

2.2.8 Panama

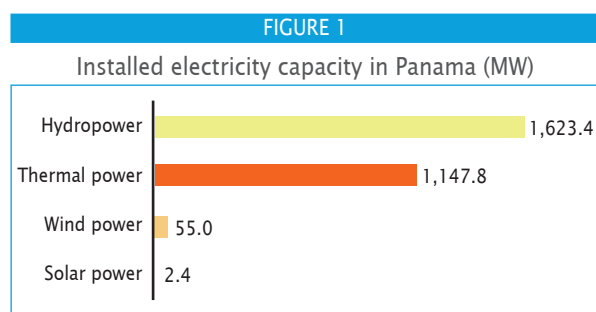
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Key facts

Population	3,657,024 ¹
Area	75,420 km ²
Climate	It has a tropical climate with two seasons, dry and rainy, with variations depending on the region and the altitude. Winter is the wet season (May to November) while summer is the dry season (December to April, with March and April normally being the warmest months). The temperatures on the coast regularly reach 35°C, but the temperature drops 1°C for every 150 m.
Topography	Panama has rugged mountains to the west and towards the Caribbean Sea and rolling hills along with large plains to the Pacific Coast. The lowlands in Panama cover around 70 per cent of the country. The highest point in Panama is the Volcán Barú, which rises to 3,475 m.
Rain pattern	From 1971 to 2002, Panama had a yearly average precipitation of 2,924 mm. ² The Pacific region shows a wet season pattern from May to November. For the Atlantic region, precipitation is continuous throughout the year. ³
General dissipation of rivers and other water sources	There are around 500 rivers in Panama in 52 watersheds, with 70 per cent of rivers running to the Pacific side (longer streams) and 30 per cent to the Atlantic side. ⁴

Electricity sector overview

The energy generated in 2014 was approximately 9,256 GWh, from which only 4.7 per cent came from renewable sources.⁵ The consumption of electricity in 2014 was 7,822 GWh. Panama exports its energy surplus to neighbouring countries like Colombia. Thus, the government aims to make Panama an energy hub in Latin America.⁶



Source: SNE-ETESA⁵

Electricity generation in Panama comes mainly from hydropower, thermal generation and renewable energy sources like wind and solar power. The installed capacity in Panama by the end of 2014 was 2,828.6 MW, which was 6.1 per cent more than in 2012. Hydropower represents 1,623.4 MW (57.4 per cent) and thermal represents 1,147.8 MW (40.6 per cent). Furthermore, 55.0 MW (1.9 per cent) came from wind farms and 2.4 MW (0.08 per cent) from solar energy (Figure 1).⁵

It is worth mentioning the role of the Panama Canal Authority. The Panama Canal Authority is the biggest independent producer (auto generator) in Panama, with an installed capacity of 258.6 MW (71.8 per cent comes from thermal plants and 28.2 per cent from mini and small hydropower (SHP)).⁷ The main objective of the Panama Canal Authority is to assure the performance of the canal. Even though there is a favourable legal framework for the development of SHP plants, a local financial framework supporting the investment of SHP plants is still lacking.

The National Department of Energy, created by Law 43 on 23 April 2011, is in charge of the energy sector.⁹ The Rural Electrification Office (Oficina de Electrificación Rural, or OER) is responsible for providing energy in the rural and isolated areas that are not connected to the national grid. The OER has a goal to increase the electrification for rural areas by using photovoltaic energy and building 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 Indigenous territories. Approximately, 25,000 inhabitants received access to electricity.¹⁰ The OER is supervised and budgeted by the Ministry of the Presidency. However, all project ideas have to be proposed by rural communities in order to be included in their planning.

The energy sector is regulated by Law No 6 introduced

on 3 February 1997 (and its later amendments) as well as by Decree Law 22 of 1998.^{9,11,12,13} The transmission of energy is carried out almost entirely by the Empresa de Transmision Electrica S.A. (ETESA). Currently, the electricity grid of Panama consists of two main transmission lines. There is a transmission systems modernization and expansion plan financed by the Latin-American Development Bank for the period of 2014-2017. The plan expects to carry out the following by the end of 2015:

- ▶ The modernization of the electricity transmission system, through increasing the capacity of transmission of electricity in the National System of Interconnection;
- ▶ Extend the coverage of the network;
- ▶ Improve the quality of the service.⁶

The construction of a third transmission line is needed and it is foreseen to become part of the national grid in a few years.¹⁴

The total electricity consumption considering all sectors (private, commercial, governmental, industrial and public electrification facilities) in Panama was 7,401 MWh in 2014. This number represents a per capita consumption of 1,735 kWh and is double the average consumption rate in Central America (848 kWh per person).¹⁵ According to a statement issued in 2014 by the Department of Energy, the demand of electricity is going to increase approximately 4.8-7.4 per cent for the next 15 years. In order to alleviate the energy shortage of 300 MW, several thermoelectric power plants have been contracted in 2015.¹⁶

In Central America, the Central American Electric Interconnection System has been set up in order to create an integrated electric market within the six countries of the region: El Salvador, Guatemala, Honduras, Costa Rica, Nicaragua and Panama.¹⁷ For instance, in 2012, an interconnection was planned with Colombia. The planned line has an extension of 614 km (including an underwater line of 55 km, with 44 km in Panamanian territory). However, this project was stopped for two years after the President of Panama disapproved of the costs. In 2014, however, the President of Panama, along with his Colombian counterpart, agreed to restart the project and projected a completion date for 2018.²⁷ After the privatization of the public electricity service in 1998, the ETESA was charged with dispatching and transporting electric energy in an efficient, safe and reliable way—through adequate planning for the expansion, the construction of new amplifications and the reinforcement of the transmission grid.¹⁸ The remuneration for the services carried out by the ETESA is regulated by Law 6 of 1997.¹¹

Small hydropower sector overview and potential

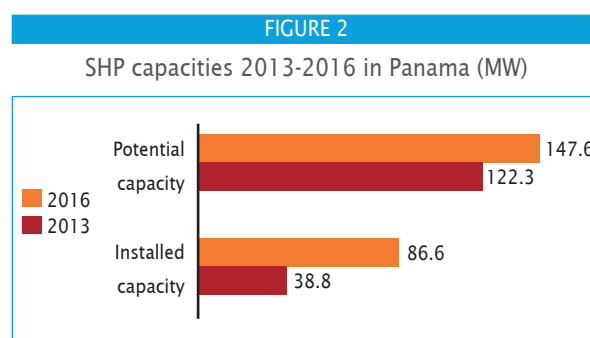
Although the Latin American Energy Organization's (OLADE) definition of SHP for Latin America is up to 5

MW,¹⁹ the legal framework in Panama considers plants up to 10 and even 20 MW.²⁰

OLADE's definitions on SHP is as follows:¹⁹

- ▶ Small hydropower: 500-5,000 KW.
- ▶ Mini hydropower: 50-500 KW.
- ▶ Micro hydropower: up to 50 KW

Figure 2 shows the increase in SHP potential and installed capacity from 2013 to 2016 (as of January). Potential capacity is defined as concessions granted for SHP plants.



Sources: ASEP,²¹ *WSHDR 2013*²²

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

Since 1970, the Government of Panama has shown interest in the development of SHP plants. The government, in collaboration with the US Agency for International Development carried out a study in the country and identified 40 potential SHP sites. In the framework of these studies, the following micro hydropower plants were built: La Tronosa (60 kW), La Pintada (30 kW), Pueblo Nuevo (50), Buenos Aires (10), Entradero de Tijeras (50 kW) and El Cedro (35 kW). These micro hydropower plants were built with the support of the Government and the communities.²³

In Panama, a self-generation producer is defined as an entity producing and consuming electricity in the same place in order to attend its own needs. These kinds of energy producers do not sell or transport energy to third parties. However, they can sell the energy surplus to other energy agents.⁷

Renewable energy policy

The starting point for the promotion of renewable energies is included in Chapter II, Title VIII of the Law 6 of 1997.¹¹ Renewable energy sources are defined in this law as geothermal, wind power, solar energy, biomass and hydropower. The high prices and the high levels of energy consumption led to the promulgation of the Law 44 of April 2011;¹⁸ this law aims to promote mostly wind power and the diversity in the renewable energy sources. The application of the model Long-Range Energy Alternative Planning is used to determine the possible scenarios of combination in between energies, i.e. hybrid systems. It is a way for developing scenarios created by Schwartz in the context of economic and energy models.²⁴

According to the National Energy Plan,²⁵ incentives are being applied in order to comply with the Kyoto Protocol. However, these incentives might need to be adapted to the new agreements made in the 2015 COP 21 held in Paris.²⁶ The Panamanian Government and private investors are working on developing SHP, wind farms, solar energy, and biomass generation.

Small hydropower legislation

The government established a legal framework in 2004 by enacting Law 45, with incentives for hydropower generation and other renewable energy sources with an extended scope for the SHP definition (up to 20 MW).²⁰ Law 45 provides incentives for small and mini hydropower plants: SHP plants up to 10 MW are not charged for selling energy directly or indirectly, small projects of 10-

20 MW receive exemptions for the first delivered 10 MW for 10 years, there are fiscal exemptions for importing equipment, machinery, materials and others and there are fiscal incentives for projects up to 10 MW and with up to 25 per cent of CO₂ emissions per year.

Barriers to the small hydropower development

Although there is a favourable legal framework granting fiscal incentives in order to develop SHP plants, the SHP sector development is not significant. The most important barrier is the lack of a solid financial framework in order to support the investment in SHP plants. It is also worth noting that the OER does not include the development of SHP plants in its future plans.