

# Panama

## 2.2.8

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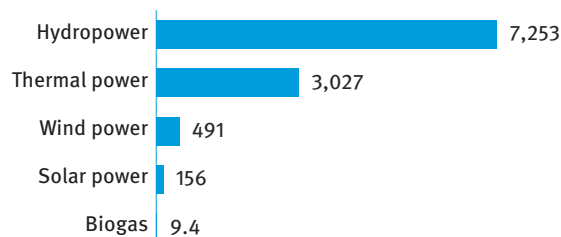
### Key facts

<b>Population</b>	4,037,043 <sup>1</sup>
<b>Area</b>	75,420 km <sup>2</sup>
<b>Climate</b>	Panama has a tropical climate with two seasons, dry and rainy. The variations in climatic conditions depend on the region and the altitude. Winter is the wet season and lasts from May to November, while summer is the dry season and lasts from December to April, with March and April ordinarily being the warmest months. The temperatures on the coast regularly reach 35 °C, however, at higher altitudes the temperatures decrease by 1 °C for every 150 metres. <sup>2</sup>
<b>Topography</b>	There are rugged mountains to the west and towards the Caribbean Sea and rolling hills and vast plains by the Pacific Coast. The lowlands cover approximately 70 per cent of the country's territory. The highest point in Panama is the Volcán Barú, which rises to 3,475 metres above sea level. <sup>2</sup>
<b>Rain pattern</b>	Yearly precipitation in Panama averages approximately 3,000 mm. The Pacific region experiences a wet season from May to November, while, for the Atlantic region, precipitation is continuous throughout the year. <sup>2,3</sup>
<b>Hydrology</b>	There are approximately 500 rivers in Panama in 52 watersheds. Seventy per cent of rivers run to the Pacific side (longer streams) and 30 per cent to the Atlantic side. <sup>4</sup>

### Electricity sector overview

The main sources of electricity generation in Panama are hydropower and thermal power. In 2017, electricity generation was at 10,936 GWh, of which 72 per cent came from renewable energy sources (Figure 1).<sup>5</sup>

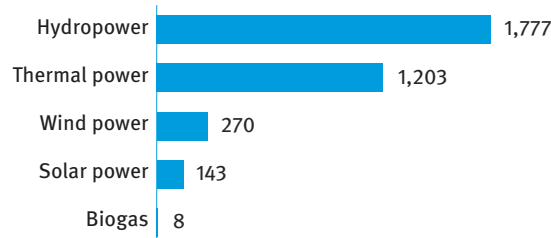
Figure 1.  
**Annual electricity generation by source in Panama (GWh)**



Source: SNE<sup>5</sup>

At the end of 2017, Panama had 3,401 MW of installed electrical capacity, which was 45 per cent higher than in 2011 (2,344 MW).<sup>5</sup> Renewable energy sources, including hydropower, wind power, solar power and biogas, contributed 64 per cent, while thermal power accounted for 37 per cent (Figure 2). Compared to the *World Small Hydropower Development Report (WSHPDR) 2016*, the most pronounced increase has been observed in the installed capacity of wind and solar power, which have been predominantly developed under power purchase agreements (PPAs) allocated through auctions.<sup>6</sup>

Figure 2.  
**Installed electricity capacity by source in Panama (MW)**



Source: SNE<sup>5</sup>

A significant role in the electricity sector of Panama is played by the Panama Canal Authority, which is the biggest independent electricity producer in the country, with an installed capacity of 220.7 MW (73 per cent from thermal power and 27 per cent from hydropower).<sup>8</sup>

The National Secretariat of Energy (Secretaría Nacional de Energía, SNE), established by Law No. 43 on 23 April 2011, is in charge of the energy sector.<sup>9</sup> The Rural Electrification Office (Oficina de Electrificación Rural, OER) is responsible for providing energy to the rural, isolated areas that are not connected to the national grid. The OER has a target to increase the electrification rate in rural areas using photovoltaic solar power and electricity grids for short distances (10 km). From November 2013 to October 2014, up to 109 projects were completed in the provinces of Colon, Darien, Coclé, Bocas del

Toro and in indigenous territories. As a result, approximately 25,000 inhabitants received access to electricity.<sup>10</sup> In 2016, 94 per cent of the population had access to electricity, including 99 per cent in urban areas and 81 per cent in rural areas.<sup>24</sup> The OER is supervised and funded by the Ministry of the Presidency. However, all project ideas have to be proposed by the rural communities in order to be included in official planning.<sup>2</sup>

The energy sector is regulated by Law No. 6 of 3 February 1997 (and its later amendments) as well as by Decree Law No. 22 (1998),<sup>9,11,12,13</sup> After the privatization of the public electricity sector in 1998, the Empresa de Transmision Electrica S.A (ETESA) took charge of dispatching and transporting electricity in an efficient, safe and reliable way, as well as of ensuring adequate planning for the expansion of generation capacities, the construction of new facilities and the reinforcement of the transmission grid. The remuneration for the services provided by ETESA is also regulated by Law No. 6 (1997).<sup>11</sup>

Currently, the electricity grid of Panama consists of three main transmission lines. The Government adopted a plan to modernize and expand the transmission systems between 2014 and 2017, which was financed by the Latin American Development Bank. The plan mainly referred to the third transmission line (completed in 2017) and was replaced with the Plan for the Panama National Grid Expansion 2017-2031.<sup>16</sup> The current plan consists of three major components: i) basic studies, including the forecast of energy demand and power at the level of the Main Transmission System; ii) the “Indicative Generation Plan”, outlining the plans to increase generation, providing information on the evolution of the generation sector, describing the current supply situation and defining the potential alternatives to meet the demand; and iii) the “Transmission System Expansion Plan”, compliance with which will be mandatory once it has been approved by the National Authority of Public Services (Autoridad Nacional de los Servicios Públicos, ASEP).<sup>14</sup>

The total electricity consumption considering all sectors (private, commercial, governmental, industrial and public electrification facilities) in Panama in 2016 was 8,588 GWh.<sup>26</sup> Thus, per capita consumption in 2016 was 2,127 kWh, which is almost twice as high as the average consumption rate in Central America (1,170 kWh per person).<sup>15</sup> According to the National Energy Plan update (2017), the total installed capacity and electricity generation of Panama should increase to 4,746 MW and 16,098 GWh, respectively, by 2030.<sup>26</sup>

Panama is exporting its electricity surplus to neighbouring countries, such as Colombia. The Government is aiming to make Panama an energy hub in Latin America and is looking for strategies to interconnect with neighbouring countries.<sup>7</sup> The Central American Electric Interconnection System (SIEPAC) was officially inaugurated in December 2014 and includes Guatemala, Honduras, Nicaragua, El Salvador, Costa Rica and Panama. With an investment of US\$ 500 million, the system currently consists of one line of 230 kV with 300 MW of capacity. The second line (SIEPAC II) should come

into operation in 2020. In 2016, through this system, Panama exported only 3.9 per cent of the electricity generated in the country and imported 0.3 per cent of the electricity consumed in the country.<sup>26</sup> Although electricity exchanges among the countries have been rather modest so far, this initiative has a great potential. There is also a plan for integration with Colombia with a capacity of 400 MW, which is expected to be completed by 2022 and represents a very interesting option for Panama due to price advantages.<sup>16</sup>

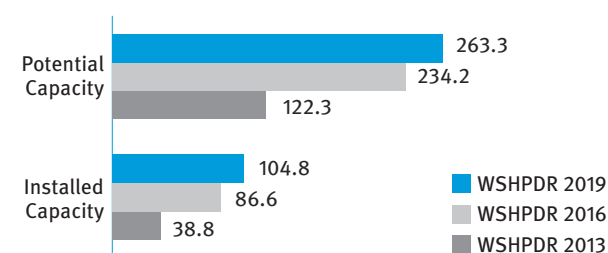
In Panama, a self-generation producer is defined as an entity producing and consuming electricity in the same place to meet its own needs. These electricity producers do not sell or transport the generated electricity to third parties; however, they can sell electricity surplus to other agents. Currently, these producers in Panama have an installed capacity of 7.2 MW.<sup>8</sup>

Electricity tariffs are set monthly by ASEP and include a variable price that fluctuates with the fuel market prices.<sup>16</sup> Between 2008 and 2017, electricity prices varied between 0.165 US\$/kWh and 0.243 US\$/kWh. However, when taking into account government subsidies, the prices varied between 0.158 US\$/kWh and 0.219 US\$/kWh.<sup>18</sup>

## Small hydropower sector overview

Although the Latin American Energy Organization (OLADE) uses hydropower plants with a capacity up to 5 MW as the definition of small hydropower (SHP), SHP capacity up to 20 MW is considered for incentives under the legal framework of Panama.<sup>19,20</sup> For the sake of comparison with the previous reports, this report uses the definition of up to 10 MW for SHP, but data is provided for both the 10 MW and the 20 MW thresholds. Under the 10 MW definition, as of May 2018, there were 20 SHP plants, with a combined installed capacity of 104.8 MW, and 33 SHP plants with concessions granted or pending, with a combined capacity of 158.45 MW (Table 1).<sup>21,22</sup> In this report, the additional potential capacity is defined as the capacity of new SHP projects granted with concessions. Thus, total SHP potential stood at 263 MW. Compared to the results of the *World Small Hydropower Development Report (WSHPDR) 2016*, the installed and potential capacities increased by 21 and 12 per cent, respectively (Figure 3).

Figure 3.  
Small hydropower capacities 2013/2016/2019 in Panama (MW)



Source: *WSHPDR 2016*,<sup>2</sup> ASEP,<sup>21,22</sup> *WSHPDR 2013*<sup>27</sup>

Note: The comparison is between data from *WSHPDR 2013*, *WSHPDR 2016* and *WSHPDR 2019*

**Table 1.**  
**Small hydropower capacity in Panama**

Plant size	Capacity (MW)		Number of plants	
	Installed	Additional potential	Installed	Additional potential
<10 MW	104.80	158.45	20	33
10 MW-20 MW	108.70	45.08	8	4
<b>Total</b>	<b>213.50</b>	<b>203.53</b>	<b>28</b>	<b>37</b>

Source: ASEP<sup>21,22</sup>

## Renewable energy policy

The starting point for the promotion of renewable energy in Panama is included in Chapter II, Title VIII of Law No. 6 of 1997.<sup>11</sup> Renewable energy sources are defined in this law as geothermal power, wind power, solar power, biomass and hydropower. The high prices and the high levels of energy consumption led to the promulgation of Law No. 44 of April 2011.<sup>23</sup> This law aims to promote the diversity in the renewable energy sources mix and particularly focuses on wind power. The Long-Range Energy Alternative Planning Model is used to determine the possible scenarios of various energy mixes. Some articles of this law were modified by Law No. 13 of March 2013.<sup>24</sup>

The Paris Climate Change Agreement has also become a major factor incentivizing the use of renewable energy sources.<sup>16</sup> The Government of Panama has pledged to increase the share of renewable sources in electricity generation by 30 per cent by the end of 2050 compared to 2014.<sup>26</sup>

## Legislation on small hydropower

The Government of Panama in 2004 established a legal framework for the hydropower sector by enacting Law No. 45, which established incentives for hydropower generation and other renewable energy sources as well as an extended scope for the SHP definition (up to 20 MW).<sup>18</sup> The incentives for small and mini-hydropower plants under this law include: no charge for electricity sold directly or indirectly by SHP plants up to 10 MW; exemptions for the first 10 MW delivered for 10 years by projects between 10 MW and 20 MW; fiscal exemptions for the importation of equipment, machinery, materials, etc.; fiscal incentives for projects up to 10 MW; and up to 25 per cent subsidy on the original investment calculated based on the reduction of CO<sub>2</sub> equivalent emissions per year.<sup>18</sup>

## Barriers to small hydropower development

Although there is a favourable legal framework in place that grants fiscal incentives in order to develop SHP projects, the sub-sector development remains not very significant. The most important barriers are:

- Lack of a solid financial framework;

- Low level of investment in SHP projects;
- Dependence of remote communities on Government funds to obtain access to electricity.

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