significant proportion of rural areas un-electrified.[102]

In recent years, higher GDP figures and a more equal distribution of economic resources, alongside robust policy and regulatory frameworks and the extension of electricity infrastructure, have been key in powering LAC's sustainable path towards universal electricity access.[103] However, electrification rates have slowed down and there is a persistent access gap in last-mile communities, besides the affordability challenges previously explained.

Electrification rates have slowed down and there is a persistent access gap in last-mile communities

Generally speaking, the most effective measures adopted by LAC governments have consisted of:

- Subsidies and cross-subsidies (higher tariffs for users above a certain consumption threshold and lower tariffs for low-income users);
- Creation of a regulatory body with competencies over electricity tariffs, subsidies and quality standards;
- Public Private Partnership (PPP) agreements with private actors and international funding institutions;
- Community-inclusive business models to guarantee the operations and maintenance (O&M) of the off-grid systems installed in remote communities.

Other concrete measures decided by LAC governments include:

- Laws and amendments to set specific off-grid renewable targets for power companies;
- Provision of tax incentives to high-quality products
- Establishment of feed-in tariffs;
- Establishment of national quality standards for electricity components;
- Reduction of bureaucracy, procedure times and requirements for small off-grid projects.

Recent regulatory examples of countries that have made an outstanding progress in this regard are:

- Argentina (Law 27424-2017, 2017);
- Bolivia (Supreme Decree 4477, 2021);

102 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 15-19

103 Idem: page 8, 9

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- Chile (Law 21118, 2018);
- Colombia (Law 1715, 2014 and resolution 038, 2018);
- Dominican Republic (Law 57-07, 2020);
- Peru (Law N° 28749, 2016 and supreme decree N° 018-2020-EM, 2020).

In addition, Guatemala has recently published a good example of well-structured guidelines for the development of renewable energy off-grid projects.

Guatemala's "Plan Indicativo de Electrificación Rural 2020-2050" contains a straightforward methodology to select rural communities in need of electricity and the technical requirements of the solutions to be installed. The Plan also defines the key responsibilities for all the partners involved, provides clear guidance on the systematised procedure to follow and indicates the financing mechanisms available.[104]

Another positive sign that governments are increasingly supporting the adoption of decentralised electricity models is the number of countries that have passed net metering/net billing laws, specifically designed for residential users and small businesses —from two in 2010[105] to 17 in 2018.[106]

Such laws can significantly reduce the risks posed by grid extension to isolated systems, especially when combined with a clear framework in case that happens. Furthermore, they can unleash the potential of DRE systems to cover the affordability gap in electrified yet low-income areas, as they allow electricity users to offset their electricity costs with their own electricity generation from interconnected systems.

As a result, net metering/net billing laws can bring good prospects for the growing adoption of DRE systems, particularly solar and wind based. However, it is important to stress that the actual deployment of advanced metering infrastructure remains an important challenge particularly amongst state-owned utilities.[107]

Countries that have already integrated net-metering mechanisms at national level are: Argentina, Bahamas, Barbados, Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Dominican Republic, Suriname and Uruguay.[108]

104 Gobierno de Guatemala, Plan Indicativo de Electrificación Rural 2020 - 2050, 2020

105 UNEP, Zero Carbon: The opportunity, cost and benefits of the coupled decarbonization of the power and transport sectors in Latin America and the Caribbean, 2020: page 30

106 IDB, Avances en el diseño de políticas y marcos regulatorios para las energías renovables en América Latina y el Caribe para Generación Distribuida, 2019: page 14

107 IDB, Cómo Consumen Energía los Hogares? Evidencia de América Latina y el Caribe, 2020: page 97

108 IDB, Avances en el diseño de políticas y marcos regulatorios para las energías renovables en América Latina y el Caribe para Generación Distribuida, 2019: page 20

Naturally and as previously mentioned in the supply section, the advantageous policy and regulatory environment facilitated by the measures above has materialised in an increasing number of national rural electrification plans and projects, and it is attracting significant international attention.

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Figure 15 shows examples of relevant projects undertaken by different LAC countries leading on the adoption off-grid electricity systems (see Figure 14).

Such plans and projects are a solid proof that LAC policymakers have started to recognise the value of off-grid renewable energy solutions to improve energy security, close their persistent electricity access gap and propel inclusive economic growth and job creation at local and thus national scale.[109]

While national plans are a decisive first step to institutionalise universal electricity access, they should also integrate specific policy measures and regulations to facilitate the deployment of off-grid renewable energy solutions. Such measures could be based on experiences around private sector driven models from other regions, as illustrated by the recently launched "Clean Energy Mini-Grid Policy Development Guide",[110] co-developed by ARE, UNIDO, INENSUS, AfDB Green Mini-Grid Help Desk and AMDA. In this regard, ARE and the IDB are keen to work hand in hand with governments to implement such schemes.

Country	Programme	Duration (years)
Argentina	Proyecto de Energías Renovables en Mercados Rurales (PERMER)	2000 - present
Bolivia	Programa Electricidad para Vivir con Dignidad (PEVD)	2008 - 2023
Brazil	Brazilian Programme for Rural Electrification Using Photovoltaics (PRODEEM)	1994 -2003
Chile	Programa Energización Rural y Social	2020 - present
Colombia	Rural Electrification National Plan	2019 - 2031
Haiti	Haiti Renewable Energy for All Project	2018 - 2024
Honduras	Programa Nacional de Electrificación Rural y Social	2005
Suriname	Support to Improve Sustainability of the Electricity Service	2016 - 2019
Nicaragua	National Program for Sustainable Electrification and Renewable Energy (PNESER)	2012 - 2016
Guatemala	Plan Indicativo de Electrificación Rural	2020 - 2032
Peru	National Rural Electrification Plan (PNER)	2016 - 2025
Ecuador	Energy Master Plan (PME)	2016 - 2025
Mexico	Estrategia Nacional de Energía	2013 - 2027

Figure 15. Examples of major electricity access programmes in LAC countries

109 IRENA, REGIONAL ACTION PLAN: ACCELERATING RENEWABLE ENERGY DEPLOYMENT IN LATIN AMERICA, 2020: page 2

110 AfDB GMG Help Desk, ARE, AMDA, INENSUS & UNIDO, Clean Energy Mini-Grid Policy Development Guide, 2021

The regulatory and policy advances mentioned above have created an improved environment for international investors and fostered the creation of funding mechanisms to support LAC countries in their electrification efforts.

If structured well, national programmes and funds provide a great opportunity for project developers and private investors to engage in rural electrification projects in the region, notably through PPPs, leverage public funding, improve energy efficiency and guarantee O&M services throughout the lifetime of the off-grid renewable energy systems.[111]

In addition, international funding partners can play a critical role in supporting national and regional electrification efforts. Figure 16 illustrates ongoing funding opportunities supported by international funding institutions that constitute valuable opportunities for project developers and investors to enter the LAC off-grid renewable energy market.

Country	Funding mechanism	Leading entities	Financial instrument
LAC	Caribbean Energy Security Initiative (CESI)	USAID, USTDA, OPIC, DFC	Grant, debt, guarantees, political risk insurance
LAC	Scaling-up Renewable Energy in Low Income Countries Program (SREP)	CIF	Grants, guarantees, concessional and contingency debt, equity
Latin America	Latin America Investment Facility (LAIF)	EIB, AFD, AECID, KfW, COFIDES, CABEI, IDB, CAF, World Bank	Grants, debt, equity and guarantees
Caribbean	Caribbean Investment Facility (CIF)	EIB, AFD, CBD, World Bank, DFID, JICA	Grants, debt, equity and guarantees
Brazil, Colombia	MGM Sustainable Energy Fund II (MSEF II)	BIO	Equity, quasi-equity and mezzanine project finance

Figure 16. Major funding mechanisms in the region led by international funding partners[112, 113, 114, 115, 116]

111 IDB & OLADE, Energy Access and Affordability Voluntary Action Plan for Latin America and the Caribbean, 2018: page 7

112 U.S. Department of State, Caribbean Energy Security Initiative (CESI), 2021 [online]

113 CIF, Our Work, 2018 [online]

114 LAIF, About LAIF, 2021 [online]

115 CIF, About CIF, 2021 [online]

116 BIO, MSEF II, 2019 [online]

Country	Funding mechanism
Argentina	Fondo para la Generación Distribuida de Energías Renovables (FODIS)
Brazil	Conta de Desenvolvimento Energético (CDE)
Chile	Fondo de Acceso Energético
Colombia	Fondo de Apoyo Financiero para la Energización de las Zonas Rurales Interconectadas (FAER)
	Fondo de Apoyo Financiero para la Energización de las Zonas No Interconectadas (FAZNI)
Ecuador	Rural Electrification Fund (FERUM)
Haiti	Off-Grid Electricity Fund (OGEF)
Honduras	Honduras Renewable Energy Financing Facility (H-REFF)
Mexico	Fondo para la transición energética y el aprovechamiento sustentable de la energía (FOTEASE)
	Fondo de Servicio Universal Eléctrico (FSUE)
Peru	Fondo Nacional de Electrificación Rural (FONER)

Fiigure 17. Examples of funding mechanisms in the region led by LAC governments[117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127]

1.3. Main challenges and recommendations for LAC governments and international funding partners to scale up the participation of private off-grid companies and international investors

The LAC region has experienced a rapid, positive transition towards electricity access since the 1990's, however electrification rates have slowed down due to socioeconomic, technical and geographical challenges posed by last-mile communities in rural areas. Furthermore, the affordability and reliability of the national grid remain outstanding barriers that current policy efforts do not seem to fully address.

As previously mentioned, off-grid renewable energy systems can bring a promising future to address those challenges due to their high flexibility and cost-efficiency, allowing them to serve hardest-to-reach communities and end user pockets. However, for off-grid electricity solutions to get deployed, governments need to ensure a stable and attractive environment for project developers and investors to operate.

117 Gobierno de Argentina, Generación Distribuida de Energías Renovables, Beneficios Promocionales, 2021 [online]

118 Câmara de Comercialização de Energia Elétrica, Conta de Desenvolvimento Energético, 2021 [online]

119 Gobierno de Chile, Ministerio de Energía, BIPS, Fondo de Acceso Energético, 2021 [online]

120 Gobierno de Colombia, Ministerio de Minas y Energía, Fondo de Apoyo Financiero Para la Energización de las Zonas Rurales Interconectadas - FAER, 2021 [online]

121 Gobierno de Colombia, Ministerio de Minas y Energía, Fondo de apoyo Financiero para la Energización de las Zonas no Interconectadas - FAZNI, 2021 [online]

122 Gobierno de Ecuador, Ministerio de Energía y Recursos Naturales no Renovables, Fondo de electrificación rural y urbano marginal (FERUM), 2021 [online]

123 OGEF, Accueil, 2021 [online]

124 Deetken Impact Sustainable Energy, Sustainable Energy, 2019 [online]

125 Gobierno de México, Secretaría de Energía, Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía, 2021 [online]

126 Gobierno de México, Secretaría de Energía, El Fondo de Servicio Universal Eléctrico (FSUE), tiene como objetivo alcanzar para 2018 el 99 por ciento de la cobertura eléctrica nacional, 2017 [online]

127 Gobierno de Perú, Ministerio de Energía y Minas, Manuales del FONER II / FONER I, 2021 [online]

The solutions to electricity access implemented by LAC member states are as heterogeneous as the specific challenges of each country. All in all, LAC countries present four defined profiles of electricity access that require different approaches to achieve universal electricity access.[128]

Income	Electricity coverage	Country examples	Top priority challenge
High	High	Argentina, Brazil and Mexico	Need to institutionalise electricity access programmes
Middle	High	Colombia and Panama	Need to deploy innovative solutions for last-mile communities
Middle	Middle-low	Guatemala, Honduras and Peru	Large socioeconomic challenges; need to improve policy and regulatory frameworks further
Low	High	Many Caribbean island states	High dependence on fossil fuels; poor reliability of the grid
Low	Low	Haiti	Need to develop basic policy frameworks, institutions and infrastructure
		All countries	Difficulty to mobilise own resources for rural electrification; inclusion of private actors in the off-grid renewable energy market, especially in last-mile electrification

Figure 18. Challenges for selected LAC countries[129]

Countries like Argentina and Brazil have managed to implement successful government-led electrification initiatives, such as PERMER and Light for All. However, coordination between rural electrification actors could be improved to avoid the overlap of projects, thus increasing their impact and efficiency.

The main challenge is to systematise rural electrification projects under an overarching national, multi-annual plan. Such a plan can serve as a central pillar to coordinate electricity access efforts between national and international actors and allow for the design of tailored policies and regulations to attract private off-grid companies that are particularly needed to electrify last-mile communities.

Similarly, Colombia and Panama have also achieved a high electrification rate through the implementation of ambitious electrification plans and policy and regulatory frameworks, but the electrification of last-mile communities remains a core challenge in these countries. Thus, a key priority could be to incentivise innovation and best practices amongst off-grid renewable energy companies to support their electrification activities in hardest-to-reach communities.

On the other hand, electricity access progress in countries like Honduras, Guatemala and Peru is constrained by serious socioeconomic challenges and it will require strong support

128 Idem: page 5, 6

129 Based on IDB & OLADE, Energy Access and Affordability Voluntary Action Plan for Latin America and the Caribbean, 2018: page 5, 6

The difficulty to mobilise national resources and the lack of private actors in the off-grid renewable energy market are two challenges shared by all countries

from international funding institutions to leverage their public funding and increase private participation in the electricity market. Those countries have started to build an enabling environment for international funding institutions, private off-grid renewable energy developers and investors to bring in their experience on last-mile electrification through cost-efficient business models.

For many small island states, typically in the Caribbean, the main challenge is posed by inefficient and unreliable energy systems, either national electricity grid or diesel generators, which are heavily dependent on fossil fuels and thus extremely sensitive to market shocks and natural disasters. As a result, the top priority is to increase the share of renewably energy, reliability and resilience of their energy system, especially against extreme weather events.

In addition, Haiti is often depicted as a case of its own, since the country gathers all the urgent needs of the previous groups and it will require significant international support, both in terms of financial resources and capacity building to build a robust institutional framework and basic infrastructure.

Finally, the difficulty to mobilise national resources for rural electrification and the subsequent lack of private actors in the off-grid renewable energy market are two strong challenges shared by all countries.

Nevertheless, research on the LAC context, as well as on other regions such as South-East Asia and Sub-Saharan Africa, shows that some common policy and regulatory requirements are essential to achieve universal electricity access in the region. With this in mind, ARE and IDB are keen to work with national governments to help them overcome the issues of last-mile electrification, as demonstrated by previous ARE-led capacity building activities[130] as well as the IDB Energy Sector Framework.[131]

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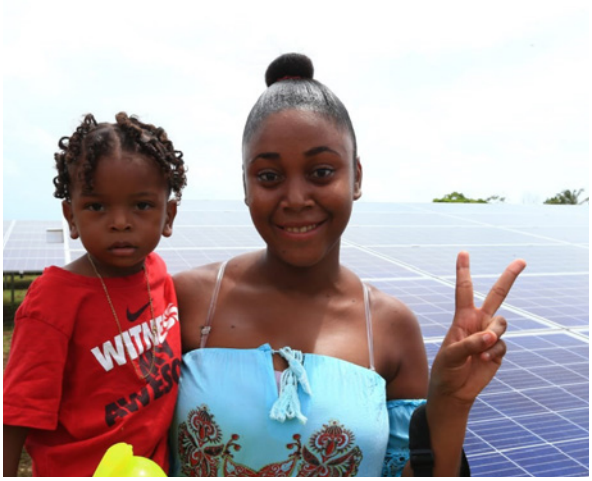
130 ARE, ARE Project Portfolio, 2020

131 IDB, Energy Sector Framework Document, 2018

1.3.1. SOCIOECONOMIC CHALLENGES AND RECOMMENDATIONS

Electricity access is closely related to the historical social and economic context of LAC countries. For instance, poverty levels, race and gender, lack of industrialisation and modernisation of economic sectors, difficult access to finance and productive appliances, as well as a subsequent dependence on old, unproductive practices have a large impact in electricity access rates.



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For this reason, **support schemes for electricity access should look beyond basic last-mile electrification and include local socioeconomic goals** as a central element to guarantee the affordability and sustainability of the off-grid electricity systems. Long-term, positive socioeconomic impact of electrification programmes, implemented by off-grid private sector, can also be enhanced through:

- Inclusive electrification programmes that focus on **scaling up income-generating activities** via PURE, the provision of market linkage and capacity building support for local actors (i.e. end users, small entrepreneurs, and local distributors). Bottom-up approaches involving the main beneficiaries in the decision-making process have demonstrated to increase the sustainability of the electrification projects significantly.[132]
- **Specific capacity building and access to finance support addressed to empowering women and ethnic minorities** (i.e. indigenous and afro-descendants), boosting local productivity and implementation capacity. [133]
- Market and capacity building support is needed where communities often lack basic distribution networks and the capacity to operate and maintain the off-grid renewable energy systems. Focus on **strengthening or building those networks and developing local human capital for the O&M of the systems** needs to be considered. This in turn creates skilled local employment. Local operators can not only expand the lifetime of the off-grid solution in place, but also build and safeguard community trust.
- In addition, case studies have shown the strategic advantage of **creating local "user service centres"**, as well as **involving local authorities in the consumer outreach efforts** to support the off-grid companies in reaching a wider audience and managing community expectations.[134]
- Ensuring financial viability for small entrepreneurs to access productive use equipment, efficient appliances and to afford electricity. This may include governments and international funding partners providing **guarantees to local micro finance institutions (MFIs) to stimulate micro loans** for small entrepreneurs and to **promote flexible**

132 ARE, Access to Energy Services through Renewable Sources in Latin America & The Caribbean, 2017

133 ARE, Women Entrepreneurs as Key Drivers in the Decentralised Renewable Energy Sector: Best Practices and Innovative Business Models, 2020

134 IDB, Sustainable Energy Distribution in Latin America: Study on Inclusive Distribution Networks, 2016: page 13-15

payment methods. A good example was the Microcredit Programme managed by the "Fondo de Desarrollo del Sistema Financiero y de Apoyo al sector" (FONDESIF), to stimulate MFIs issue credits to small productive entrepreneurs in rural areas of Bolivia.[135]

- **Energy efficiency programmes**, partially supported by international funding institutions, can cover the cost of efficient appliances powered by off-grid renewable energy and increase end-user capacity to afford productive and cost-efficient machinery. In addition, international funding institutions could build on lessons learnt from other regions in the world to encourage the **implementation of alternative business models tailored to specific LAC contexts**, such as ABC and micro-franchising, barely explored in the region.
- **Promoting the diversification of rural economies powered by reliable electricity from off-grid renewable energy solutions.** Often, rural economies depend entirely on subsistence agriculture and are thus highly sensitive to market shocks. Off-grid renewable energy solutions can power complimentary activities within the agri-food chain, such as food processing and retailing, as well as other sectors with high economic potential potential. Promising sectors could include tourism, hospitality, craft-making, carpentry and small-scale textile, depending on the context.

1.3.2. POLICY & REGULATORY CHALLENGES AND RECOMMENDATIONS

A major challenge for the smooth participation of international funding institutions, private companies and investors in the LAC electricity market, is the heterogeneity of policy and regulatory frameworks within the electricity sector, together with often limited, concrete policies to incentivise private sector driven off-grid renewable energy electrification in last-mile communities.

A significant step towards setting a common strategy to achieve SDG-7 was made in 2019 at COP 25, where 10 LAC countries committed to the ambitious goal of attaining 70% of renewable energy within their installed generation capacity for electric power (320 GW) by 2030. However, much more work needs to be done to accelerate the participation of private off-grid renewable energy companies and investors into the LAC electricity market and speed up electrification efforts.

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In addition, electricity regulation in most LAC countries 'only' obliges utility companies to connect end-users that are not farther than 100-200 km away from the national grid. Yet, even if governments increased the distance required, extending the national grid to last-mile communities has been in many cases proven an inefficient and expensive task and it does not necessarily address the reliability nor the affordability problem.

While off-grid renewable energy companies are best placed to overcome the challenges in last-mile com-

135 OLADE, ACDI & University of Calgary, Diagnóstico del Sector Energético en el Área Rural de Bolivia. Proyecto: Electrificación Rural, 2005: page 125

munities, only a few of them operate in the region due to market barriers. Challenges vary country by country but may include unfair competition with the national grid tariffs, licensing restrictions, unclear guidelines for grid extension, complex bureaucracy, as well as limited quality standards for off-grid renewable energy technology.

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For instance, governments may have a preference to support a specific technology, as well as companies that are already established in the market. Furthermore, lengthy bureaucratic processes and high licensing requirements tend to favor the participation of big utility companies and can make it more difficult for small companies to enter or scale up within the market.

In particular, policies and regulations can thus be enhanced through:

- **A well-defined regulatory framework for off-grid electricity generation, transmission and distribution that allows further participation from the private sector**. That could include fee-for-service concessions and cross-subsidy schemes, guidelines for the possible integration of off-grid renewable energy systems with the national grid combined with a well-defined compensation mechanism for off-grid renewable energy companies in case of grid arrival and in case that the integration of the off-grid renewable energy system with the national grid is not possible, as well as cost-reflective tariffs for off-grid developers and operators.
- The framework should also **consider simplified bureaucracy for small-scale off-grid projects, while reducing licensing requirements for SMEs**. This may also include a reform of subsidy schemes to include electricity generated from off-grid renewable sources and modernising the criteria to grant such subsidies. Governments are advised to work together with ARE and the IDB on the development of these frameworks, based on international best practices.
- It is also essential that governments **implement quality infrastructure and quality assurance frameworks**, including technical and quality standards for off-grid technologies and the services provided to protect the market, ensure customer trust and overcome major reliability problems in the region. Inspiration could be drawn from Dominican Republic (CNE certification of equipment) and Peru (OSINERGMIN 686-2008-OS/CD), as well as international best practices.
- Implementation of country-tailored, holistic national plans can accelerate the electrification process extraordinarily. As in the case of Argentina and Brazil highlighted above, a multi-annual national plan can help streamline electricity access efforts and improve coordination between national and local government agencies, as well as international actors, to avoid duplication and increase efficiency. Thus, governments should **define a clear electricity access national plan/strategy with specific objectives and annual targets**, within which specific off-grid regulations and electrification programmes shall be placed. Governments are encouraged to get inspiration from

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the Clean Energy Mini-Grid Policy Development Guide, as well as its contract templates, to define their strategy and objectives.[136]

National plans should **build a bridge between complimentary policies and ministries**, as opposed to isolated energy plans. For instance, a combination of education, health, entrepreneurship and economic development, gender and ethnic equality, together with electricity access objectives, could be fundamental to address historical socioeconomic constraints and ensure the sustainability of the electrification projects.

- **Strengthening or establishing Renewable Energy and Energy Efficiency Hubs/Centres in charge of setting common goals and priorities according to regional contexts** —notably on electricity access— should be a priority. Additionally, capacity building for national governments to meet these goals could be offered. These hubs and their programmes can be designed and implemented in partnership with ARE, which has extensive experience in bringing in industry stakeholders and private investors, international best practices and capacity building experts.

  In partnership with ARE and the IDB, the sub-regional hubs can also help unlock further resources from international funding institutions to complement their own allocated resources, facilitate knowledge exchanges between national renewable energy associations in LAC and other regions, and streamline data collection and monitoring.

- LAC governments are encouraged to **remain renewable energy techology agnostic and support local off-grid companies to design and implement the best solution to fit contextual electricity needs.** Flexible or modular technologies as well as digital and space-based solutions should be prioritised to scale up electricity demand, improve efficiency and increase impact.

1.3.3. FINANCIAL CHALLENGES AND RECOMMENDATIONS

Some LAC governments have established a national fund for rural electrification or electricity access projects. However, a common problem is that such funds are often not structured to incentivise the participation of private capital in rural electrification projects.

In particular, financial challenges can be addressed through the recommendations below:

- Where not already done, governments could **set up national funds for rural electrification specifically structured to attract private investment.**
- Similarly, international funding institutions could **create or strengthen sub-regional finance facilities** with an increased pool of available resources allocated for **risk mitigation mechanisms to support national funds.** International funding partners

136 AfDB, ARE, AMDA, GMG Help Desk, INENSUS, UNIDO, Clean Energy Mini-Grid Policy Development Guide, 2020

could do this by providing guarantees and by diversifying available funds from different sources.

- Building on the national funds and the financial facilities, governments, international funding partners and others could offer a vast array of **low-risk, smart financial instruments for off-grid renewable energy companies** with private investor participation, such as smart grants, concessional loans and results-based financing, through PPPs.

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In addition to risk diversification and engagement with private international investors, **PPPs are also helpful in increasing competitivity** amongst off-grid investee companies and in **attracting international companies** with transferable experience on innovative technologies and business models from other regions. For instance, fee-for-service concessional agreements can successfully address barriers around up-front costs of mini-grids and improve their technical sustainability, while private-led PAYGo business models have enabled the massive deployment of standalone systems in Africa.

- In addition to the abovementioned national electrification plans, encompassing both grid extension/densification and off-grid electrification approaches, governments should **enact conducive, long-term concession agreements as well as tariff methodologies for off-grid renewable energy companies**, enabling private investors and developers to assess the opportunities, bolster their project planning and mitigate financial risk (i.e. in the case of unclarity on what would happen if the grid arrives where there is already a mini-grid).

1.3.4. KNOWLEDGE & CAPACITY CHALLENGES AND RECOMMENDATIONS

The knowledge and capacity gaps amongst regional and international actors in the LAC electricity market underpin most of the challenges presented in this document.

For instance, project risks are exacerbated by the lack of knowledge of local off-grid renewable energy companies on the latest digital, technology and business models innovations in the off-grid renewable energy market.

Meanwhile, governments might be unsure about how to develop effective policies and regulations to support the off-grid electricity market, how to develop quality assurance frameworks for off-grid renewable energy electrification, how to unlock specific funding for off-grid renewable energy projects and how to implement PPA contracts that suit their national context.

In addition, language barriers and lack of communication at the international level can lead to a knowledge gap amongst international project developers and investors regarding potential business and investment opportunities in the LAC off-grid sector.

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The knowledge gaps above are further aggravated by insufficient coordinated efforts for data collection at local, national and regional level, which are essential to design effective electricity access plans and policies, as well as to attract off-grid renewable energy companies and private investors to the market.

For instance, there is little impact data available on how off-grid renewable energy solutions enhance productive uses, reduce inequalities, scale up local economic activities and increase electricity demand.

Other important data that is missing is the contribution of off-grid systems to mitigate climate change, reduce poverty and offer sustainable electricity services, while decreasing the number of power outages, improving the quality of the electricity service and increasing resiliency, particularly regarding, but not limited to, natural disasters.

Altogether, knowledge and capacity gaps can be addressed as follows:

- **International business associations and funding institutions, could facilitate the exchange of lessons learnt and capacity building**, enabling strategic communications between stakeholders in LAC and from other regions.

  ARE has a wealth of experience in capacity building for policymakers across the world, particularly on rural electrification policy design,[137] tariff-setting, contracting, financing and business models for off-grid systems,[138] quality assurance frameworks for off-grid renewable energy, as well as supporting off-grid renewable energy companies to access the best available knowledge and funding around the globe.

- ARE, in partnership with the IDB, LAC governments and international funding partners, should coordinate the development of an **accurate methodology for data collection, and encourage data collection in electricity access projects** from off-grid renewable energy companies, investors and local authorities.

  Afterwards, such data should be centralised and accessible to all stakeholders with an interest in the LAC market. An outstanding example is the Energy Hub from the IDB, which aims at creating a public platform with relevant data from the energy sector across the region that can serve decision making processes in the market. However, the platform is still relatively new, and it still requires significant coordinated efforts for data collection and sharing between different actors within the energy sector.

- Finally, international funding partners and governments should **promote innovative digital technologies** that are key to support their data collection processes, fill knowledge gaps and simplify electrification efforts.

137 AfDB, ARE, AMDA, GMG Help Desk, INENSUS, UNIDO, Clean Energy Mini-Grid Policy Development Guide, 2020

138 ARE, ARE Project Portfolio, 2020

For instance, space-based technologies and demand forecasting programmes can significantly help local and international project developers to identify suitable sites for off-grid electrification, as well as the best business model and technology to serve them.

Similarly, remote monitoring and mobile-based payment solutions can help off-grid renewable energy operators map current electricity consumption and identify opportunities to scale up end-user demand via PURE, reduce risk by estimating end-user payment and credit profiles and obtain data on the performance and suitability of the systems in place.[139]

International funding partners and governments could promote innovation in and uptake of off-grid digital technologies by launching calls for innovation, including digital innovation as key selection criteria in tenders and investment portfolios and collaborating with local universities.

Challenge	Recommendation	Stakeholder
Socioeconomic		
Historical socioeconomic constraints	Include local socioeconomic goals beyond basic last-mile electrification	International funding institutions; governments
	Promote inclusive electrification approaches with a focus on scaling up income-generating activities	
	Provide capacity building and access to finance support addressed to empowering women and ethnic minorities	
Lack of basic distribution networks and capacity at the local level	Strengthen or build local distribution networks	International funding institutions; governments
	Develop local human capital for the O&M of the off-grid renewable energy systems	
	Create local user service centres and involve local authorities in consumer outreach efforts	

139 ARE, Private Sector Driven Business Models for Clean Energy Mini-Grids: Lessons Learnt from South and South-East-Asia, 2019: page 8

Challenge	Recommendation	Stakeholder
Limited resources to access productive use equipment, efficient appliances and to afford electricity	Provide guarantees to local MFIs to stimulate micro loans for small entrepreneurs and to promote flexible payment methods	International funding institutions; governments
	Implement energy efficiency programmes to cover the cost of productive and efficient appliances powered by off-grid renewable energy	
	Encourage the implementation of alternative business models tailored to specific LAC contexts	International funding institutions
Local economies strongly dependent on subsistence agriculture	Promote the diversification of local economies powered by reliable electricity from off-grid solutions	International funding institutions; governments
Policy & regulatory framework		
Lack of concrete policies to incentivise private sector driven off-grid renewable energy electrification in last-mile communities	Establish a well-defined regulatory framework for off-grid electricity generation, transmission and distribution that allows further participation from the private sector	Governments
	Implement quality infrastructure and quality assurance frameworks for off-grid technologies and services	
Need for stronger coordination between rural electrification actors and for a systematic approach to electrification projects at national and regional level	Define a clear electricity access national plan/strategy with nexus objectives and annual targets across complimentary policies and ministries	Governments
	Strengthen or establish Renewable Energy and Energy Efficiency Hubs/Centres in charge of setting common goals and priorities according to regional contexts	International funding institutions
Public tendency to support a specific technology and companies	Remain renewable energy technology agnostic and support local off-grid companies to design and implement the best solution to fit contextual electricity needs	Governments
Financial		
National funds not structured to incentivise the participation of private capital	Set up national funds for rural electrification and electricity access specifically structured to attract private investment	Governments
	Create or strengthen sub-regional finance facilities with a pool of resources allocated for risk mitigation mechanisms to support national funds.	International funding institutions
	Offer a low-risk, smart financial instruments to off-grid companies (i.e. smart grants, concessional loans and results-based financing), through PPPs	International funding institutions; governments
	Enact conducive, long-term concession agreements as well as tariff methodologies for off-grid renewable energy companies	Governments
Knowledge & capacity		

Challenge	Recommendation	Stakeholder
Lack of knowledge from local off-grid companies on digital, technology and business models innovations	Facilitate the exchange of lessons learnt and capacity building and enable strategic communications between stakeholders in LAC and from other regions	International business associations; international funding institutions
Lack of knowledge from local governments on effective policies and regulations to support the off-grid electricity market and unlock funding		
Lack of knowledge from international project developers and investors on potential business and investment opportunities in the LAC off-grid sector		
Insufficient coordination efforts for data collection at local, national and regional level	Develop an accurate methodology for data collection and encourage data collection in electricity access projects	International business associations; international funding institutions; governments
	Promote innovative digital technologies to support data collection, fill knowledge gaps and simplify electrification efforts	International funding institutions; governments

Figure 19. Overview of main challenges and recommendations

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2 Status of the off-grid renewable energy market in Haiti

2. STATUS OF THE OFF-GRID RENEWABLE ENERGY MARKET IN HAITI

IN A NUTSHELL – HAITI

ELECTRICITY ACCESS:

"Haiti has the **lowest electricity access in LAC (38.7%)** and presents a vast business opportunity for off-grid renewable energy companies and investors to electrify the **6,819,511 people** that live **without electricity** in the country."

"**Only 15% of rural population** is electrified, translating to **861,605 rural households** without electricity."

"Haiti is also the country with the **lowest access to clean cooking** technologies in LAC, **only 10%,** around **1 million people**."

POWER DEMAND:

"Economic sectors with high prevalence in rural areas, such as **agriculture, fishing and mining**, are almost **inexistent in the energy consumption mix** of the country—large opportunity to power those sectors with off-grid renewable energy solutions."

POWER SUPPLY:

"**Only 60%** of the **installed capacity is reliable,** as many generation units need repair work."

"The country has a generation mix of **83% for fossil fuels**, while **renewable energy** represents only **17%."**

"The country has set the ambitious goal of increasing the share of **renewable electricity to 50%** within its electricity mix by 2030."

"In September 2020, ANARSE, supported by the IDB and World Bank, launched the **programme PHARES**, which provides **subsidies to private mini-grid developers/operators** to ensure the sustainability of the services provided and to guarantee an affordable electricity tariff for end-users."

ENABLING ENVIRONMENT:

"Haiti is becoming a **hub of international investment** for electrification projects."

"Haiti has developed specific regulations to allow **concession contracts for independent producers**, and it has set **modern and transparent bidding processes** to enable private participation and foreign direct investment into the electricity market."

Haiti has the lowest electricity access in the LAC region (38.7%) and presents a vast business opportunity for off-grid companies and investors to electrify the 6,819,511 people that live without electricity in the country.

The largest opportunity for off-grid electrification is in rural areas, where only 15% of the population is electrified and where highly polluting and expensive diesel generators constitute the main source of electricity in eight of the nine isolated areas conforming Haiti's electricity system.

Despite the important difficulties that Haiti faces, the country is becoming a hub of international investment for electrification projects, and it has built a promising enabling environment for private project developers and investors to enter the market and address its large electricity access deficit.

Indeed, to overcome challenges related to the heavy dependence on fossil fuels and energy security during and after extreme events, the Haitian government has set the goal of reaching 50% renewable energy within its electricity mix by 2030 —notably from hydro, wind and solar power, as well as biomass.

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In addition, with support from international funding institutions, Haiti has developed specific regulations to allow concession contracts for independent producers, and it has set modern and transparent bidding processes to enable private participation and foreign direct investment into the electricity market.

2.1. Overview of Haiti's off-grid renewable energy market

Haiti is a low-income Caribbean country located on the island of Hispaniola, shared with the Dominican Republic to the East. The country has 11,263,000 inhabitants, spread across 27,750 km^2, and a population density of 403 inhabitants/km^2.[140]

The country's GDP stands at USD 19,473 million, with a per capita figure of USD 2,000, considerably below LAC's number (USD 16,000).

The Haitian economy has been battered by multiple shocks since mid-2018. Even before COVID-19 hit, the economy contracted by 1.7% in 2019 and in the context of the political turmoil and social discontent, GDP contracted by an estimated 3.7% in 2020 as the COVID-19 pandemic exacerbated the already fragile economy and political instability. Further projections estimate a 1.3% GDP growth by 2026.[141]

140 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 177

141 IMF, Real GDP Growth. Annual percent change, 2021 [online]

In terms of development, Haiti holds the 179th position out of 190 in the World Bank Ease of Doing Business ranking 2020,[142] and it presents a Human Development Index of 0.51 (1 being highly developed and 0 being underdeveloped).[143]

The poverty rate was nearly 60% in 2020, compared to the latest official national estimate of 58.2% in 2012. About two thirds of the poor live in rural areas.[144]

In addition to the pandemic and the political instability, Haiti remains highly vulnerable to natural hazards, mainly hurricanes, floods and earthquakes, to which more than 96% of the population is exposed. As an example, the hurricane Matthew that hit the country in 2016 caused damages estimated at 32% of 2015 GDP, while the 2010 earthquake decimated 120% of the country's GDP.[145]

Indicator	Figure
Surface (km2)	27,750
Population (absolute numbers)	11,263,000
Share of urban population (%)	56
Share of rural population (%)	44
GDP USD 2011 PPP (MUSD)	19,473
GDP per capita (thou. USD 2011 PPP/inhab.)	2
GDP growth rate (2020, %)	-3.7
Rank in Human Development Index	0.51
Share of ODA in GDP (% GNI)	5,051
Electrification rate (%)	38.7
Total installed capacity (MW)	470
Total energy production (Mtoe)	3.56
Total energy consumption (Mtoe)	3.4
Consumption of electricity per capita (kWh / inhab.)	39
Energy use per capita (toe/inhab.)	0.3

Figure 20. Haiti indicators[146, 147, 148, 149,150, 151, 152, 153]

142 World Bank, Doing Business 2020. Economy Profile of Haiti, 2020 [online]

143 UNDP, Human Development Index Ranking - Haiti, 2020 [online]

144 World Bank, The World Bank in Haiti, 2020 [online]

145 Idem

146 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 177

147 World Bank, Population, Total - Haiti, 2020 [online]

148 World Bank, Urban Population (% of total population) - Haiti, 2020 [online]

149 World Bank, Rural Population (% of total population) - Haiti, 2020 [online]

150 ECLAC, Latin America and the Caribbean: Growth Projections for 2020 and 2021, 2020 [online]

151 UNDP, Human Development Index Ranking - Haiti, 2020 [online]

152 World Bank, Net ODA received (% of GNI) - Haiti, 2019 [online]

153 Energy Hub, Access to electricity service, 2018 [online]

2.1.1. ELECTRICITY ACCESS

The electricity market in Haiti comprises nine isolated areas: Port-au-Prince, Cap-Haitien, Jacmel, les Cayes, Nord-Est, Petit Goave, Port-de-Paix, l'Archaie and l'Artibonite. Excluding Port-au-Prince, these are largely powered by small diesel generators, which are highly polluting and economically unsustainable in the long-term. Electricity production in large cities is supplied by independent producers to Electricité d'Haïti (EDH), the main and only utility in the country, who purchases and sales the electricity to final users.[154]

Today, the most significant obstacles to the development of the electricity sector in Haiti are limited institutional capacity and poverty. Many people use electricity without paying, which severely affects EDH's income and makes it unable to finance infrastructure improvements.

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Haiti presents the lowest electrification rate in LAC (38.7%), resulting in 6,819,511 people without electricity. The electrification rate in rural areas is as low as 15%, translating to 861,605 rural households without electricity.[155] Furthermore, at the current electrification rate, Haiti is not projected to achieve universal electricity access until 2150.[156]

Haiti is also the country with the lowest access to clean cooking technologies in LAC, only around 10% (1 million people), while 90% of the population is reported to use biomass as the main cooking fuel.[157]

2.1.2. POWER DEMAND

Haiti remains the poorest country in the Latin America and Caribbean region and it is among the poorest countries in the world. Its economic and social development is hindered by political instability and governance issues.

Together with the lack of reliable electricity, those challenges can significantly explain the low electricity consumption per capita of the country – 39 kW/inhabitant, as opposed to 2,087 kW/ inhabitant in LAC.

Out of the total 2019 consumption (3,40 Mtoe), 74% was dedicated to residential use, followed by the transport (15%), the industrial (9%) and the commercial (2%) sectors.

The sector related to agriculture, fishing, and mining does not represent a significant share of energy consumption. When compared to other LAC countries with more developed economies and a much higher share of energy consumption for productive sectors as op-

154 Boston University Institute for Sustainable Energy, Assessment of Haiti's electricity sector, 2018: page 7

155 Energy Hub, Access to electricity service, 2018 [online]

156 IDB, SEforALL, Duke Energy Access Project, The Energy Access Dividend in Honduras and Haiti, 2019: page 9

157 REN21, Renewables 2020 Global Status Report, 2020: page 150

posed to residential consumption, the lack of industrialisation and modernisation in Haiti's economic activities becomes clear.

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2.1.3. POWER SUPPLY

Haiti has an installed electricity capacity of 471 MW.[158] The country does not have a single national grid. Instead, Electricité d'Haïti (EDH), which is the only utility in the country, operates a local grid at Port-au-Prince. Ten smaller regional grids cover the urban area, while thirty small grids serve rural areas.[159]

Additionally, only 60% of the electricity generation capacity installed is reliable, as many generation units need repair work.[160] The country has a generation mix of 82.9% for fossil fuels, while renewable energy represents only 17.1%.[161]

Within the renewable energy mix, the country has a capacity of hydropower production of 78 MW, while solar production represents only 3 MW.[162]

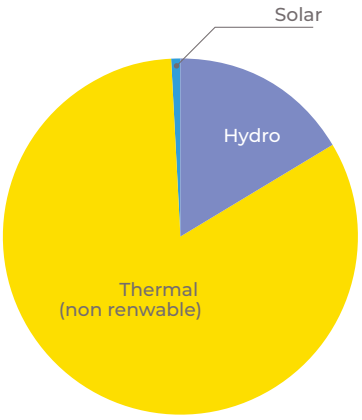


Figure 21. Haiti electricity mix[163]

The country has set the ambitious goal of increasing the share of renewable electricity to 50% within its electricity mix by 2030. Such goal envisages an increase of 5.6% in biomass, 24.5% in hydropower, 7.6% in solar and 9.4% in wind power installations.[164]

158 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 178

159 IDB, SEforALL, Duke Energy Access Project, The Energy Access Dividend in Honduras and Haiti, 2019: page 27

160 U.S. International Trade Administration, Haiti - Country Commercial Guide, 2020 [online]

161 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 178

162 U.S. Department of Energy, Haiti Energy Snapshot, 2020 [online]

163 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 178

164 REN21, Renewables 2020 Global Status Report, 2020: page 216

In addition, Haiti's government established the National Authority of the Energy Sector Regulation (ANARSE) in 2016 to promote and develop the energy sector through tailored regulations on the production, operation, transport, distribution and marketing activities at the national level.

In September 2020, ANARSE, supported by the IDB and World Bank, launched the program PHARES (Haitian Program for Access of Rural Communities to Solar Energy) to make the electricity sector more efficient and to expand access to affordable electricity through private sector driven mini-grids. The programme provides subsidies to private developers/operators to ensure the sustainability of the services provided and to guarantee an affordable electricity tariff for end-users.

2.2. Enabling environment

Moving away from unreliable, polluting and expensive fossil fuel-based electricity infrastructure towards a modern and sustainable system based on local renewable energy generation is a necessary condition to increase electricity access for 70% of underserved population.

Haiti's government has built on domestic expertise and leveraged the support of international partners to identify, design and implement solutions to overcome those obstacles and to bring the clean, reliable and affordable electricity transition further.

To do this, ANARSE has developed specific regulations to allow concession contracts for independent producers, and it has set modern and transparent bidding processes to enable private participation and foreign direct investment in "large" regional grids currently operated by the public power utility, as well as greenfield sites through the deployment of renewable energy mini-grids.[165]

National actor	Role
Ministry of Public Works, Transport and Communications (MTPTC)	Design, define and implement the policy of the executive power in the areas of public works, transport, communications, drinking water, energy
Autorité Nationale de Régulation du Secteur de l'Energie (ANARSE)	Under MTPTC, ensure the promotion and development of the energy sector by regulating the production, operation, transport, distribution and marketing activities of electricity throughout the national territory
International funding institutions	UNEP, World Bank, IDB, USAID

Figure 22. Key national actors involved in the sector

165 Renewable Energy World, Haiti is breaking down renewable energy barriers and developers should take note, 2021 [online]

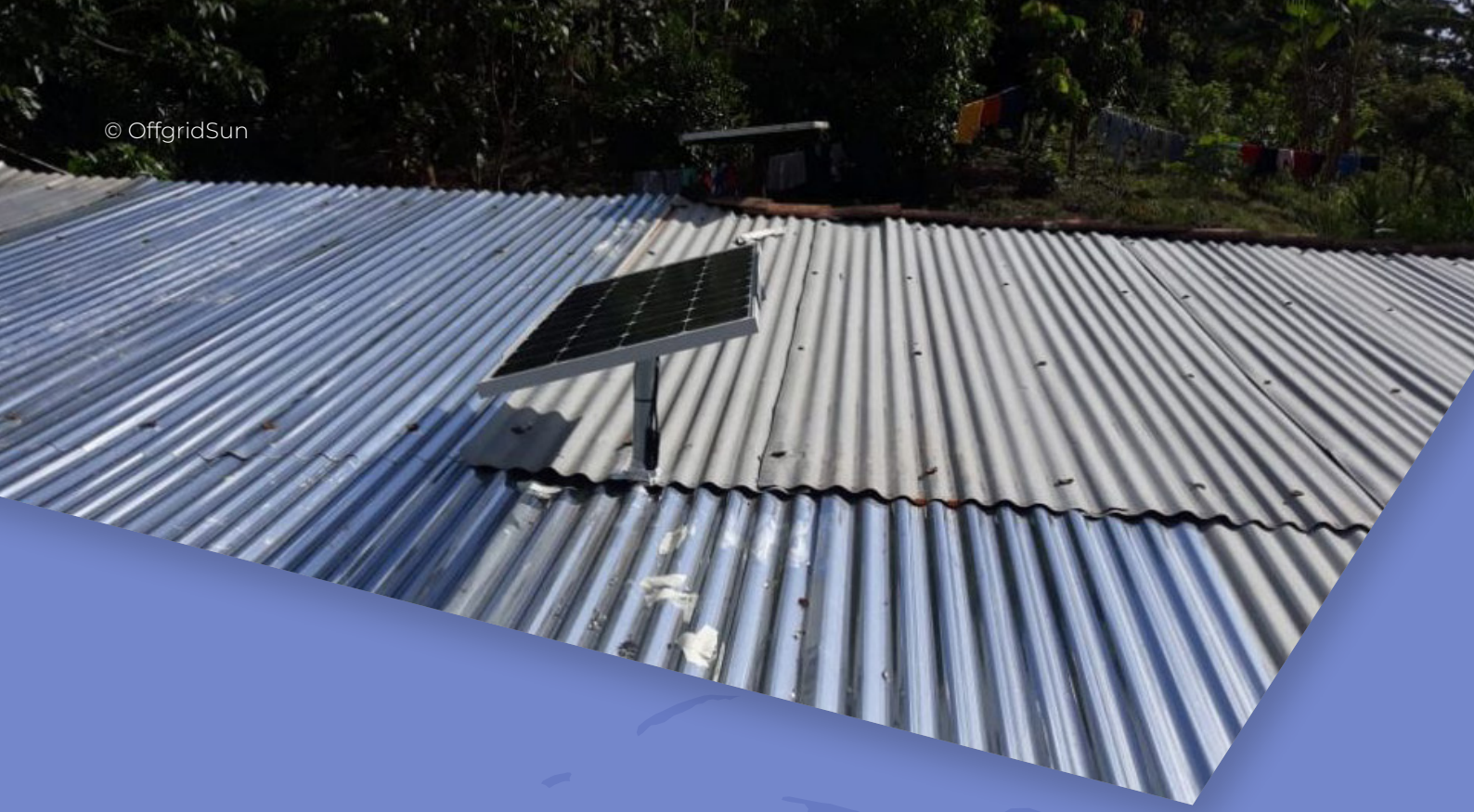
Funding mechanism	Leading entities	Financial instrument	Size (USD million)
Renewable Energy for All project	CIF	Grant	19.6
Modern Energy Services for All	CIF	Grant	15.6
Off-Grid Electricity Fund	World Bank, Clean Technology Fund (CTF) and the Scaling up Renewable Energy Program (SREP)	Debt and equity	17.2

Figure 23. Major funding mechanisms in the country[166, 167, 168]

166 World Bank, Haiti Renewable Energy For All Project, 2017 [online]

167 World Bank, Haiti Modern Energy Services For All Project, 2017 [online]

168 OGEF, Haiti is Likely to Attract More and More Solar Off-grid Companies in 2020!, 2020 [online]



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3 Status of the off-grid renewable energy market in Honduras

3. STATUS OF THE OFF-GRID RENEWABLE ENERGY MARKET IN HONDURAS

IN A NUTSHELL – HONDURAS

ELECTRICITY ACCESS:

"Honduras has the **second lowest electrification rate in the region (80.8%),** accounting for a pool of potential consumers of **1,728,502 unelectrified people.**"

"The **electrification rate** is much lower in **rural areas, at 56%,** where around **411,928 rural households** lack electricity."

"Besides electricity access, a major challenge is to provide **62% of households,** already connected to the national grid, with a more **reliable and cleaner** power."

"Honduras is the **third** LAC country with the **lowest access to clean cooking** technologies, only around **55% of the population**, or **4 million people**."

POWER DEMAND:

"Rural areas provide plenty of room for off-grid renewable energy systems to power and **diversify local economies** —where **72% of people** depend on **subsistence agriculture**—, increase **productivity** and boost **electricity consumption**."

"There is an important lack of industrialisation in Honduras' productive activities, particularly in rural areas where **agriculture, fishing and mining,** only accounting for **1%** of the total **electricity consumption**, are the main economic activities."

POWER SUPPLY:

"**61.5%** of the electricity capacity installed comes from **renewable sources**."

"The country has set the goal of reaching a **70% share of renewable electricity** within its electricity mix, and today it stands as the **largest electricity generator of solar PV** in the world."

"As of 2019, the country has installed around **7 MW of off-grid energy systems**, however many of them still rely on LPG and diesel."

ENABLING ENVIRONMENT:

"The government has set ambitious plans and regulations, such as the **Electricity Act,** the **Electricity Industry Law** and the upcoming **Draft Law for Social Electrification**, to **attract private investment**."

"Honduras has several **financial mechanisms** to fund electricity access projects, such as **H-REFF** and **FOSODE**, that are specifically beneficial to **facilitate the participation of private renewable energy companies and investors**."

Honduras has the second lowest electrification rate in the region (80.8%), which translates to a pool of potential consumers of 1,728,502 unelectrified people, most of them located in rural areas.

Despite an impressive increase in electricity coverage since 2000, off-grid renewable energy solutions are urgently needed to accelerate Honduras' electrification rates and increase the reliability of the electricity system, often compromised by the impacts of extreme events.

Furthermore, rural areas provide plenty of room for off-grid renewable energy systems to power and diversify local economies, where 72% of people depend on subsistence agriculture, increase productivity and boost electricity consumption per capita in the country, currently lower than the LAC average.

In this regard, the government has set ambitious plans and regulations to attract private investment towards the electrification of rural areas as a means to increase local development and reduce inequalities. Furthermore, Honduras has several financial mechanisms to fund electricity access projects that are specifically beneficial to facilitate the participation of private renewable energy companies and investors in the country's electrification efforts.

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Together with Honduras' ongoing reforms to liberalise the electricity sector and attract international investment, ambitious renewable energy goals and abundant renewable resources, the addressable market of new businesses and residential off-grid customers in rural areas constitute an excellent business opportunity for international private developers and investors.

3.1. Overview of Honduras' off-grid renewable energy market

Honduras is a lower middle-income country located in Central America, between Guatemala, El Salvador and Nicaragua. The country has a population of 9,158 people spread across 112,490 km^2, and a population density of 81 inhabitants/km^2. The country's GDP per capita stands at USD 55,826 million, with a per capita figure of USD 6,100, considerably below LAC's number (USD 16,000).

The country experienced a GDP growth of 2.7% in 2019 compared to 2018, way higher than LAC's average (0.1%).[169] In 2020, the current pandemic and the associated decrease in national consumption and investment caused a sharp contraction in the GDP growth

169 UN, World Economic Prospects, 2020: page 153

of 8%,[170] which is expected to increase by 4.5% in 2021. Further projections estimate a 3.9% GDP growth in 2026.[171]

In terms of development, Honduras holds the 133rd position out of 190 in the World Bank Ease of Doing Business ranking 2020,[172] and it presents a Human Development Index of 0.63 (1 being highly developed and 0 being underdeveloped). Furthermore, poverty rates increased to 55.4% in 2020 (around 700,000 people) from 49% in the previous year, and thus remain a big concern in the country, together with criminality and the incidence of natural disasters.[173] The poverty figure is even higher in rural areas (60.1%), compared to urban areas (38.4).[174]

© acciona.org

170 IMF, Real GDP Growth. Annual percent change, 2021 [online]

171 UK FCDO, Factsheet updated April 2021. Honduras, 2021 [online]

172 World Bank, Doing Business 2020. Economy Profile of Honduras, 2020: page 4

173 World Bank, Macro Poverty Outlook, 2021: page 122, 123

174 World Bank, The World Bank in Honduras, 2020 [online]

Indicator	Figure
Surface (km²)	112,490
Population (absolute numbers)	9,158,000
Share of urban population (%)	55
Share of rural population (%)	45
GDP USD 2011 PPP (MUSD)	55,826
GDP per capita (thou. USD 2011 PPP / inhab.)	6.1
GDP growth rate (%)	-8
Rank in Human Development Index	0.63
Share of ODA in GDP (% GNI)	1.97
Electrification rate (%)	85.0
Total installed capacity (MW)	2.83
Total energy production (Mtoe)	2.27
Total energy consumption (Mtoe)	4.14
Consumption of electricity per capita (kWh / inhab.)	792
Energy use per capita (toe / inhab.)	0.45

Figure 24. Honduras indicators[175, 176, 177, 178]

3.1.1. ELECTRICITY ACCESS

Honduras presents the second lowest electrification rate in LAC (80.8%), resulting in 1,728,502 people without electricity. The electrification rate is much lower in rural areas, at 56.4%, only behind Haiti, and the number of rural households without electricity is estimated at 411,928.[179]

Furthermore, the IDB estimates that, at the current electrification rate, the country will only be able to achieve universal electricity access by 2038, thus missing the SDG-7 target.[180]

The country has experienced an impressive improvement in its electrification rate since 2000, from 43% to the current rate, as a result of its "Proyecto de Infraestructura Rural (PIR)" initiated in 2005.[181] However, Honduras is still far from achieving universal energy access and it faces important challenges to reach last-mile communities, as evidenced by the low electricity rate in rural communities.

175 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 185

176 ECLAC, Latin America and the Caribbean: Growth Projections for 2020 and 2021, 2020 [online]

177 UNDP, Human Development Index Ranking - Honduras, 2020 [online]

178 World Bank, Net ODA received (% of GNI) - Honduras, 2019 [online]

179 Energy Hub, Access to electricity service, 2018 [online]

180 IDB, SEforALL, Duke Energy Access Project, The Energy Access Dividend in Honduras and Haiti, 2019: page 10

181 IDB, Zooming into Successful Energy Policies in Latin America and the Caribbean. Reasons for Hope, 2019: page 10

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Besides electricity access, the major challenge in the country is to provide 62% of households, which are already connected to the national grid, with a more reliable and cleaner source of electricity.[182]

Honduras is also the third LAC country with the lowest access to clean cooking technologies, only around 55% (4 million people),[183] while half of the population is reported to use biomass as the main cooking fuel.[184]

3.1.2. POWER DEMAND

Honduras has one of the lowest incomes in the LAC region and its sustainable development is seriously constrained by high inequality (particularly related to land and income distribution), extreme poverty and unemployment.

Together with the lack of electricity infrastructure and reliability, those challenges can significantly explain the low electricity consumption per capita of the country –792 kW/inhabitant, as opposed to 2,087 kW/inhabitant in LAC.

Out of the total energy consumption in 2019 (4,14 Mtoe), 40% was dedicated to residential use, followed by the transport (35%) the industrial (14%) and the commercial sectors (9%), and only 1% was consumed in activities related to agriculture, fishing and mining.

As in the case of Haiti, the low energy consumption in the country's economic sectors illustrates a lack of industrialisation in Honduras' productive activities, particularly in rural areas where agriculture, fishing and mining constitute main economic activities.

The low energy consumption of the agriculture sector is particularly problematic in rural Honduras, as this sector constitutes the main living source for 72% of poor families that depend on subsistence agriculture[185] and where only 32% of households benefit from electricity access.[186] However, such data also highlight an important market opportunity for rural electrification and local economic development via a combination of PURE and the deployment of off-grid renewable energy systems.

182 IDB, The Energy Access Dividend: Accelerating off-grid solutions and bolstering reliability can generate big gains in Honduras and Haiti, 2019 [online]

183 REN21, Renewables 2020 Global Status Report, 2020: page 246

184 WHO, Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children, 2016: page 42

185 GAFSP, GAFSP'S COVID Response, 2021 [online]

186 IDB, Lo esencial no debería ser invisible: el desafío de acceso a los servicios de agua, electricidad y transporte en América Latina y el Caribe, 2020 [online]

3.1.3. POWER SUPPLY

Honduras has experienced a positive transition in terms of electricity generation since 2012, when 70% of the electricity generated in the country came from fossil fuels, compared to only 30% from renewable sources. As of today, 61.5% of the electricity capacity installed comes from renewable sources, namely hydro (25.8%), solar (18,2%), wind (8.4%), thermal (7.8%) and geothermal (1.2%).[187]

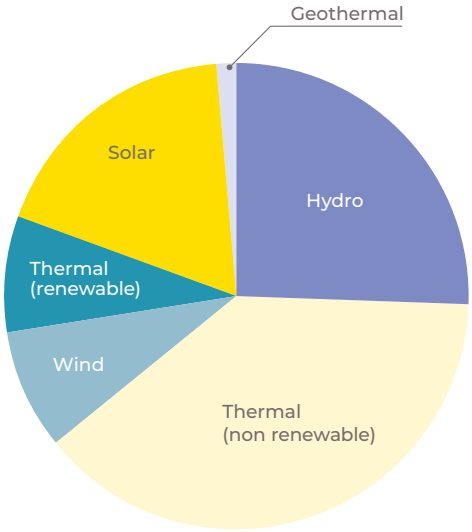

Figure 25. Honduras electricity mix[188]

The country has enough renewable resources (particularly hydro and solar) to become self-sufficient, and the government has implemented several measures to attract private investment towards this goal. Currently, the amount renewable generation capacity installed in Honduras amounts to 1,740 MW.[189]

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Furthermore, the country has recently set the goal of reaching a 70% share of renewable electricity within its electricity mix, and today it stands as the largest electricity generator of solar PV in the world, ahead of many European countries.[190]

The country has already put in place feed-in tariffs and net-metering/billing regulations,[191] facilitating the adoption of more cost-reflective tariffs, allowing for a potential interaction of decentralised electricity systems with the national grid, thus paving the path for off-grid

187 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 186

188 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 186

189 Idem: page 186

190 REN21, Renewables 2020 Global Status Report, 2020: page 213

191 Idem: page 78

systems to increase their share in the electricity market. As of 2019, the country has installed 6.8 MW of off-grid energy systems, however many of them still rely on LPG and diesel.[192]

3.2. Enabling environment

Honduras experienced a significant increase in its electricity coverage since 2000, remarkably due to the rural electrification efforts of the "Empresa Nacional de Energía Eléctrica" (ENEE), and a significant amount of resources provided by international donors towards rural electrification projects.

Furthermore, the country is in the process of building an institutional framework that allows for a higher participation of private companies in the electricity mix, particularly for the generation and provision of electricity in rural areas. The framework is a result of a slow and profound process initiated to liberalise the national electricity market in the 1990s.

Nevertheless, ENEE remains the main agency in charge of the generation, transmission and distribution of electricity as specified by the "Framework Law of 1994".[193,194] Therefore, the Honduran electricity market is still structured as a public state monopoly, vertically integrated.

ENEE presents a permanent financial deficit due to the high cost of thermal energy. In 2018, ENEE's debt accounted for HNL 42,027 million (around USD 1,749 million).[195]

The same Law established the National Commission of Energy (CNE), the regulatory body in the sector, and the "Social Fund for Electricity Development" (FOSODE), which has been proven an effective tool to finance electrification studies and works. Furthermore, FOSODE works hand in hand with the "Social Electrification Office" (OES), whereby rural communities can submit electrification requests.[196]

Another important legislation was the Electricity Act, Decree No. 158-94, which set a competitive market, applied cost-reflective tariffs and subsidies, and allowed for the private provision of electricity, as well as the Electricity Industry Law (2014) to liberalise the country's energy sector. The latter envisioned to transform ENEEE into three different entities under a holding company.

Honduras currently has a Draft Law for Social Electrification, that is being analysed before it is sent to the Congress in July 2021.

192 Secretaría de Estado en el Despacho de Energía, Balance Energético 2018, 2018: page 27, 40, 55

193 Ley Marco de 1994

194 IDB, Acceso y Asequibilidad a la Energía Eléctrica en América Latina y El Caribe, 2019: page 55

195 Global Transmission Report, Spotlight on Honduras: In the middle of energy reforms, 2018 [online]

196 Idem

National actor	Role
Secretaría de Energía (SEN)	Responsible for developing sustainable and comprehensive national energy policies that encourage the participation of renewable energy resources and their efficient use, including rural electrification policies
Comisión Reguladora de Energía Eléctrica (CREE)	Regulates the activities of the agents and institutions that operate within the Honduran Electricity Subsector
Empresa Nacional de Energía (ENEE)	Responsible for the production, commercialisation, transmission and distribution of electricity in Honduras
Oficina de Electrificación Social (OES - FOSODE)	Planning, management and implementation of social electrification projects in rural and urban areas
Operador del Sistema (ODS)	Guarantees the continuity and security of electricity supply and the correct coordination of the generation and transmission system at a minimum cost for all electricity market operations
Fondo Hondureño de Inversión Social (FHIS)	Promotes the improvement of the living conditions of marginalised social groups
International funding institutions	IDB, GEF, CIF

Figure 26. Key national actors involved in the sector

Funding mechanism	Leading entities	Financial instrument	Size (USD million)
Honduras Renewable Energy Financing Facility (H-REFF)	Deetken Impact, IDB, GEF, Calvert Foundation, CIF	Mezzanine and pure equity	63
Fondo Social de Desarrollo Eléctrico (FOSODE)	ENEE, IDB, other	-	9.5 per year + additional contributions

Figure 27. Major funding mechanisms in the country[197, 198]

197 Deetken Impact Sustainable Energy, Sustainable Energy, 2019 [online]

198 ENEE, Informe de Análisis Ambiental y Social (AAS) Y Propuesta de Plan de Gestión Ambiental (PGAS), 2017 [online]

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4 Status of the off-grid renewable energy market in Suriname

4. STATUS OF THE OFF-GRID RENEWABLE ENERGY MARKET IN SURINAME

IN A NUTSHELL – SURINAME

ELECTRICITY ACCESS AND POWER DEMAND:

"Suriname presents the **third lowest electrification rate in LAC (90.3%),** or **55,642 potential consumers** without access to electricity."

"The electrification rate is much lower in **rural areas**, at **72% —14,072 unelectrified households**."

ELECTRICITY DEMAND:

"It is estimated that **more than 130 communities**, accounting for around **30,000 people**, rely on **intermittent electricity systems** from polluting generators, which hinder their capacity to scale up their economic activities and pose health risks."

"The main **opportunity** in the country is to **find the right technologies and business models to electrify last-mile**, highly dispersed communities, leverage PURE and bring those communities out of poverty."

ENERGY SUPPLY:

"Suriname's **national grid** covers a relatively **small area**, leaving most vulnerable communities reliant on **expensive, inefficient and polluting fuels** for energy generation."

"**Renewable energy** sources account for **38%** of Suriname's installed electricity capacity, while **62%** corresponds to **fossil fuels**."

"The government currently allocates **nearly 5.5% of its GDP** (the largest percentage of GDP in LAC) to **subsidise electricity costs."**

"Difficulties to transport fossil fuels to rural, isolated communities and the low population density and dispersion of those make the **extension of the national grid** an **impossible** and **expensive** task."

"Since 2012, Suriname has received more than **USD 45 million from the IDB** to deploy more efficient, off-grid systems to electrify isolated communities."

ENABLING ENVIRONMENT:

"Suriname is **collaborating with international funding institutions** to enhance its policies and there are already several **projects on the way** to deploy microgrid and standalone solutions in rural areas."

"Suriname's **policy and regulatory framework for the electricity sector** is still **under development**, but the government has already undertaken some decisive steps to attract private companies and investors to the market, mainly through the **Electricity Act** and the **Energy Authority Act**."

Suriname presents the third lowest electrification rate in LAC (90.3%), resulting in a pool of 55,642 potential consumers without access to electricity. 30,000 of those potential customers live in isolated and disperse communities near the Amazonas.

Moreover, Suriname's electricity infrastructure is strongly reliant on inefficient, polluting and expensive diesel generators dispersed across isolated areas within the country. The reliance on diesel and oil also causes issues around energy security and vulnerability to volatile oil prices as well as disruptions in fuel transport, worsened by the frequency of extreme weather events.

Since 2016, the Government of Suriname is working on the creation of an enabling environment for private off-grid renewable energy companies and investors, to accelerate the development of an inclusive electricity market and electrify last-mile communities that cannot be reached by the national grid.

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Suriname is collaborating with international funding institutions to enhance its policies and there are already several projects on the way to deploy microgrid and standalone solutions in rural areas. Thus, it is expected that the opportunities in the country for off-grid renewable energy solutions will continue to grow in the coming years.

Taken together, the facts exposed above mean that Suriname offers a compelling opportunity for off-grid renewable energy companies and investors.

4.1. Overview of Suriname's off-grid renewable energy market

Suriname is a lower middle-income country located in the Caribbean coast of South America, between Guyana and French Guiana. The country has a population of 581,000 inhabitants spread across 163,820 km^2, and a population density of 4 habitants/km^2. The country's GDP stands at USD 9,493 million, with a per capita figure of USD 16,000, equal to LAC's average.[199]

The country experienced a limited GDP growth of 0.3% in 2019 compared to 2.6% in 2018, slightly higher than LAC's average (0.1%).[200] In 2020, the current pandemic and the associated decrease in national consumption and investment caused a sharp contraction of 13.5% in the GDP growt, which is expected to increase to 0.7% in 2021.[201] Further projections estimate a narrow, 1.3% GDP growth by 2025.[202]

In terms of development, Suriname holds the 162nd position out of 190 in the World Bank Ease of Doing Business ranking 2020,[203] and it presents a Human Development Index of

199 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 250

200 IMF, Suriname. At a Glance, 2021 [online]

201 Idem

202 Idem

203 World Bank, Doing Business 2020. Economy Profile of Suriname, 2020: page 4

0.738 (1 being highly developed and 0 being underdeveloped).[204] Furthermore, data on multidimensional poverty in 2017 estimate that more than 26% of the population suffer from poverty,[205] a figure that escalated to 39.4% in 2018.[206]

Indicator	Figure
Surface (km^2)	163,820
Population (absolute numbers)	581,000
Share of urban population (%)	66
Share of rural population (%)	34
GDP USD 2011 PPP (MUSD)	9,493
GDP per capita (thou. USD 2011 PPP / inhab.)	16
GDP growth rate (2020, %)	-13.5
Rank in Human Development Index	0.74
Share of ODA in GDP (% GNI)	0.71
Electrification rate (%)	90.3
Total installed capacity (MW)	0.5
Total energy production (Mtoe)	1
Total energy consumption (Mtoe)	0.6
Consumption of electricity per capita (kWh / inhab.)	3,083
Energy use per capita (toe / inhab.)	1.03

Figure 28. Suriname indicators[207, 208, 209, 210, 211, 212, 213, 214]

4.1.1. ELECTRICITY ACCESS

Suriname presents the third lowest electrification rate in LAC (90.3%), resulting in 55,642 people without electricity. The electrification rate is much lower in rural areas, at 72%, only behind Haiti and Honduras, and the number of rural households without electricity is estimated at 14,072.[215]

The country has experienced a slow but continuous improvement in its electrification rate since 2000, from 82.2% to the current rate. However, Suriname still faces important

204 UNDP, Human Development Index Ranking - Suriname, 2020 [online]
205 World Bank, Macro Poverty Outlook, 2021: page 140
206 UNDP, Human Development Report 2020, 2020: page 6
207 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 250
208 World Bank, Population, Total - Suriname, 2020 [online]
209 World Bank, Urban Population (% of total population) - Suriname, 2020 [online]
210 World Bank, Rural Population (% of total population) - Suriname, 2020 [online]
211 IMF, Suriname. At a Glance, 2021 [online]
212 UNDP, Human Development Index Ranking - Suriname, 2020 [online]
213 World Bank, Net ODA received (% of GNI) - Suriname, 2019 [online]
214 Energy Hub, Access to electricity service, 2018 [online]
215 Energy Hub, Access to electricity service, 2018 [online]

electricity access challenges that will hamper its development towards universal electricity access by 2030.

The main obstacles are related to the lack of a clear policy and regulatory framework for the electricity sector, as well as a lack of electricity infrastructure and reliability in hinterland communities, the latter consisting of 54,000 Maroons and 8,000 indigenous inhabitants approximately.[216]

Very little data is available on the exact number of people without access to clean, reliable and affordable electricity within these communities, however it is estimated that there are at least 130 underserved villages not covered by any electricity infrastructure.[217] Most of their electricity systems rely on expensive fossil fuels with a limited generation capacity of 4 to 6 hours per day, thus hampering essential services and local economic activity.[218]

4.1.2. POWER DEMAND

Overall, Suriname presents a high electricity consumption per capita, higher than Haiti and Honduras, 3,083 kW/inhabitant compared to 39 kW/inhabitant and 782 kW/inhabitant, as well as the LAC average figure (2,087 kW/inhabitant).

Such a high figure could be related to high income disparities between rural (especially hinterland communities) and urban areas, ethnic groups, as well as gender inequalities and low educational and employment levels.[219]

Out of the total 2019 energy consumption (0.6 Mtoe), 42% was dedicated to transport, followed by the industrial (18%) agriculture, fishing and mining (16%), residential use (15%) and commercial services (6%).[220]

Suriname presents large disparities between urban and rural areas, where many communities that live on traditional agriculture, hunting and fishing, lack essential services such as electricity, water and health care, as well as basic infrastructure, such as roads.

More concretely, is it estimated that more than 130 of those communities, accounting

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216 IDB, Innovación con Energía en Suriname: Primera Planta Solar para Comunidades Rurales, 2018 [online]

217 IDB, Suriname. Consolidating a Sustainable Energy Sector (Su-L1055). Loan Proposal, 2019: page 3

218 IDB, Innovación con Energía en Suriname: Primera Planta Solar para Comunidades Rurales, 2018 [online]

219 Ministry of Home Affairs, Suriname Progress report on the implementation of the Montevideo Consensus 2013-2018, 2018: page 8

220 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 250

for around 30,000 people, rely on intermittent electricity systems from polluting generators, thus posing significant health risks.[221]

Thus, the main electricity challenge in the country lies in finding the right technologies and business models to electrify last-mile, highly dispersed communities that comprise a large majority of ethnic groups, and in leveraging the productive uses of electricity to bring them out of poverty.

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4.1.3. POWER SUPPLY

As of 2019, renewable energy sources account for 38.2% of Suriname's installed electricity capacity, while 61.8% corresponds to fossil fuels. In addition, oil accounted for 96% of the total energy balance of the country, mainly due to the large oil reserves that the country has.

Within the share of renewable energy installed, hydro power accounts for 37% of the total (198 MW), while solar and thermal renewable electricity barely account for 0.10% (1 MW) and 0.30% (2 MW) respectively.[222]

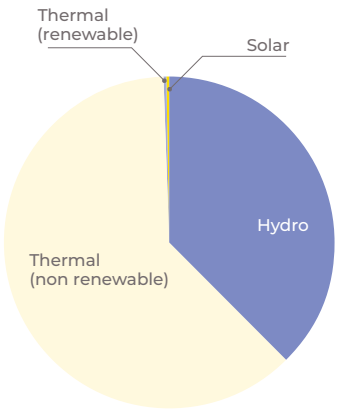

Figure 29. Suriname electricity mix[223]

221 IDB, Lasting Light for Rural Communities in Suriname, 2020 [online]

222 OLADE, Panorama Energético de América Latina y El Caribe, 2020: page 251

223 Idem

The national grid comprises seven isolated areas operated by the national utility. The largest power network is N.V. Energievoorziening Paramaribo (EPAR), which serves around 143,485 users.[224] EPAR is supplied by a combination of hydro power, heavy fuel oil (HFO) and diesel more recently, while the other six networks rely solely on HFO and diesel.[225]

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The largest hydropower plant in the country, Afobaka (189 MW), currently accounts for 72% of the total installed capacity of the national grid. The Afobaka plant has also covered 60% of the electricity needs in the country since 1960. [226]

The plant used to be privately owned and operated under a PPA, but it was handed over to the government of Suriname in December 2019.

Suriname's dependence on its national oil resources, which represent almost half of the new oil and gas reserves discovered in 2020,[227] allows the country to be highly self-sufficient. However, it also poses serious development and market risks due to price volatility in the oil market and the disruptions in fuel transport caused by natural disasters and the lack of transport infrastructure.

Furthermore, Suriname's oil-based energy system becomes highly inefficient due to the distribution of the country's national grid, which covers a relatively small area,[228] leaving most vulnerable communities reliant on expensive and polluting fuels for energy generation.

To help ensure the affordability of electricity for vulnerable communities, the government currently allocates nearly 5.5% of its GDP (the largest percentage of GDP in LAC) to subsidise electricity costs.[229] The government is currently working to set up a more efficient electricity system that allows for reduced subsidies.

In addition, repeated economic recessions, natural disasters and lack of infrastructure make the endeavour of transporting fossil fuels to rural and isolated areas enormously difficult. Furthermore, the low population density and highly disperse distribution of these communities make the extension of the national grid an impossible and expensive task.

224 IDB, Suriname. Consolidating a Sustainable Energy Sector (Su-L1055). Loan Proposal, 2019: page 2

225 Idem

226 Renewable and Sustainable Energy Reviews, Turbines of the Caribbean: Decarbonising Suriname's electricity mix through hydro-supported integration of wind power, vol. 146, 2020: page 2

227 The New York Times, Suriname Could Be Latest Big Oil Find as Industry Cuts Costs, 2021 [online]

228 Renewable and Sustainable Energy Reviews, Turbines of the Caribbean: Decarbonising Suriname's electricity mix through hydro-supported integration of wind power, vol. 146, 2020: page 1

229 IDB, Zooming into Successful Energy Policies in Latin America and the Caribbean: Reasons for Hope, 2019: page 20

In response to the challenges above, Suriname has received considerable support from the IDB to increase its share of renewable energy within its electricity mix and invest in more efficient, off-grid systems to electrify isolated communities.

Specific examples include a USD 15 million loan in 2012,[230] which led to the deployment of the first hybrid mini-grid (500 kW) installed in rural Suriname (Atjoni and Pokigron, 2018),[231] and an additional USD 30 million loan in 2019.[232]

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4.2. Enabling environment

Suriname's policy and regulatory framework for the electricity sector is still under development. However, the government has already undertaken some decisive steps to create an enabling environment for private companies and investors to participate in the electricity market.[233]

The most prominent example was the enactment of the Electricity Act and the Energy Authority Act in 2016, aimed at improving the availability and affordability of electricity in the country, as well its environmental impact. The most important reforms brought by the Acts were:[234]

- The establishment of the Energy Authority of Suriname (EAS) as an independent body, responsible for the supervision of the national electricity market, as well as for
- The development of an Electricity Sector Plan (once every five years at least).
- The reduction of public subsidies on electricity tariffs via the introduction of cost-reflective and affordable tariffs.
- The separation of the national utility —N.V. Energie Bedrijven Suriname (EBS) —into different business units for the generation, transmission and distribution of electricity.

The Ministry of Natural Resources (MNH) is the main public entity in charge of designing national policies within the electricity sector, while the Energy Authority of Suriname develops the subsequent regulations according to the policies established.

In addition, the electricity market is largely managed by the state-owned utility EBS, which owns and operates all the transmission and distribution infrastructure installed, as well as

230 IDB, Suriname will work to strengthen its energy sector with the IDB's support, 2012 [online]

231 IDB, Innovación con Energía en Suriname: Primera Planta Solar para Comunidades Rurales, 2018 [online]

232 IDB, Suriname to increase the electricity coverage in rural areas with IDB support, 2019 [online]

233 Climatescope, Climatescope 2017. Suriname, 2017 [online]

234 IDB, Suriname. Consolidating a Sustainable Energy Sector (Su-L1055). Loan Proposal, 2019: page 4

41% of generation supplied. Staatsolie and Suralco control the remaining share of generation.[235]

National actor	Role
N.V. Energie Bedrijven Suriname (EBS)	National utility in charge of the generation, transmission and distribution of electricity within the national power system
Ministry of Natural Resources (MNH)	In charge of the efficient management and sustainable development of the water and energy supply and the development of the mining sector
Department of Rural Energy (DEV)	Part of the MNH; responsible for rural electrification in sparsely inhabited interior areas
Energy Authority of Suriname (EAS)	Independent authority responsible for supervising and regulating the electricity sector
International funding institutions	AFD, CDB, GEF, IDB, SNV, FMO

Figure 30. Key national actors involved in the sector

Funding mechanism	Leading entities	Financial instrument	Size (USD million)
Development of Renewable Energy, Energy Efficiency and Electrification for Suriname	GEF, IDB	Grant, debt	4.4
Consolidating a Sustainable Energy Sector	IDB	Debt	30

Figure 31. Major funding mechanisms in the country [236, 237]

235 Climatescope, Climatescope 2017. Suriname, 2017 [online]

236 GEF, Development of Renewable Energy, Energy Efficiency and Electrification of Suriname, 2021 [online]

237 IDB, Suriname to increase the electricity coverage in rural areas with IDB support, 2019 [online]

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