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Electrification in Panama

Deep-Dive Analysis

14 March 2025

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UAC country deep-dive reports are produced to serve as reference material to accelerate last-mile access. Reports consist of 3 components:

1. Overview of electrification in the country, including history, current status, geographic & demographic trends, and future plans.

Source: Various publicly available data sources; interviews with Coalition members & other partners

2. Summary of a geospatial plan, recommending electrification modalities for target communities in order to achieve 100% electricity access and improve quality of service

Source: Geospatial plans produced by groups comprising Waya Energy, the MIT-Comillas Universal Access Lab, and/or TTA (authorship varies by country), based on satellite imagery and data inputs from national agencies & other sources

3. Summary of challenges & considerations for operationalizing electrification plans, organized by theme

Source: Interviews with coalition members & other partners; publicly available reports; analysis by Catalyst

DISCLAIMERS

- The geospatial plans are not government-endorsed roadmaps. They are intended as reference material to support future electricity access planning and implementation. As such, they are presented for informational purposes only.
- Each plan is based on modeling that incorporates a specific set of assumptions (including a specific definition of "unelectrified"). Thus, the plans' conclusions may not be directly comparable to those of other electrification analyses for that country.
- Grid densification activities outlined in the geospatial plans are intended to represent business-as-usual operations for utilities, based on expected service improvements & demand growth in communities already electrified today.

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Acronyms and abbreviations

AECID	Spanish Agency for International Development Cooperation
ASEP	National Public Services Authority
DE	Distribution Enterprise
DFI	Development Finance Institution
EDECHI	Enterprise for Electrical Distribution Chiriqui
EDEMET	Electrical Distributor for Metro-West
ENSA	Elektra Noreste S.A.
EPM	Public Enterprises of Medellín
EPC	Engineering, procurement, and construction
FCC	Chinese Co-Financing Fund
FONER	National Rural Electrification Fund
HH	Household
IDB	Inter-American Development Bank
IEA	International Energy Agency
INEC	National Institute of Statistics and Census
kWh	Kilowatt hour
M&E	Monitoring & evaluation
O&M	Operations and maintenance
OER	Office of Rural Electrification
PER	Rural Electrification Program
PERS II	Sustainable Rural Electrification Program II
PPP	Public-private partnership
PV	Photovoltaic
PUE	Productive use of energy
RE	Renewable energy
SNE	National Energy Secretariat
USD	United States Dollar

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Current status of electrification and energy access in Panama

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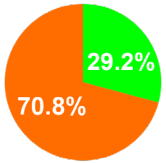
Panama has made steady progress in increasing electricity access in recent years, but electrification of the rural population lags behind

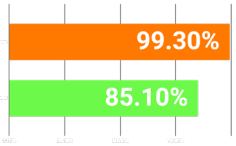
At least **191,400 people** without access to electricity[1,2] in 2023

4.32 million
Total population[3], with an urban & rural split of:[4]



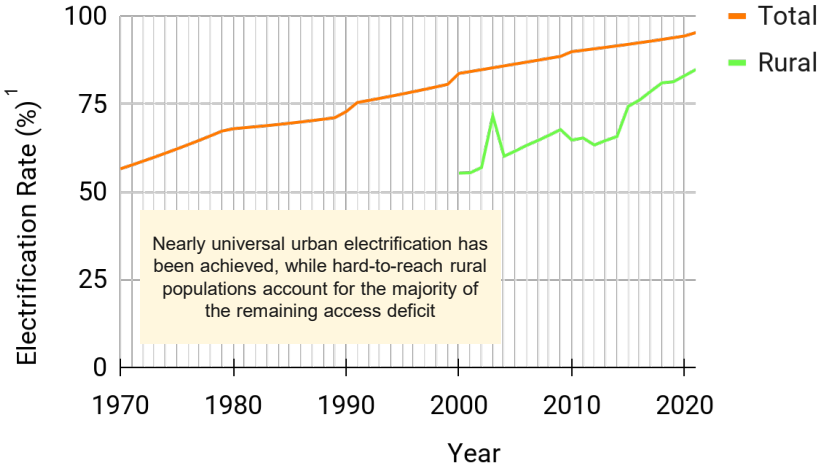
*There is a current population growth rate of 1.29%[3]

95.2%
Total electrification rate,[1,2] corresponding to at least **75 thousand households** without electricity access.[2,5]



urban/rural electrification rate (%)[1]

818 kWh
Annual residential electricity demand per capita (2022)[6]



(1) SNE estimate, 2023. **(2) Note:** The reported number of unelectrified households (and people) is likely underestimated due to the exclusion of many isolated communities from the Panamanian census. According to satellite analysis of population and electrification infrastructure, conducted by Waya Energy and IIT-Comillas in 2023, there are around 155,404 households without electricity in Panama. **(3)** Population & Demographic Indicators 2022, UNDESA, 2022. **(4)** OLADE Population, Energy Hub, IDB, 2024. **(5)** Calculated using average household size, based on the population size and the number of private dwellings counted by the census (Private dwellings in the Republic, INEC, 2023). **(6)** Energy Statistics Data Browser, IEA, 2023

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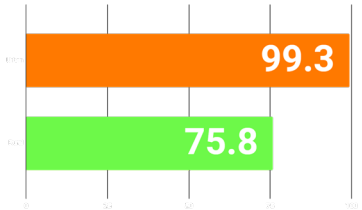
Panama boasts diversified generation capacity, anchored by hydro, but work remains in boosting rural clean cooking access and improving grid reliability

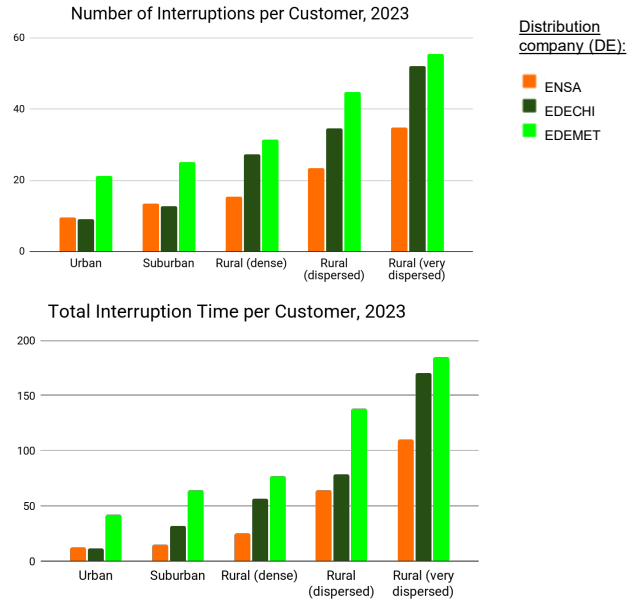
91%

Clean cooking access rate[1]:
~143 thousand households without access to clean cooking in 2022[2]

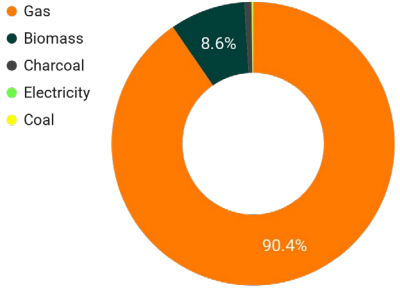
urban/rural clean cooking access rate (%)[1]



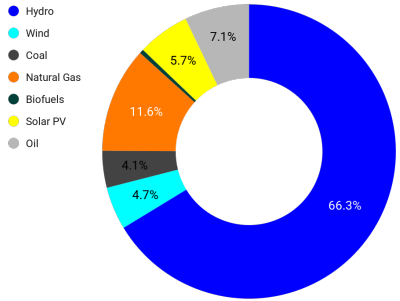
Service quality varies by utility and declines significantly as remoteness increases[4]



Breakdown of primary cooking fuels in 2022:[1]



Electric grid mix in 2022[3]



(1) WHO, Database: Cooking fuels and technologies (by specific fuel category), 2022. **(2)** Calculated based on population (OLADE Population, Energy Hub, IDB, 2024) and household size (based on population and number of private dwellings (Private dwellings in the Republic, INEC, 2023). **(3)** Panama Country Profile, IEA, 2022. **(4)** Quality of Service, National Authority of Public Services (ASEP), 2024.

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Geographic and demographic trends

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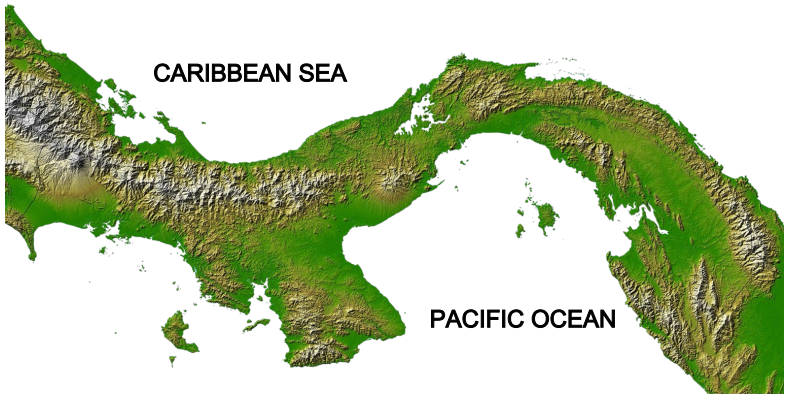
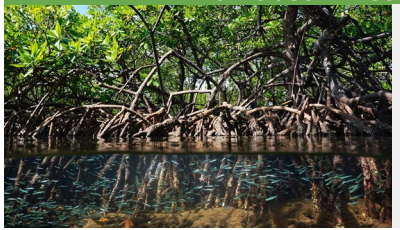
Panama consists of four main geographic regions, each with their own advantages and challenges for electrification



Caribbean Coastal Lowlands



Dense tropical rainforests, mangroves, and river networks. Sparse, rural, and predominantly indigenous population with limited road infrastructure. Economies based on subsistence agriculture, fishing, and crafts.

Mountains

High altitudes and rugged terrain, with agricultural hubs known for coffee production. Moderate population density with many rural, dispersed settlements.

Archipelagos

Isolated islands with low to moderate population density and primarily indigenous and small communities. Economies centered around tourism, fishing, and conservation.

Pacific Coastal Lowlands

Fertile plains, river deltas, and extensive commercial agricultural activity. Relatively high population density, mixed with some small fishing villages and towns.

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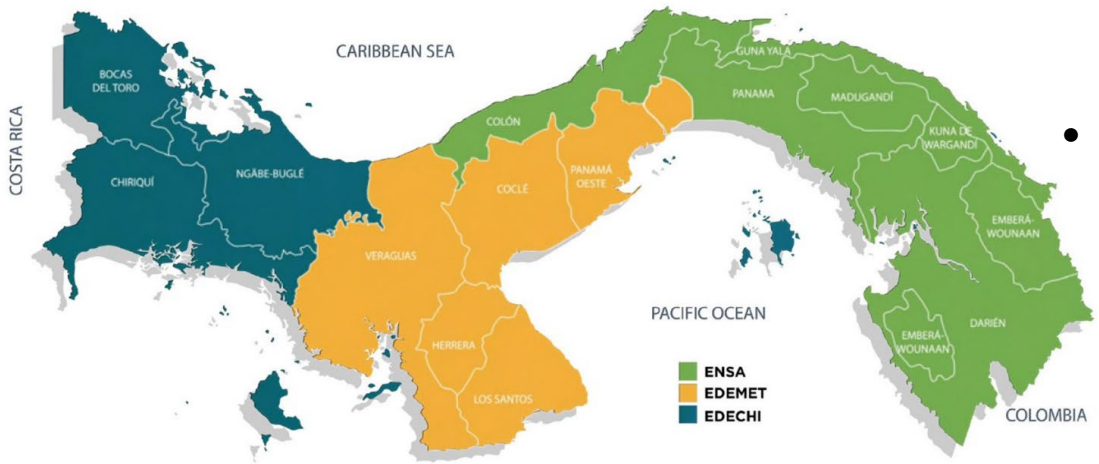
Panama has divided responsibility for the distribution of electricity among three companies, each with a concession agreement for service provision

CONCESSION AREAS BY PROVIDER



- Three distribution companies (DEs) - **ENSA, EDEMET and EDECHI** - have been granted concessions to distribute electricity by the National Authority of Public Services (ASEP)
- **The State's participation in the DEs is 49%**, with the remaining 51% in the hands of the Spanish-domiciled Naturgy group (for EDEMET and EDECHI) and of the Empresas Públicas de Medellín group (for ENSA). This sale of the majority stake in the DEs was conducted in 1998 as part of Panama's privatization of its energy sector[2]

(1) Panama- Optimal geo-referenced plan for Universal Access to Electricity. **(2)** Andrés, L. A., Guasch, J. L., Haven, T., & Fos, V. (2008). The impact of private sector participation in infrastructure: Lights, shadows, and the road ahead. The International Bank for Reconstruction and Development / The World Bank.

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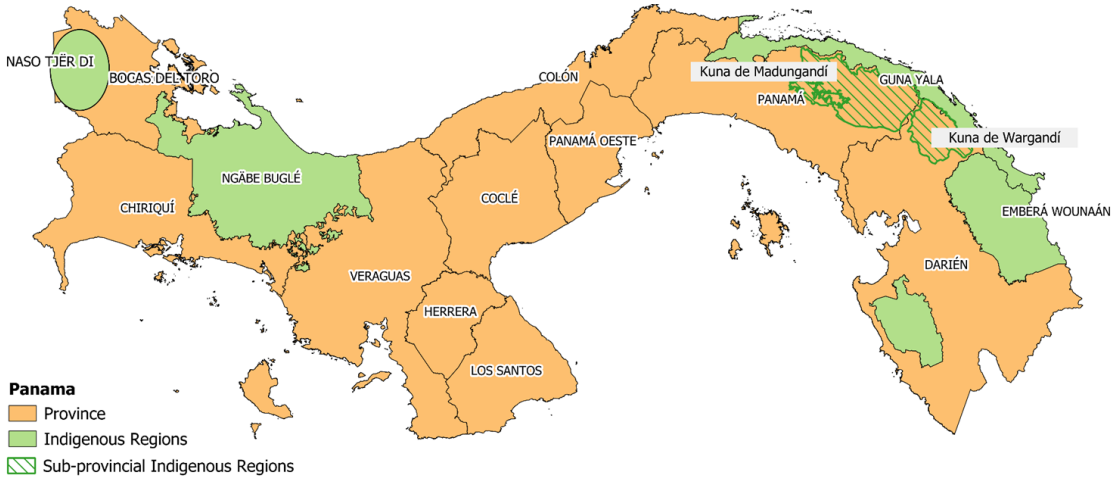
While all of Panama's provinces contain unelectrified citizens, the Indigenous Regions contain high concentrations of communities in need of new or improved energy access by 2030

Province	HHs needing service thru 2030[1]	% of total HHs needing service thru 2030[1,2]
Ngäbe Buglé	60,000	**26%**
Veraguas	23,000	8%
Coclé	15,000	5%
Bocas del Toro (contains the recently formed **Naso Tjër Di)**	11,000	**6%**
Colón	11,000	4%
Guna Yala	11,000	**31%**
Panama	11,000	1%
Chiriquí	7,000	1%
Darién	7,000	12%
Panama Oeste	7,000	1%
Herrera	3,000	2%
Emberá Wounaán	2,000	**15%**
Los Santos	2,000	2%

The four indigenous provinces of Panama (**Emberé Wounaán**, **Guna Yala**, **Naso Tjër Di**, and **Ngäbe Buglé**) face particular challenges in electrification due to their isolation and high poverty rates. As of 2021, rural households were **more than twice as likely to be in the bottom 40% of income levels** in Panama than urban households.[4]



(1) Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. **(2)** Population by Province, INEC, 2023. **(3)** Transicion Energetica Panama, IDB, Ministerio de la Presidencia, 2024. **(4)** Panama, Poverty & Equity Brief, World Bank, 2023.

*Note that the recently founded province of Naso Tjër Di is not yet fully disaggregated in mapping or data, and two Indigenous Regions (depicted above in striped green inside Panama and Darien provinces) have not achieved province status.

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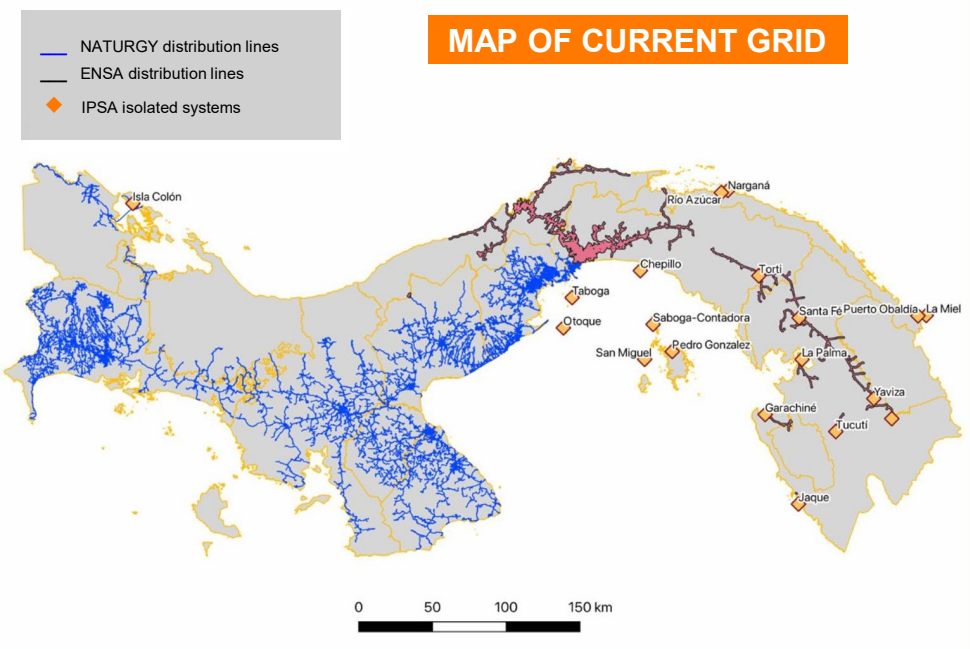
New strategies for reaching remote and rural communities will be required to fulfill energy access goals

- **New customers requiring electrification are primarily in rural areas** far from Panama's grid infrastructure
- Efforts of the Rural Electrification Programs (PER and PERS II) have mostly focused on grid extension, **but new approaches will be required** to reach unelectrified Panamanians in remote areas



(1) Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. **(2)** Transicion Energetica Panama, IDB, Ministerio de la Presidencia, 2024

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Panama's electrification efforts to date

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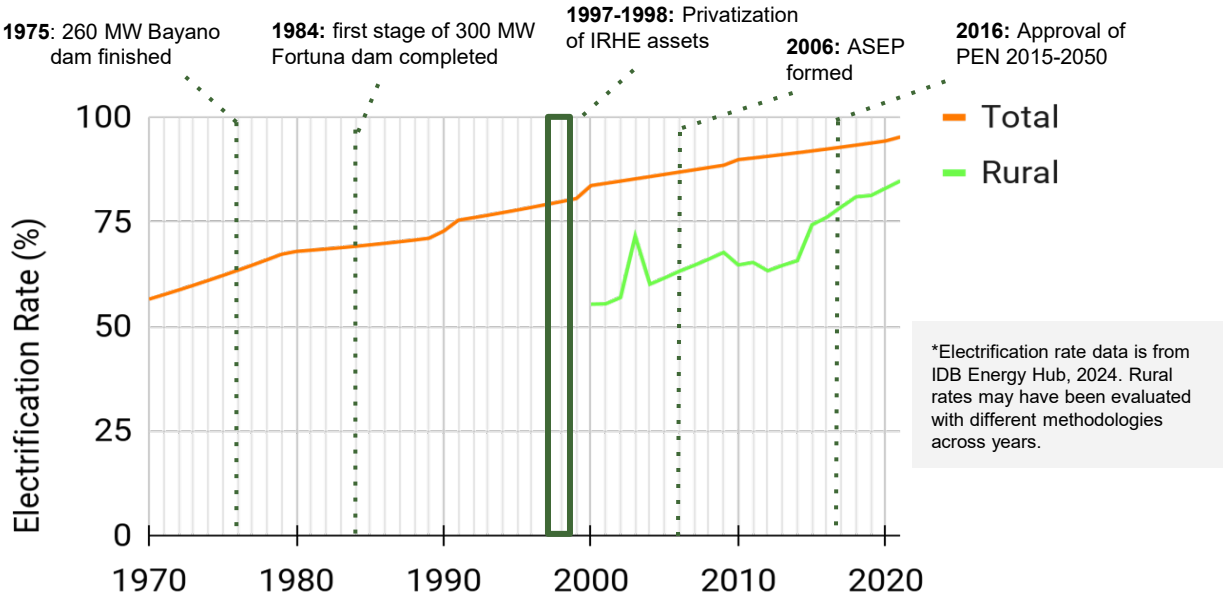
Over the last 50 years, Panama's energy market has been highly dynamic

- Throughout the 1970s and 1980s the government made significant investment in generation, mostly in hydro.
- The 1990s and 2000s saw privatization of these assets and changes in both energy market structures and regulation.



*Electrification rate data is from IDB Energy Hub, 2024. Rural rates may have been evaluated with different methodologies across years.

- The **Bayano and Fortuna hydroelectric projects**, completed in 1975 and 1984, respectively, provided significant sources of power generation that helped fuel Panama's steady electrification progress. These projects came with costs: the Bayano dam alone flooded 906 km^2 of tribal rainforest, displacing Embera and Kuna people and causing negative economic, social, and health impacts.[1]
- From 1997 to 1998, Panama worked with the International Finance Corporation (IFC) to **privatizate its electricity generation and distribution functions**. IFC helped to sell the assets of the vertically-integrated state-owned utility, Instituto de Recursos Hidraulicos y de Electrificacion (IRHE). The dynamics of the electricity market were also overhauled, creating a wholesale market including daily generation capacity spot markets.
- In 2006, Panama created the **National Authority of Public Services (ASEP)**, which supervises the electricity market though the issuing of concessions and licenses, managing distribution companies, and developing regulations.[3]
- In 2016, Panama approved the **National Electrification Plan (PEN) 2015 - 2050,** which aligns with Panama's climate goals and involves significant scale-up of green energy sources.

Sources: Panama's hydropower development defined by fierce resistance and tough choices, Circle of Blue, Schneider, 2015. Public-private partnership stories: Panama: Instituto de Recursos Hidráulicos y de Electrificación, IFC Advisory Services in Public-Private Partnerships, IFC. Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024.

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Program spotlight: Sustainable Rural Electrification Program II - PERS II

Who	IDB Inter-American Development Bank; 中拉合作基金 China-LAC Cooperation Fund; Gobierno de la República de Panamá
What	Rural electrification and institutional strengthening of the Rural Electrification Office (OER)
Where	Countrywide
When	2014 - 2021
Funding	**IDB**: USD $10 million loan (25-year tenor); **Chinese Co-Financing Fund (FCC)**: USD $10 million loan; **Government of Panama:** USD $2.25 million contribution
Technology	Grid extension and standalone solar PV systems
Tariff / Subsidy Details	The project would cover capital investment, with O&M to be recouped by distributors through tariffs

Sources: Sustainable Rural Electrification Program II - Project Completion Report (PCR), IDB, 2022. Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

Successful Outcomes

- During the period of program implementation, the **rural electrification rate increased from 71.4% to 81.5%**.
- The project purports to have **reduced CO_2 emissions** by increasing the use of grid power and reducing more carbon-intensive alternatives.

Challenges

- The program **did not achieve its goals for installing isolated systems**. It originally targeted 4,218 families, 62 schools, 11 health centres, and 13 country congresses. However, only 1,030 PV systems were installed in homes in Guna Yala.
- Most of the standalone solar systems were **out of service after 3 years** due to **battery failures**.
- The project assessment document noted that **the attempt to strengthen the OER should be considered only a partial success**: staff training shortfalls, ministry changes, and COVID effects were noted as challenges.
- Part of the strategy of the program was to encourage private sector investment to help reduce rural energy poverty, yet **distribution companies proved reluctant to invest in remote areas** during the course of program implementation, likely due to low profitability and difficulty in accessing these communities.
- The **O&M models for isolated systems were not formalized**, threatening the sustainability of these systems.

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Program spotlight:
Luz en Casa

Who	acciona.org The Energy & Water Foundation; aecid
What	Rural electrification in remote regions through standalone systems
Where	Ngäbe-Buglé province and other rural areas
When	2018 - Present
Funding	**Early phases (2018 - 2023)**: AECID and Acciona.org **Later phases (2023 - Present)**: SENACYT, Acciona.org, and others
Technology	**Standalone solar systems with batteries**, scaled to the needs of the customer (up to 300W and 640 Wh). Included lights, a radio, cell phone charger, fan, and a small television or tablet. Also included fridges and freezers for larger systems.
Tariff / Subsidy Details	Program covered CAPEX costs; OPEX covered by a USD $5-15/month fee

Sources: Acciona.org in Panama, Acciona.org Foundation, 2023. Interviews with Coalition and government stakeholders, 2025.

Successful Outcomes

A total of **5,075 standalone solar systems** have been deployed in Panama. **Sustainability** has been maximized through Acciona.org's successful **fee-for-service O&M model** that includes the following elements:

- **Local shops and technicians have been trained in repair and maintenance** and are distributed at **User Attendance (UA) centers** across target communities, serving 400-500 users each.
- Customers can bring faulty units into UA centers for a **fix and/or swap**.
- UA centers **stockpile faulty units** to ease individual manufacturer warranty claims.

Challenges

- The **regulations around private sector operators engaging in energy activities are not very well-defined**, and this uncertainty around operating models can cause operational stress.
- While Acciona and the User Attendance operators have done their best to manage repairs, **the physical geography in which they operate is very challenging**. Replication of project results in similarly tough environments could require adoption of adaptive and dynamic strategies, especially for O&M.

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Program spotlight:
Universal access to energy in Ngäbe-Buglé province

Who	aecid, oer, IDB, República de Panamá – Gobierno Nacional, Ministerio de la Presidencia
What	Rural electrification in Ngäbe-Buglé
Where	Ngäbe-Buglé province
When	Dec 2019 - Aug 2026 (ongoing)
Funding	A blended finance approach combining contributions from different parties: €10.4 million from the EU, €6 million from the Government of Panama, and €7 million from Spain's financing office
Technology	Grid extension, mini-grids, and standalone solar systems.
Tariff / Subsidy Details	Currently under discussion and subject to upcoming bill

Sources: Universal Access to Energy in Panama, Comarca Ngäbe Buglé, Delegation of the European Union to Panama, 2025. Interviews with Coalition and government stakeholders, 2025.

Successful Outcomes

- This project seeks to expand on the success of Phase 1 of the Luz in Casa program, which was led by Acciona.org and AECID.
- TTA has been able to complete the **feasibility study for the mini-grid**, which is planned for deployment in Kusapin.
- The team has **identified potential for productive use of energy solutions** in the area, which could have a strong effect on economic growth

Challenges

- The mini-grid deployment phase is **facing a regulatory challenge** and is currently stalled
  - **The government can't procure a company to build this project** because the planned mini-grid is outside of a currently concessioned area, and the **Panamanian Energy Secretariat doesn't currently have a regulation for procurement of mini-grids in regions without concessions**
  - There is currently a bill that has been presented by the Energy Secretariat; it may pass during Q1 2025, in which case the procurement process can begin
- By being located in non-concession areas, electrification projects are **not subject to the national electricity tariffs**, **cannot benefit from electricity subsidies**, and **cannot charge for distribution services**. This has the potential to threaten the financial solvency of the project.

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Future plans and considerations for electrification

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PLAN ENERGÉTICO NACIONAL 2015 - 2050

National Energy Plan (NEP) 2015 - 2050

Panama's National Energy Plan of 2015 - 2050 focuses on diversifying and decarbonizing Panama's energy systems

TARGETS

Achieve four interlinked objectives by 2050:

1) Achieve **universal access** and the reduction of energy poverty
2) Decarbonize the Panamanian energy system (**reduce energy sector emissions by 60.6%** compared to reference scenario)
3) Increase energy efficiency (**reduce electricity demand by 35%** compared to reference scenario)
4) Promote energy security through reducing dependence on foreign fuel (**supply 70% of the national energy mix through renewable sources**)

Massively scale up solar photovoltaic and wind energy to meet Panama's international climate commitments. Non-hydropower renewable energy should be increased by 15% from 2014 levels by 2030 and 30% by 2050

The NEP was borne of public consultation of key interest groups in Panama. It went into effect in 2016.

The first stage of the NEP involved a short-term plan that ran from **2015-2019**, and focused on electrification via grid extension (primary mechanism) and increasing photovoltaic capacity (secondary mechanism).

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A research group recently developed **geospatial analysis** to identify unelectrified areas and recommend appropriate technologies to electrify them.

THE OBJECTIVE

To develop a least-cost approach to achieve 100% electricity access in Panama, including definition of technology type and estimated investment for each client.

THE USE CASE

To serve as a reference to government partners in future planning for last-mile electrification.

Note that this analysis references satellite images & other supporting data to run a model based on a specific set of assumptions (including a specific definition of “unelectrified”). As such, its conclusions may not be directly comparable to those of other electrification analyses. The work is *not* a government-endorsed roadmap, and it was not originated for the context of UAC research. It is presented here for informational purposes only.

Least cost geospatial plan partners

Client

SECRETARÍA DE ENERGÍA
GOBIERNO NACIONAL

Contracting entity

IDB
Inter-American Development Bank

Financing support

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Technical partners

we waya energy

Universal Energy Access Lab
MIT and IIT-Comillas

tta Trama TecnoAmbiental

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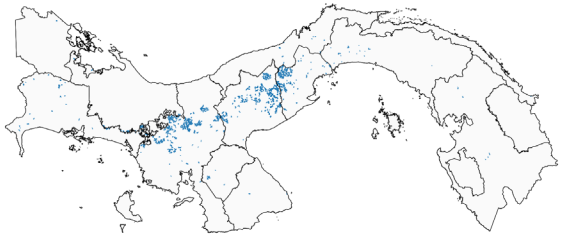
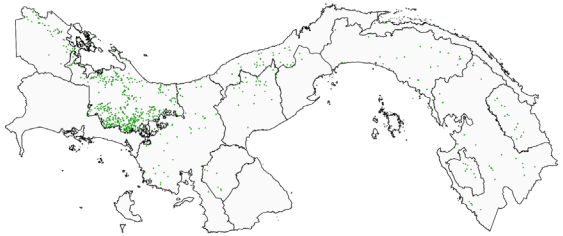
The geospatial analysis illustrates which electrification technologies are the most optimal, choosing from grid extension, mini-grids, and standalone solutions

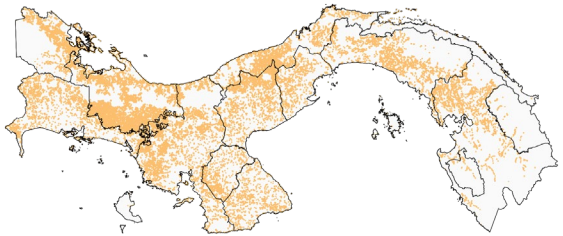
Areas where grid extension is the least-cost approach



Areas where mini-grids are the least-cost approach



Areas where standalone solar is the least-cost option



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Technology 1: Standalone Solar

The solution for dispersed, low-demand households far from the grid

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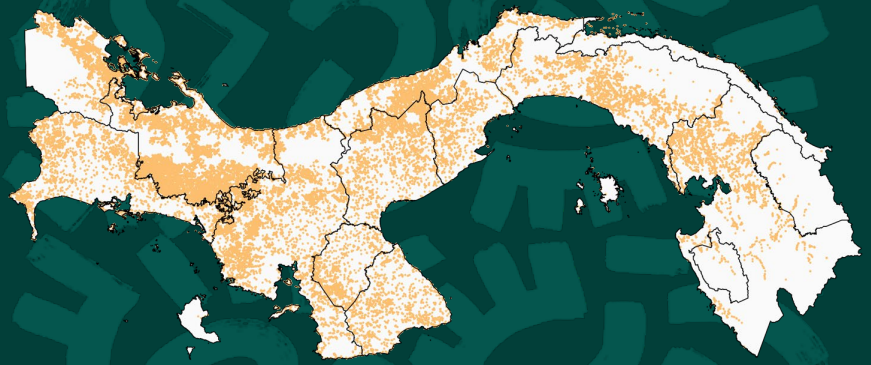
For standalone solar, the geospatial analysis shows…

That stand-alone solar systems are the most cost-effective solution for 63% of required connections.

The required investment to reach this target is estimated at **USD $245 million**.



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Key Players in Standalone Solar: Government Partners

Name	Description
SECRETARÍA DE ENERGÍA GOBIERNO NACIONAL	**The National Energy Secretariat (SNE)** formulates and oversees national energy policies, including strategies for rural electrification and the integration of renewable energy sources. In 2024, SNE launched the initiative Operación Solar, which aims to install standalone solar systems in 663 homes and 10 schools across vulnerable communities.
GOBIERNO NACIONAL CON PASO FIRME · MINISTERIO DE OBRAS PÚBLICAS	**The Rural Electrification Office (OER)** within the Ministry of Public Works is responsible for implementing electrification projects in non-concession areas, including stand-alone solar systems. The office has been instrumental in implementing PER and PERS II.
REPÚBLICA DE PANAMÁ — GOBIERNO NACIONAL — MINISTERIO DE GOBIERNO	**The Ministry of Government (MINGOB)** oversees rural development and collaborates with local authorities on initiatives that improve living conditions, including electrification.
ASEP Autoridad Nacional de los Servicios Públicos	**The National Authority of Public Services (ASEP)** is the government agency that regulates and supervises public services, including electricity. While its focus is primarily on the national grid, it also plays a role in overseeing the expansion of off-grid technologies.
MiAMBIENTE	**The Ministry of Environment (MiAmbiente)** focuses on environmental sustainability, providing guidelines and approvals for projects involving renewable energy.

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Key Players in Standalone Solar: Development Partners

Name	Description
IDB Inter-American Development Bank	The **Inter-American Development Bank (IDB)** supports stand-alone solar initiatives in Panama by providing funding, technical assistance, capacity building, and policy guidance to expand rural electrification and promote sustainable energy solutions in underserved areas. Among other efforts, IDB provided a USD $20 million loan (including USD $10 million in co-financing from FCC) to support the Sustainable Rural Electrification Program (PERS II) in 2014.
aecid	**The Spanish Agency for International Development Cooperation (AECID)** supports the implementation of off-grid electricity projects and works to strengthen local capacity for managing, maintaining, and scaling renewable energy systems in Panama. Their partnership with Acciona.org Foundation on the Luz en Casa program has enabled successful deployment of standalone solar systems in the indigenous province of Ngäbe-Buglé. They have also worked with IDB and LACIF to install both standalone solar systems and mini-grids for homes, schools, health centers, public spaces, and micro-businesses in Ngäbe-Buglé.
acciona.org The Energy & Water Foundation	**Acciona.org Foundation** co-invests equity from the Acciona company to support standalone solar projects in remote and indigenous communities.
FONPRODE Fondo para la Promoción del Desarrollo	**The Development Promotion Fund (FONPRODE)**, managed by the Spanish government, has supported grid extension and rural electrification efforts in Panama, often in partnership with the Panamanian government.
CAF BANCO DE DESARROLLO DE AMÉRICA LATINA	**Development Bank of Latin America** (CAF) is a potential partner for financing of renewable energy projects. In 2023, they launched an initiative to train indigenous women to install and repair solar panels in remote communities in Panama, in addition to broader financing to support the country's energy transition policies.

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Key Players in Standalone Solar: Execution

Name	Description
acciona.org The Energy & Water Foundation	**Acciona.org Foundation** is a micro-utility providing standalone solar systems through a fee-for-service model. It implemented the Luz en Casa program, focusing on solar kits for rural communities in Panama. Acciona.org is now providing service to more than 5,000 families in the Ngäbe-Buglé province.
tta Trama TecnoAmbiental	**TTA** has provided significant support for both planning and execution of rural electrification in Panama, often partnering with major actors in the public and private sectors. It applies its technical expertise and on-ground knowledge to design and implement systems.
SOLUBRITE Soluciones solares que cambian vidas	**Solubrite** implements standalone solar systems with PayGo technology in off-grid communities in Panama.

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Standalone systems: Key Challenges

Regulatory and Political (1/2)

Challenges	Key considerations going forward
• **Lack of a Regulatory Framework**: There is no formalized regulatory framework for off-grid service providers. This creates uncertainty for investors, allows for inconsistent service quality, and limits access to key incentives.	• Enact regulations that **formally recognize standalone solar** as an essential utility service and **establish clear rules and standards** for providers, including: technical, economic and administrative conditions; assignment of concession areas; and quality of service requirements for standalone PV systems. • **Establish tariff models and targeted incentives** that balance affordability for consumers with profitability for standalone solar providers. • As an example, Acciona.org's operations in Peru have been granted **micro-utility status,** including a concession area, utility tariffs, and O&M subsidies.
• **Unassigned Responsibility**: Concessions only cover a limited area around existing grid lines, leaving no responsible actor for most of the rural and indigenous territory.	• Develop a framework to **award territorial concessions to micro-utilities**. **Require the provision of electricity** of a certain minimum quality to all households within each concession area and **offer incentives for micro-utilities to grow** (e.g., support for promotion of productive use activities). • In areas where there is no interested micro-utility, **ensure there is a backup provider** who is responsible for both EPC and long-term sustainable operation, **such that the entire country is covered** by electricity providers. • Alternatively, **establish PPPs or joint ventures** between the existing major utilities and organizations specializing in off-grid electrification, in order to expand service into non-concession areas.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Standalone systems: Key Challenges

Regulatory and Political (2/2)

Challenges	Key considerations going forward
• **Instability in Governance:** Frequent government transitions lead to inconsistent planning and implementation for electrification projects.	• Develop **legislative protections** to ensure **policy continuity** across government administrations. • **Centralizing rural electrification under the Ministry of Public Works** would enable stability and help insulate policies and processes that impact provision of standalone solar from political changes in the government.
• **Poor Coordination:** The lack of coordination between regulatory bodies and rural electrification agencies leads to delayed implementation processes and disconnects between on-ground needs and regulatory support mechanisms.	• **Improve coordination** between regulatory bodies to streamline approvals and oversight. • Engage policymakers in capacity-building initiatives to ensure informed decision-making on off-grid solutions.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Standalone systems: Key Challenges

Planning and Management

Challenges	Key considerations going forward
• **Lack of Official Implementation Plan**: Panama lacks an endorsed investment implementation plan that includes a schedule of planned projects, budgets, execution timelines, and commissioning dates, as well as clear responsibilities assigned to distribution companies and other electrification actors.	• **Leverage the geospatial analysis** to develop a pipeline of projects with **clear budgets and timelines**, including well-defined **roles and responsibilities**.
• **Limited Capacity**: Despite advances in planning (e.g., geospatial electrification plans), administrative capacity at the national level remains limited. For example, the OER cites limitations in both human and financial resources.	• **Improved national coordination** is needed along with an accompanying resource allocation to support the **development of national administrative capacity.**
• **Inadequate Monitoring Tools**: There is no database listing all off-grid systems that have been deployed. The "Visible Contractor" platform used for project monitoring is outdated and has not been regularly updated since 2014, failing to track project progress effectively.	• **Develop a database of all off-grid projects** and ensure it is continuously updated. • Update M&E systems like "Visible Contractor" with **real-time dashboards** and **clear KPIs** to identify delays early and ensure timely completion.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Standalone systems: Key Challenges

Economic

Challenges	Key considerations going forward
• **Limited Government Funding**: Significant capital investment is required for standalone solar system deployment. However, the Panamanian government has offered little funding allocation for rural electrification.	• **Prioritize rural electrification** on the energy agenda. • Mobilize funding from DFIs, NGOs, and philanthropic organizations.
• **Limited Investment from Service Providers:** Investment from private institutions and micro-utilities (including private entities, social enterprises, and bottom-up energy communities) is limited due to financial risks.	• **Create financial incentives to encourage investment**, such as concessional loans, grants, results-based financing, tax breaks and exemptions, and guarantees. • Develop a framework to **award territorial concessions to micro-utilities**. These concessions should be **large enough to make investments attractive** yet compact enough to **keep O&M efficient**.
• **High O&M Costs:** Ongoing operation and maintenance costs for standalone solar systems are high, making sustainability challenging. This is especially true in remote areas with limited local capacity for maintenance and limited ability to pay for O&M services.	• **Establish a social tariff or cross-subsidy system**, perhaps by expanding usage of the current Tariff Stabilization Fund, which subsidizes electricity bills for grid users with low consumption levels. This mechanism must **balance affordability for consumers with profitability for service providers**. • Enable **remote payment services,** potentially through partnerships with telecommunications companies, to reduce operational costs. • **Implement a subscription-based model or PayGo technology** with lockout capability to fund ongoing maintenance. • The application of the considerations given in this table must ensure a **sustainable business model** wherein the service provider has enough funding for investment, O&M, and profitability in the long term. This model should be **protected from risks**, including political and financial.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Standalone systems: Key Challenges

Operations, Maintenance, and Community Engagement

Challenges	Key considerations going forward
• There is a **lack of trained personnel** in rural communities for system maintenance and repairs. Supply chain issues also make it **difficult to ensure consistent availability of spare parts**.	• **Collaborate or partner with existing training programs** (e.g., Solar Mothers), national education initiatives, and capacity-building initiatives such as Acciona.org's. • **Train users and local committees** to perform routine maintenance and basic troubleshooting, with **emphasis on gender inclusion**, in order to reduce dependence on external experts. **Deploy teams of experts** to handle complex technical issues identified by **remote monitoring tools** and/or reported by local committees. • **Store frequently needed spare parts** at mini-grid sites or in nearby towns, in coordination with SNE, OER, and local authorities.
• Historically, unreliable or poorly maintained systems have left users with significant disruptions to electricity supply, resulting in a **negative public perception** of standalone solar systems.	• Acciona.org has successfully addressed this challenge in rural Panama through **quality assurance**, **O&M contracts,** and the institution of **local distribution centers** (or user attendance centers) that can repair or swap out faulty components. Their methodology could be **replicated** outside their operating areas. • **National quality standards** and **third-party verification** is critical to ensure quality and longevity of systems and their components.
• **Lack of emphasis on community participation in energy projects** may limit buy-in, sense of ownership, and sustainability.	• Promote the establishment of **local representative bodies or committees** that (1) collaborate with project implementers and service providers to **ensure alignment of efforts with community needs & contexts** and (2) support **long-term monitoring, reporting, and supervision**. • Promote and incentivize the **inclusion of women** in local representative bodies

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Technology 2: Mini-grids

The solution for clustered households far from the grid

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For mini-grids, the geospatial analysis shows…

That PV mini-grids* are the most cost-effective solution for 22% of required connections.

The required investment to reach this target is estimated at **USD $340 million**.

*These mini-grids have battery storage and no diesel backup.

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Key Players: Government Partners for Mini-Grid Projects

Name	Description
GOBIERNO NACIONAL CON PASO FIRME · MINISTERIO DE OBRAS PÚBLICAS	The **Rural Electrification Office (Oficina de Electrificación Rural - OER)** of the National Energy Secretariat plays a crucial role in executing electrification projects, particularly in non-concession areas. OER oversees mini-grid development to extend energy access to remote regions.
SECRETARÍA DE ENERGÍA GOBIERNO NACIONAL	**The National Energy Secretariat (Secretaría Nacional de Energía - SNE)** is responsible for formulating and implementing national energy policies. SNE coordinates efforts to promote renewable energy and rural electrification, including mini-grid deployment.
ASEP Autoridad Nacional de los Servicios Públicos	**Autoridad Nacional de los Servicios Públicos (ASEP)** regulates the electricity sector, including setting tariffs, quality standards, and ensuring compliance with laws and regulations that apply to mini-grids.
MiAMBIENTE	**Ministry of the Environment (Ministerio de Ambiente - MiAmbiente)** reviews and approves environmental impact assessments for mini-grid projects to ensure alignment with national sustainability goals.
REPÚBLICA DE PANAMÁ GOBIERNO NACIONAL MINISTERIO DE GOBIERNO	**Ministry of Government (Ministerio de Gobierno - MINGOB)** facilitates rural development and supports community engagement for mini-grid projects in collaboration with local authorities.

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Key Players: Development Partners for Mini-Grid Projects

Name	Description
IDB Inter-American Development Bank	**Inter-American Development Bank (IDB)** has been a key supporter of rural electrification projects in Panama, providing concessional loans and technical assistance for energy access initiatives, including deployment mini-grids in rural areas.
aecid	**The Spanish Agency for International Development Cooperation (AECID)** supports the implementation of off-grid electricity projects and works to strengthen local capacity for managing, maintaining, and scaling renewable energy systems in Panama. They have worked with IDB and LACIF to install both standalone solar systems and mini-grids for homes, schools, health centers, public spaces, and micro-businesses in Ngäbe-Buglé.
gef global environment facility INVESTING IN OUR PLANET	**Global Environment Facility (GEF)** has supported projects in Panama that integrate renewable energy solutions, including mini-grid development, to improve energy access in off-grid areas.
FONPRODE Fondo para la Promoción del Desarrollo	**The Development Promotion Fund (FONPRODE)**, managed by the Spanish government, has supported grid extension and rural electrification efforts in Panama, often in partnership with the Panamanian government.
CAF BANCO DE DESARROLLO DE AMÉRICA LATINA	**Development Bank of Latin America** (CAF) is a potential partner for financing of renewable energy projects. In 2023, they provided USD $200 million in financing to support the country's energy transition policies across a range of agenda items.

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Key Players: Execution for Mini-Grid Projects

Name	Description
GOBIERNO NACIONAL CON PASO FIRME · MINISTERIO DE OBRAS PÚBLICAS	The **Rural Electrification Office (Oficina de Electrificación Rural - OER)** of the National Energy Secretariat manages and oversees electrification initiatives in non-concession areas, including partnerships with private sector entities for mini-grid projects.
CRETARÍA DE ENERGÍA GOBIERNO NACIONAL	**National Energy Secretariat (Secretaría Nacional de Energía - SNE)** develops the policy framework and coordinates rural electrification efforts, including mini-grid deployment, often collaborating with private entities.
ASEP Autoridad Nacional de los Servicios Públicos	**Autoridad Nacional de los Servicios Públicos (ASEP)** regulates mini-grid projects, setting tariffs, ensuring service standards, and granting permits under PPP arrangements
tta Trama TecnoAmbiental	**TTA** has provided significant support for both planning and execution of rural electrification in Panama, often partnering with major actors in the public and private sectors. It applies its technical expertise and on-ground knowledge to design and implement systems.
Distribution companies	Concessionaires like **ENSA**, **EDEMET**, and **EDECHI** may be involved in mini-grid efforts within their service areas or through sub-concessions.

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Mini-Grids: Key Challenges

Regulatory & Political (1/3)

Challenges	Key considerations going forward
• **Lack of Regulatory Inclusion for Off-Grid Solutions:** Current regulations focus on grid-connected systems, with no explicit inclusion of off-grid solutions like mini-grids. This creates gaps in cost-of-service remuneration and quality standards, impacting service sustainability and equity.	• **Update the regulatory framework** to explicitly include off-grid solutions, with **clear guidelines for cost-of-service remuneration and quality standards**. This would ensure reliable and affordable electricity services for all users, irrespective of their location or supply mode.
• **Lack of Political Will:** Mini-grids are a viable option but are not actively promoted by the government. Mini-grids and other off-grid solutions often receive less attention and resources compared to traditional grid extensions, slowing progress in rural electrification efforts. • **Alternatively, Excess Politicization of Rural Electrification** can see politicians prioritizing certain areas over others or holding off on electrifying certain areas for political gain.	• **Increase political focus** on off-grid solutions by **integrating** them explicitly into the **national electrification strategy** and allocating sufficient resources to their development • **Insulate the National Rural Electrification Program** by putting it under the **Ministry of Public Works,** preventing the administrators in charge of execution from being changed with each subsequent administration and thus disrupting the momentum of the program.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Regulatory & Political (2/3)

Challenges	Key considerations going forward
• **Unassigned Responsibility**: Most of the rural and indigenous territory is in non-concession areas. In these areas, no single agent is assigned responsibility for mini-grid operations, making coordination and management inefficient.	• **Clearly define responsibility** for managing generation, distribution, and commercialization in unelectrified areas to improve efficiency. Responsibility may be assigned to a **single entity** or shared among multiple actors, through **PPPs or joint ventures** between the existing major utilities and organizations specializing in off-grid electrification. • Develop a framework to **award territorial concessions to micro-utilities**. **Require the provision of electricity** of a certain minimum quality to all households within each concession area and **offer incentives for micro-utilities to grow** (e.g., support for promotion of productive use activities). • In areas where there is no interested provider, **ensure there is a backup entity** who is responsible for both EPC and long-term sustainable operation, **such that the entire country is covered** by electricity providers. • Enable **integrated concessions including both mini-grids and standalone systems** to optimize coordination of technical, operational, and financial resources in remote areas.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Regulatory & Political (3/3)

Challenges	Key considerations going forward
• **Inefficient Project Implementation Processes**: Administrative and approval processes for mini-grid projects are slow and cumbersome, often involving delays from various government bodies such as the Comptroller's Office. This hampers timely execution of projects.	• **Simplify and streamline administrative and approval processes**, prioritizing efficiency and timely decision-making to avoid unnecessary delays in project execution. • **Improve coordination** between the government bodies involved in approvals.
• **Short Concession Periods**: Existing 10-year concession contracts are insufficient for long-term investments in renewable energy technologies, such as solar mini-grids, which require longer time frames to achieve financial sustainability.	• **Lengthen concession periods** to 15–25 years to align with the lifespan of renewable energy technologies, encouraging investment in sustainable mini-grid solutions.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Planning and Management (1/2)

Challenges	Key considerations going forward
• **Lack of Official Implementation Plan**: Panama lacks an endorsed investment implementation plan that includes a schedule of planned projects, budgets, execution timelines, and commissioning dates, as well as clear responsibilities assigned to distribution companies and other electrification actors.	• **Leverage the geospatial analysis** to develop a pipeline of projects with **clear budgets and timelines**, including well-defined **roles and responsibilities**. • Develop **OER-led mini-grid initiatives.**
• **Lack of Development**: There are no current mini-grid initiatives being promoted by Distribution Companies (DEs), despite the existence of over 400 communities where mini-grids are most cost-effective solution.	• **Build capacity for DEs** to plan and execute mini-grid projects, as they often lack experience with off-grid systems. • Improve **financial incentives** for DEs to engage with mini-grid projects.
• Despite advances in planning (e.g., geospatial electrification plans), **administrative capacity at the national level remains limited**. For example, the OER cites limitations in both human and financial resources.	• **Improved national coordination** is needed along with an accompanying resource allocation to support the **development of national administrative capacity.**

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Planning and Management (2/2)

Challenges	Key considerations going forward
• **Inadequate Monitoring Tools**: There is no database listing all off-grid systems that have been deployed. The "Visible Contractor" platform used for project monitoring is outdated and has not been regularly updated since 2014, failing to track project progress effectively.	• **Develop a database of all off-grid projects** and ensure it is continuously updated. • Update M&E systems like "Visible Contractor" with **real-time dashboards** and **clear KPIs** to identify delays early and ensure timely completion.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Economic (1/2)

Challenges	Key considerations going forward
• **High Initial Investment Costs and Insufficient Funding**: Mini-grids require significant upfront capital, averaging **$8,915 per customer**, making them a costly solution, particularly for rural areas with limited demand and scattered populations. Current government resources are insufficient, and distribution companies lack incentives to build mini-grids.	• Establish funding mechanisms through **public-private partnerships** and **international donors.** • Introduce financial **incentives** such as concessional loans, grants, results-based financing, tax breaks and exemptions, and guarantees to **attract private investors**. • Prioritize **high-potential pilot projects** in communities with large numbers commercial users and community facilities like schools and hospitals
• **Poor Financial Frameworks:** Tariffs and subsidy mechanisms are underdeveloped, limiting operational sustainability and contributing to disillusionment of the population.	• **Improve tariff models and financial incentives** to balance affordability for consumers with profitability for mini-grid operators, as part of a **sustainable business model**. • For example, establish a **social tariff or cross-subsidy system**, perhaps by expanding usage of the current Tariff Stabilization Fund, which subsidizes electricity bills for grid users with low consumption levels. • Promote **inclusion of PUE** to increase energy demand and improve financial sustainability.
• **Lack of Established Pre-Designs**: The absence of pre-designs for mini-grid projects delays decision-making and increases costs, making project execution slower and more expensive.	• **Develop pre-designs and standardized frameworks** to streamline project implementation and reduce delays and associated costs.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Economic (2/2)

Challenges	Key considerations going forward
• **Limited inclusion of PUE**: Inclusion of PUE in electrification projects is lacking, in part due to limited PUE initiatives associated with national electrification plans	• Integrate the **promotion and incentivization of productive use activities** into national electrification plans to **enhance the socio-economic impact** of electrification projects and **improve financial sustainability** of mini-grids by increasing energy demand. • Establish **financing mechanisms for PUE equipment**, ideally by integrating these mechanisms into broader mini-grid financing plans. • **Coordinate electrification planning with other development sectors** such as water, healthcare, and communications to expand energy use for services like water pumping, vaccine refrigeration, and internet access.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Mini-Grids: Key Challenges

Technical

Challenges	Key considerations going forward
• **Limited Telecommunication Coverage**: Isolated areas lack affordable data coverage for system monitoring and remote payments.	• Partner with telecom providers to **deploy joint internet and energy coverage initiatives** to support remote monitoring and payments for mini-grids.
• **Dependence on Fossil Fuels**: Mini-grids in Panama primarily rely on diesel generators, with minimal adoption of renewable energy sources.	• **Lengthen concession periods** to justify long-term renewable energy investments. • Consider the **long-term operational fuel costs** when weighing cost effectiveness of diesel vs. renewable energy systems.
• **Limited Access to Trained Technicians**: There is a lack of trained personnel in rural communities for system maintenance and repairs. Simultaneously, it is difficult to deploy technical teams/personnel to remote regions.	• **Train users and local committees** to perform routine maintenance and basic troubleshooting, with emphasis on gender inclusion. This will improve operational efficiency and prevent premature failures. • **Deploy teams of experts** to handle **complex** technical issues identified by **remote monitoring tools** and/or reported by local committees.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Technology 3: Grid Extension

The solution for households near enough to the grid or clustered at volumes which justify investment in grid distribution infrastructure

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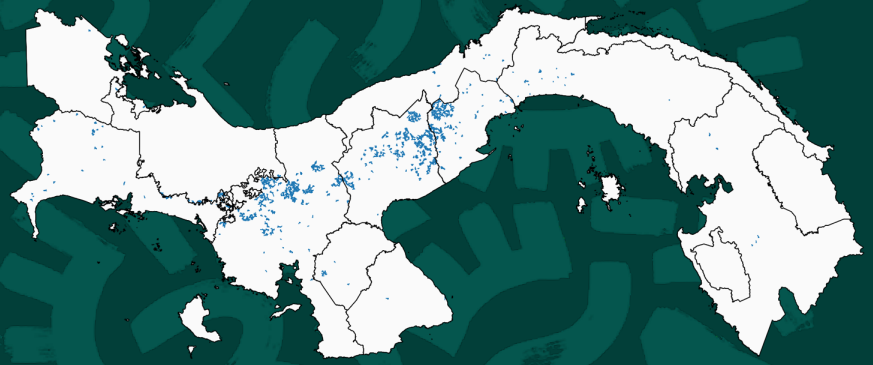
For grid extension, the geospatial analysis shows…

That grid extensions are the most cost-effective solution for 15% of required connections.

The required investment to reach this target has yet to be confirmed.



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Key Players: Government Partners for Grid Extension

Name	Description
SECRETARÍA DE ENERGÍA Gobierno Nacional	The **Rural Electrification Office (Oficina de Electrificación Rural - OER)** of the National Energy Secretariat oversees the implementation of electrification projects in non-concession areas, including grid extension initiatives.
República de Panamá — Gobierno Nacional — Ministerio de la Presidencia — Oficina de Electrificación Rural	The **National Energy Secretariat (Secretaría Nacional de Energía - SNE)** sets the national energy agenda and policies, including electrification strategies that involve grid extension.
ASEP Autoridad Nacional de los Servicios Públicos	**Autoridad Nacional de los Servicios Públicos (ASEP)** regulates and supervises the electricity sector, ensuring compliance with standards for grid expansion, setting tariffs, and overseeing concession agreements with distribution companies.
ENSA Grupo epm	**Distribution Companies (ENSA, EDEMET, EDECHI)** operate within concession areas and are directly responsible for grid extension projects under their jurisdiction, in alignment with national electrification goals.
MEF Ministerio de Economía y Finanzas República de Panamá	**Ministry of Economy and Finance (Ministerio de Economía y Finanzas - MEF)** allocates public funding for grid extension projects, particularly in areas where private investments are insufficient.
MiAMBIENTE	**Ministry of the Environment (Ministerio de Ambiente - MiAmbiente)** ensures that grid extension projects meet environmental regulations and align with sustainability goals.

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Key Players: Development Partners for Grid Extension

Name	Description
IDB Inter-American Development Bank	**Inter-American Development Bank (IDB)** has been a major contributor to Panama's rural electrification efforts, providing funding and technical assistance for grid extension projects as part of broader energy access programs.
FONPRODE Fondo para la Promoción del Desarrollo	The **Development Promotion Fund (FONPRODE)**, managed by the Spanish government, has supported grid extension and rural electrification efforts in Panama, often in partnership with the Panamanian government.
CAF BANCO DE DESARROLLO DE AMÉRICA LATINA	The **Development Bank of Latin America (CAF)** has provided financing for infrastructure projects in Panama, including energy infrastructure like grid extension initiatives aimed at expanding electricity access.
THE WORLD BANK	**World Bank** has historically funded electrification and infrastructure projects in Panama, including programs to extend grid access to rural and underserved areas.

Key Players: Execution for Grid Extension Projects

Name	Description
SECRETARÍA DE ENERGÍA GOBIERNO NACIONAL	The **Rural Electrification Office (Oficina de Electrificación Rural - OER)** of the National Energy Secretariat executes grid extension projects and hands them over to distribution companies for operation.
Distribution companies	Electricity distribution in Panama is managed by three companies: **ENSA, EDEMET, and EDECHI**. The Panamanian State owns 49% of the shares in these distribution companies, while **Naturgy** holds 51% in EDEMET and EDECHI, and **Empresas Públicas de Medellín (EPM)** owns 51% of ENSA. Through concession contracts, the State mandates these distributors to provide electric energy distribution and commercialization services within their respective concession areas. **ENSA** operates in the eastern region of Panama, **EDEMET** covers the central-western region, and **EDECHI** operates in the Chiriquí province and other western areas.

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Grid Extension: Key Challenges

Regulatory & Political

Challenges	Key considerations going forward
• **Lack of Service for Informal Settlements:** Legal and regulatory barriers prevent grid connections in informal settlements	• Explicitly **include off-grid solutions in regulations**, with clear guidelines on cost-of-service remuneration, quality standards, and service obligations to ensure equity in electrification. • Develop **flexible policies** to allow electrification in informal areas.
• **Limited Responsibility of Utilities:** The responsibility of utilities to provide service does not extend beyond 1 km of the existing grid	• **Improve planning and coordination of stakeholders** to determine responsibility for areas beyond the 1-km obligation. • **Use funds like FONER to cover extension costs** beyond the 1-km obligation. • **Update ASEP regulations** to either increase the mandatory service range to a more inclusive distance for priority areas or mandate the provision of service to all households within the concession area. • Otherwise, **promote decentralized, off-grid solutions** for communities far from existing infrastructure.
• **Tariff Design and Subsidies**: Current tariff structures do not fully account for the economic realities of rural users, potentially leading to inequitable pricing and financial unsustainability for electrification initiatives	• **Reform Tariff Structures**: Design tariffs that align with users' ability to pay while ensuring sustainability for service providers. Consider cross-subsidization models to balance costs between urban and rural users.
• **Slow Administrative Processes**: Complex and inefficient administrative approval processes, particularly through the Comptroller's Office, delay project implementation and reduce the effectiveness of rural electrification efforts	• **Streamline Administrative Processes**: Simplify and accelerate approval processes, particularly for projects managed by the Rural Electrification Office (OER), to improve execution timelines and accountability.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Grid Extension: Key Challenges

Planning and Management

Challenges	Key considerations going forward
• **Lack of Official Implementation Plan**: Panama lacks an endorsed investment implementation plan that includes a schedule of planned projects, budgets, execution timelines, and commissioning dates, as well as clear responsibilities assigned to distribution companies and other electrification actors.	• **Leverage the geospatial analysis** to develop a pipeline of projects with **clear budgets and timelines**, including well-defined **roles and responsibilities**.
• Despite advances in planning (e.g., geospatial electrification plans), **administrative capacity at the national level remains limited**. For example, the OER cites limitations in both human and financial resources.	• **Improved national coordination** is needed along with an accompanying resource allocation to support the **development of national administrative capacity.**
• **Inadequate Monitoring Tools**: There is no database listing all off-grid systems that have been deployed. The "Visible Contractor" platform used for project monitoring is outdated and has not been regularly updated since 2014, failing to track project progress effectively.	• **Develop a database of all off-grid projects** and ensure it is continuously updated. • Update M&E systems like "Visible Contractor" with **real-time dashboards** and **clear KPIs** to identify delays early and ensure timely completion.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Grid Extension: Key Challenges

Economic

Challenges	Key considerations going forward
• **Investment Costs**: Infrastructure costs for grid expansion in remote and sparsely populated areas are very high. Raising funds can be a long and uncertain process.	• Leverage **geospatial analysis** to opt for mini-grids or standalone solutions where they are the least-cost option. • **Streamline the process** of accessing grid extension financing from the **Rural Electrification Fund (FER)** to improve execution timelines and **reduce uncertainty** in project financing. • Leverage financing from **development finance institutions** and **multilateral agencies**.
• **Reluctance from Distribution Companies (DEs)**: Distribution companies are hesitant to increase investments due to delays in subsidy payments, insufficient cost recognition, and debt limitations.	• Facilitate **concessional loans** through development banks to help DEs **restructure existing debt**. • Establish a **dedicated fund** using contributions from the government and multilateral organizations to **ensure timely subsidy payments**. • Consider a **unified tariff system** that enables **cross-subsidization** between customer classes to ensure affordability for low-income consumers while **maintaining financial sustainability** for DEs. • **Conduct regular cost-of-service studies** to adjust tariffs fairly. • Introduce **new incentives** to reduce investment costs, stimulate demand, and mitigate financial risks for utilities that extend their services to remote regions. • **Educate consumers** about the cost of electricity provision and the importance of timely bill payments to reduce losses.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.

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Grid Extension: Key Challenges

Technical

Challenges	Key considerations going forward
• **Infrastructure Delays**: Key projects like the Metetí substation are delayed, hindering the ability to expand the grid and execute electrification plans effectively.	• **Prioritize investments in critical infrastructure**, such as substations, to enable the expansion of the national grid and support planned electrification projects.
• **Aging Grid Infrastructure:** Some areas of the grid need significant upgrades.	• **Invest in modernizing existing grid infrastructure** to enhance reliability and efficiency.
• **Limited Technical Resources**: A shortage of specialized personnel and logistical issues in informal settlements complicates project execution.	• Invest in **workforce training** to address the lack of specialized personnel and ensure adequate resources for servicing hard-to-reach areas.
• **Poor Service Quality in Remote Areas:** Quality of service is reduced at the end of very long distribution feeders.	• Consider **grid-connected distributed generation** to enhance stability and provide ancillary services to existing distribution lines, improving service quality at a lower cost than upgrading the network in areas where the low demand does not yet justify such investment.

Sources: Optimal geo-referenced plan for Universal Access to Electricity Panama 2030, Waya Energy & IIT Comillas, 2024. Interviews with Coalition and government stakeholders, 2025.