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World Small Hydropower Development Report 2019

Americas

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World Small Hydropower Development Report 2019

AMERICAS

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2.2 Central America

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Introduction to the region

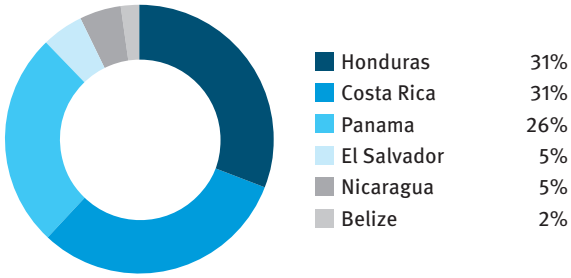
Central America comprises the region bordered by the Pacific Ocean to the west and the Caribbean Sea and the Gulf of Mexico to the east. The region includes eight countries – Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama. While the overall geographic shape of the region is narrow, its topography and climate vary widely. Northern Mexico is arid, while the southern regions of the country are humid to very humid. For the rest of the region, the climate is defined by altitude and proximity to the coast. For example, in Guatemala, the climate is temperate in areas above 1,000-2,000 metres, while the lower regions are tropical, with temperatures that can reach 40 °C.[3]

Mexico has 158 river basins with a total mean runoff estimated at 379,000 hm^3/year. In Honduras, the most important river is the Ulúa, which flows 400 km to the Caribbean Sea. In Belize, of the 18 major rivers and many perennial streams, the Belize River is the largest (290 km). In Nicaragua, the Rio Grande and its tributaries are the most extensive river system. El Salvador has ten hydrographic regions that drain into the Pacific Ocean and the Lempa River. Costa Rica is divided into 34 major basins, 17 basins for each side, with sizes between 207 km^2 and 5,084 km^2. There are 52 watersheds and approximately 500 rivers in Panama. Most of these rivers (70 per cent) run to the Pacific side (longer streams), with the other 30 per cent running to the Caribbean side. The most important river in Panama is the Chagres River, which forms the basin where the Panama Canal is located.

An overview of the countries of Central America is presented in Table 1. Mexico has the highest installed capacity of SHP in the region. The distribution of SHP up to 10 MW across the countries of the region is shown in Figure 1.

The Central American Electric Interconnection System (SIEPAC) was completed in 2014, creating a regional energy market among El Salvador, Guatemala, Honduras, Costa Rica, Nicaragua and Panama. The SIECAP allows the countries to exchange energy up to 300 MW. There are also plans to connect Mexico to the SIECAP. Besides the SIEPAC, a transmission line of 103 km links Mexico and Guatemala since April 2010. It has a capacity of 200 MW towards Guatemala and 70 MW in the opposite direction. Mexico is also connected to Belize by a transmission line with a capacity of 65 MW. To the north, Mexico has 11 interconnections with Texas and California in the USA, with capacities ranging from 36 MW to 800 MW. There was great interest in a 2012 plan that would link Panama and Colombia through a 614 km interconnection. However, this project has yet to be realized.[7,8,9]

Figure 1.
Share of regional installed capacity of small hydropower up to 10 MW by country in Central America (%)



Source: *WSHPDR 2019*[3]

Note: Does not include Guatemala and Mexico as data on capacity up to 10 MW is not available.

Table 1.
Overview of countries in Central America

Country	*Total population (million)*	*Rural population (%)*	*Electricity access (%)*	*Electrical capacity (MW)*	*Electricity generation (GWh/year)*	*Hydropower capacity (MW)*	*Hydropower generation (GWh/year)*
Belize	0.4	54	92	158	397	55	261
Costa Rica	5.1	21	99	3,530	11,210	2,328	8,677
El Salvador	6.5	29	96	1,846	5,700	575	1,339
Guatemala	16.2	49	91	4,072	11,490	1,438	5,765
Honduras	9.3	44	88	2,571	9,345	676	3,088
Mexico	124.7	20	99	55,889	263,393	12,125	29,138
Nicaragua	6.2	42	82	1,482	4,527	143	468
Panama	4.0	33	94	3,401	10,936	1,777	7,253
Total	**172.4**	-	-	**72,949**	**316,998**	**19,117**	**55,989**

Source: *WSHPDR 2019*,[3] WB,[4] WB,[5] MEM[6]

The reduction of electricity tariffs and the inclusion of more renewable energy (RE) sources might become a major political challenge in the future. Except for Mexico (0.06-0.08 US$/kWh for domestic and industrial use), electricity tariffs are high in most countries of the region. The opposition to new hydropower projects by the local population (native groups in many cases) is another political challenge that the region is facing.[3]

Small hydropower definition

The definition of SHP varies throughout the region (Table 2). Costa Rica and Belize do not have an official definition of SHP, but Costa Rica considers installed capacity less than 20 MW to be plants with limited capacity. The rest of the countries have some specific classification, with the highest being a capacity of 30 MW in Mexico and Honduras.

Regional small hydropower overview and renewable energy policy

Despite the large number of watercourses in the region and the important role that large hydropower plants play in the energy sector of the region (18 per cent of annual generation), SHP has continued to remain a small fraction of overall hydropower generation. However, in terms of installed capacity, SHP projects have grown by 47 per cent compared to the *World Small Hydropower Development Report* (*WSHPDR*) *2016*, having reached a total capacity of 524 MW, mainly due to new capacities commissioned in Mexico (Figure 3). Also, there is still a large untapped potential of 742 MW (based on local definitions of SHP), but more feasibility studies need to be conducted in order for many countries to fully utilize their SHP potential (Figure 2).

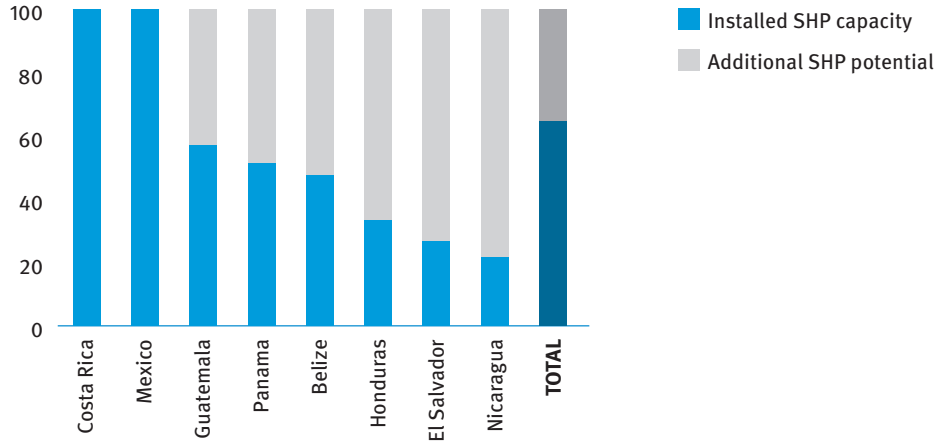
Table 2.
Small hydropower capacities in Central America (local and ICSHP definition) (MW)

Country	*Local SHP definition*	*Installed capacity (local def.)*	*Potential capacity (local def.)*	*Installed (<10 MW)*	*Potential (<10 MW)*
Belize	-	-	-	10.3	21.7
Costa Rica	-	-	-	125.5	125.5*
El Salvador	up to 20	42.0	158.0	22.6	119.8
Guatemala	up to 5	114.3	201.0	114.3**	201.0**
Honduras	up to 30	301.8	N/A	128.0	385.0
Mexico	up to 30	699.3	N/A	N/A	N/A
Nicaragua	up to 10	18.6	85.7	18.6	85.7
Panama	up to 20	213.5	417.0	104.8	263.3
Total		-	-	**524**	**1,202**

Source: *WSHPDR 2019*[3]

Note: * The estimate is based on the installed capacity as no data on potential capacity is available. ** Data as per the local definition of SHP.

Figure 2.
Utilized small hydropower potential by country in Central America (local SHP definition) (%)



Source: *WSHPDR 2019*[3]

Note: This Figure illustrates data for local SHP definitions or the definition up to 10 MW in case of the absence of an official local one. For Honduras, the data is presented for the SHP definition up to 10 MW due to the absence of data on potential capacity according to the local definition. For Costa Rica and Mexico, the additional potential is not known.

An overview of SHP in the countries of Central America is outlined below. The information used in this section is extracted from the country profiles, which provide detailed information on SHP capacity and potential, among other energy-related information.

In **Belize**, the installed capacity of SHP plants below 10 MW has not changed since the *WSHPDR 2016* and remains at 10.3 MW. The additional potential is estimated to be at least 11.4 MW, indicating that 48 nearly 50 per cent of the country's potential has been developed. The national development plan of Belize, called Horizon 2030, includes the promotion of green energy and energy efficiency as one of its strategic priorities. This includes the creation of an institutional framework for producing a viable energy policy. The country's National Sustainable Energy Strategy 2012-2033 aims to institutionalize a countrywide infrastructure to collect data, in order to identify feasible sites for the development of solar, wind and hydropower energy.

In terms of RE development, **Costa Rica** has heavily invested in the sector and has become a world leader in the generation of electricity through RE sources. The installed capacity of SHP up to 10 MW in Costa Rica is reported to be 125.5 MW, while the available potential remains unknown. However, SHP does not seem to be a priority among RE sources. In the 2016-2035 Generation Expansion Plan, there are no planned SHP projects from public services distribution companies.[9] In addition, over the last years, moratoriums on hydropower development (including SHP) have been signed by some municipal councils concerned about the environmental impacts. Finally, the central Government also established a moratorium on watersheds with a high potential for HP development.[3] In general, the energy plans in Costa Rica aim to diversify RE sources, especially

with respect to non-conventional sources (wind, solar and biomass), however, with no specific plans for hydropower or SHP development.

In **El Salvador**, the installed capacity of SHP up to 10 MW is 22.6 MW. The slight increase, compared to the *WSHPDR 2016*, is due to the modernization and refurbishment of certain plants. The potential capacity is at least 119.8 MW and could be developed by the year 2026. In terms of RE policies, one of the strategic guidelines of the National Energy Policy 2010-2024 (NEP) is the diversification of the energy mix and the promotion of RE sources. Therefore, to ease the implementation of RE generation projects, several adjustments were made to the legal and regulatory frameworks of the electricity and environmental sectors, and to taxation regulations.

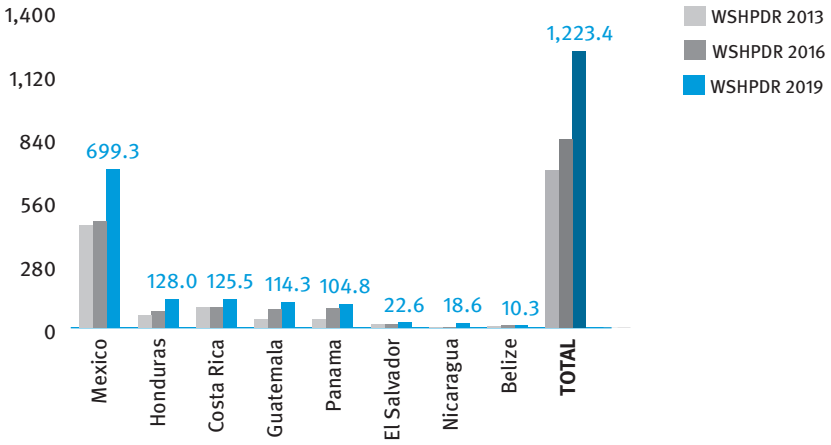
In **Guatemala**, the installed capacity for SHP plants up to 5 MW was 114.3 MW, while the potential is estimated to be at least 201.0 MW, indicating that approximately 57 per cent of the known potential has been developed. The 2013-2027 Energy Policy includes plans for the promotion of RE sources in electricity generation, with a long-term goal of generating 80 per cent of electricity from RE. There is also the National Energy Plan 2017-2032, which establishes an additional installed capacity target of 6,102 MW by 2032, with 58 per cent coming from hydropower. This Plan also promotes the "Law of Incentives for Renewable Energy Development", energy efficiency and the reduction of greenhouse gas emissions by 29.2 per cent by 2032.

The installed SHP capacity of **Honduras** (up to 10 MW) increased to 128 MW, with the potential estimated at 385 MW. The Government of Honduras intended to reverse the structure of the country's electricity sector to a ratio of 60 per cent RE and 40 per cent fossil fuel by 2022, but the target has already been achieved. Also, the Honduras Scaling-Up Renewable Energy Programme in Low-Income Countries (SREP) is financing a series of activities aimed mainly at improving rural electrification and developing the RE sector in the country.

In the case of **Mexico**, the installed SHP capacity (up to 30 MW) reached 699.3 MW. This increase is due to a large number of generation permits issued before the 2013 Energy Reform, to developers willing to benefit from the previous regulatory framework. The new Government plan from the 2018 Presidential election focuses on reducing the use of natural gas by increasing the generation of existing hydropower plans and building new ones. Also, this plan aims to reduce domestic electricity tariffs. The potential of SHP in Mexico remains unknown.

In **Nicaragua**, there are 14 operational SHP plants up to 10 MW with a combined capacity of 18.61 MW, and a further 20 potential sites with a combined capacity of 67.06 MW were identified. Even though there is no RE policy in place in Nicaragua, the National Energy Policy (2004) established a framework for the promotion of RE energy. Also, the Plan for Electricity Generation Expansion for the 2016-2030 period includes the addition of 1,223 MW of new capacity, of which 783 MW will come from RE sources. From these RE sources, hydropower will see the greatest capacity addition in the coming decade. Also, there is a favourable legal and attractive incentive structure for SHP projects up to 5 MW.[3]

Figure 3.
Change in installed capacity of small hydropower from *WSHPDR 2013* to *2019* by country in Central America (MW)



Source: *WSHPDR 2013*,[1] *WSHPDR 2016*,[2] *WSHPDR 2019*[3]

Note: *WSHPDR* stands for *World Small Hydropower Development Report.* For Guatemala, data is for SHP up to 5 MW; for Mexico, up to 30 MW; for other countries, up to 10 MW.

It is reported that for SHP up to 10 MW, in **Panama**, there are 20 plants with a combined installed capacity of 104.8 MW and 33 plants with concessions granted or pending with a combined capacity of 158.45 MW. High prices and energy consumption levels led to the promulgation of Law 44 of April 2011, which aims to promote wind power and diversity in RE sources. Also, the Paris Climate Change Agreement has become a driver for the promotion of the use of RE sources. Panama has pledged to increase the RE share in its electricity generation mix by 30 per cent by the end of 2050, employing the year 2014 as a baseline.[3]

No **feed-in tariffs (FITs)** have been introduced in the region, however, a range of other incentives for the development of RE technologies are granted by the Governments in the region.

Barriers to small hydropower development

There are three major challenges to SHP development found throughout the region. First, a lack of solid financial frameworks for SHP investment is common to all countries. It translates into limited funds available for commercial banks, high interest rates, the need for long-term financial assistance, loan requirements that are difficult to comply with for SHP projects and dependence of remote communities solely on Government funds.

Second, there is a need for better policies, legislation and regulatory processes to promote SHP projects. In the region, it is easy to observe a promotion of RE sources within the energy mix of each country. However, there are preferences for the development of other types of RE projects, rather than SHP.

Third, in the last years, there have been social and environmental concerns regarding hydropower projects, which also affect SHP. This is particularly the case for **Costa Rica**, where some municipal Governments and the central Government, due to concerns about the environmental impacts, introduced moratoriums on hydropower development. In **Guatemala**, as a result of environmental and social opposition to the development of hydropower, the Ministry of Energy and Mines has developed a consulting methodology for local populations based on the International Labour Organization's "C169, Indigenous and Tribal Peoples Convention".[3]

In **El Salvador**, the construction of power plants can also face public opposition. Moreover, some project development areas are affected by insecurity and violence. There is also a lack of reliable river flow data series and detailed hydropower potential inventories. **Mexico** also lacks reliable hydrological data and hydropower projects are associated with social and community concerns. Moreover, the process of obtaining permits and licences is complex and costly, with multiple authorities involved in the decision-making process and imposing various restrictions. There is also a lack of coverage and maintenance of the roads and of the electric grid in areas with high hydropower potential, requiring major investments. In **Honduras**, there is a need to invest into transmission networks and to develop the ancillary services markets.

In **Belize**, SHP development is complicated by the unregulated market, the lack of standards and of a Standard Offer Contract (SOC) for Renewable Energy Generation, as well as by a limited skilled labour force in the SHP sector. In **Nicaragua**, power purchase agreements are of too short a duration as to motivate SHP project development. Finally, in **Panama**, financial limitations are the key barrier, with the level of investment in SHP projects remaining low.

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