AKA Energy

Switch Energy Competition

Ecuador & Guatemala

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Executive Summary

Problem Overview	Lack of infrastructure or connection to the grid in remote areas affects limits reliable access to electricity and safe cooking fuels in rural areas. Overreliance on hydropower leaves both grids vulnerable to changes in water resources. Lack of expertise, manpower, and political stability make it difficult to diversify, despite abundant resources.
Electrification Solution	• Diversifying the current through PV Farms, Wind Farms & Large-Scale Geothermal projects
Clean Cooking Solution	• Securing the LPG supply chain through RFID & transitioning LPG pricing • Implementing alternative cooking fuel pilot projects
Impact & Financials	• Increasing the renewable energy supply by 810MW • Providing enough additional energy to power 2.95 million households • Total costs accumulate to $4.49 B
Transferability & Feasibility	• Would need focus on government policy and relations development with the large Indigenous population to build new projects • Implementable are the LPG supply chain and smaller scale off-grid projects

Energy Landscape in Ecuador

Hydropower Dependency and Oil Consumption

- **Hydropower Reliance:** 74.6% of electricity generation comes from hydropower, with droughts impacting hydropower generation.
- **Oil as Dominant Energy Source:** 82% of Ecuador's total energy consumption is from oil, and 77% of transportation energy relies on oil products.
- **6th in Latin America for refined oil production.**
- **Unreliable Access in Rural Areas:** Only 3 out of 20 electricity distribution companies meet national standards for service quality.
- **Environmental Degradation:** Ecuador lost 2.6 million hectares of forest between 2000 - 2020, partly due to oil and mineral extraction.
- **Political Instability:** Between 2010 - 2020, Ecuador saw 5 changes in government leadership, impacting energy policy consistency.

Energy Landscape in Guatemala

Hydropower and Rising Fossil Fuel Use

- **Hydropower Reliance:** Hydropower accounts for 52.6% of electricity generation, vulnerable to droughts.
- **Increase in Fossil Fuels:** Coal and oil have risen sharply, increasing CO2 emissions. Coal use increased by 153% from 2000 to 2022.
- **Highest electricity prices in Latin America** (USD 0.298/kWh).
- **Corruption** has hindered the progress of energy projects and worsened environmental damage.

Energy Mix and Resource Utilization

Ecuador

Hydropower (74.6%): Key electricity source due to abundant resources and established infrastructure, but highly vulnerable to droughts.

Oil (82% of total energy consumption): Dominant energy source due to Ecuador’s oil reserves. Oil is used extensively in transportation and industry.

Natural Gas: Minimal use (0.02% of the energy mix) due to limited domestic reserves and high import costs.

Nuclear: Not considered due to high costs, lack of infrastructure, and limited domestic expertise.

Other Renewables: Vast solar and wind potential. Development is hindered by political instability and slow investment.

Guatemala

Hydropower (52.6%): Main electricity source due to favorable geography, but vulnerable to climate variability (droughts).

Biofuels (26%): Widely used in rural areas and for industrial purposes but contributes to CO2 emissions and deforestation.

Coal (9.5%) and Oil (5.3%): Used to meet energy demand during dry periods, but reliance on imports raises costs and emissions.

Natural Gas: Not part of the current energy mix due to limited infrastructure and supply.

Nuclear: Not feasible due to cost, lack of infrastructure, and safety concerns.

Other Renewables: Significant solar, wind, and geothermal potential, but underinvestment and lack of political focus have slowed their development.

Energy Accessibility & Affordability

Electricity

Ecuador	Guatemala
97% access in urban areas, 88% in rural areas; rural communities face infrastructure gaps and frequent outages.	90% access in urban areas, 70% in rural areas; rural and indigenous communities are disproportionately affected.

Cooking

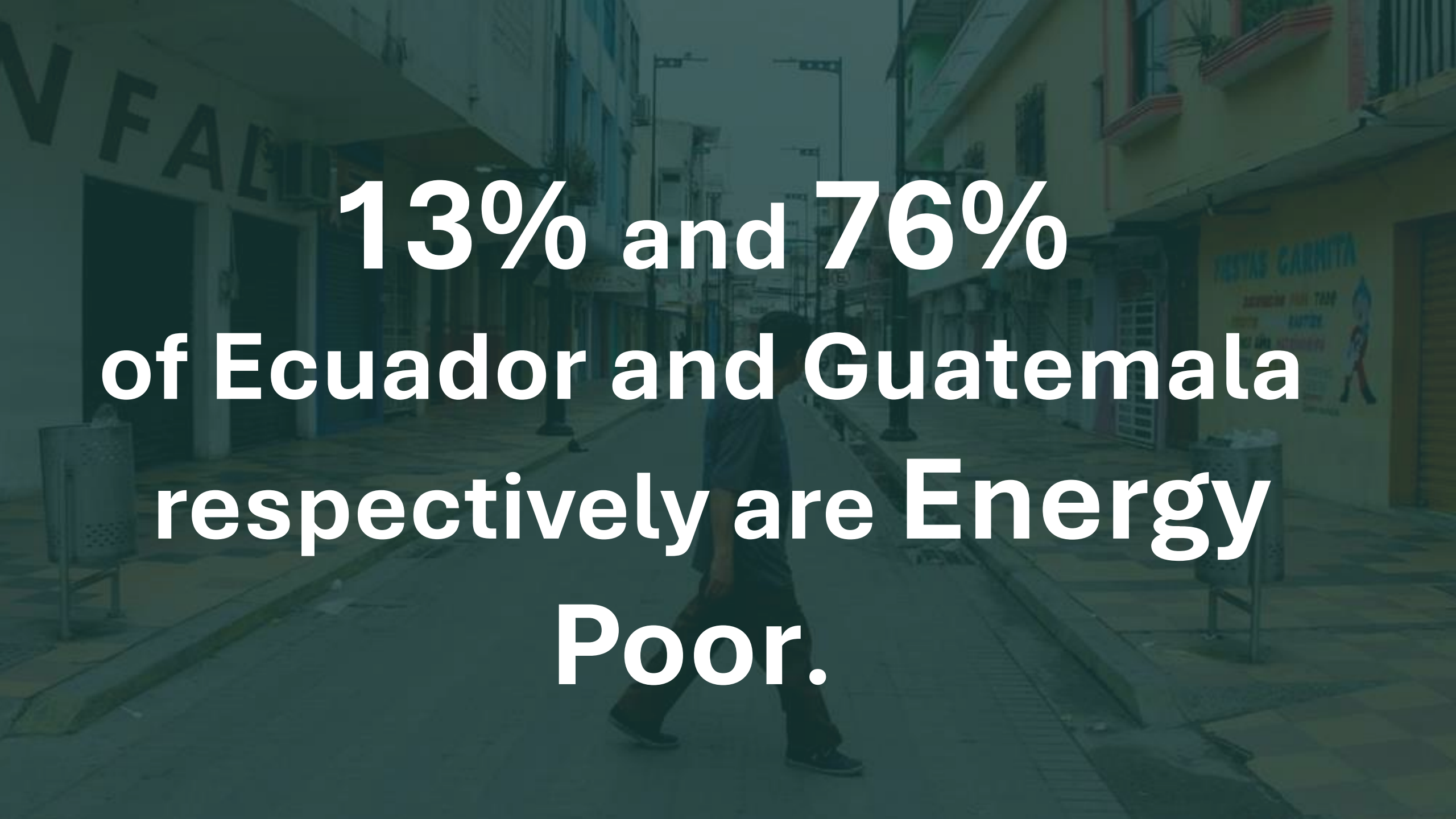
Ecuador	Guatemala
Predominant reliance on LPG (91% of total households) but with heavy government subsidies, and rural areas still use firewood.	Only 48% of the population has access to clean cooking fuels; 61% rely on biomass (e.g., firewood), leading to indoor pollution and health risks.

Industry & Transportation

Ecuador	Guatemala
Oil dominates, supplying 77% of total energy consumption, and 51% of oil demand is for transportation.	Heavy reliance on biofuels and oil; rural areas have poor access to energy for industry and agricultural production.

Affordability

Ecuador	Guatemala
Oil dominates, supplying 77% of total energy consumption, and 51% of oil demand is for transportation.	High electricity prices, driven by dependence on imported fuels and inefficient infrastructure, make energy unaffordable for many, especially in rural areas, exacerbating energy poverty across the country.



13% and 76% of Ecuador and Guatemala respectively are Energy Poor.

Environmental Impact

Ecuador

- ***Hydropower***: Provides low-carbon energy that helps mitigate global warming but disrupts ecosystems in the Amazon, displaces communities, and strains water resources during droughts.
- ***Oil Extraction***: A major contributor to deforestation, with 2.6 million hectares lost between 2000-2020, causing soil degradation, water contamination, and increased CO2 emissions.

Guatemala

- ***Hydropower***: Dominates electricity generation with low-carbon emissions, but droughts cause instability, leading to increased reliance on coal and oil, which harm the atmosphere and disrupt ecosystems.
- ***Coal Use***: A 153% increase in coal consumption since 2000 has significantly raised CO2 emissions and caused water contamination from mining and ash disposal.
- ***Biofuels***: While renewable, large-scale biofuel production contributes to deforestation and emissions, reducing their net environmental benefits.

Quality, Reliability, Safety, & Security

Ecuador

RELIABILITY

ENERGY SERVICES ARE INCONSISTENT, PARTICULARLY IN RURAL AREAS, WITH FREQUENT BLACKOUTS DUE TO HYDROPOWER'S VULNERABILITY TO DROUGHTS. WHILE URBAN CENTERS HAVE MORE RELIABLE GRIDS, RURAL INFRASTRUCTURE REMAINS UNDERDEVELOPED.

SAFETY

URBAN AREAS HAVE MODERNIZED INFRASTRUCTURE, BUT RURAL REGIONS FACE SAFETY RISKS FROM OUTDATED SYSTEMS. LPG IS WIDELY USED FOR COOKING, BUT POOR INFRASTRUCTURE MAINTENANCE LEADS TO LEAKS, AND MANY RURAL HOUSEHOLDS STILL RELY ON FIREWOOD, CONTRIBUTING TO INDOOR AIR POLLUTION AND RELATED HEALTH PROBLEMS.

ENERGY EFFICIENCY

ECUADOR HAS MADE MINIMAL PROGRESS IN ENERGY EFFICIENCY INITIATIVES. EFFORTS TO IMPLEMENT SMART METERING AND ENERGY-SAVING PROGRAMS ARE LIMITED, WITH MUCH OF THE ENERGY SECTOR STILL RELIANT ON INEFFICIENT OIL-BASED SYSTEMS. INDUSTRIAL AND TRANSPORTATION SECTORS CONSUME LARGE AMOUNTS OF ENERGY, WITH FEW PROGRAMS PROMOTING ENERGY-EFFICIENT TECHNOLOGIES OR RENEWABLE ENERGY INTEGRATION.

SECURITY

ECUADOR'S ENERGY INFRASTRUCTURE IS VULNERABLE TO NATURAL DISASTERS SUCH AS EARTHQUAKES AND DROUGHTS, WHICH AFFECT HYDROPOWER GENERATION. SECURITY AGAINST ATTACKS OR CYBER DISRUPTIONS IS LIMITED, WITH A LACK OF SUBSTANTIAL MEASURES IN PLACE TO SAFEGUARD CRITICAL ENERGY INFRASTRUCTURE FROM MALICIOUS THREATS OR DISRUPTIONS. CROSS-BORDER ENERGY TRADING WITH NEIGHBORING COUNTRIES PROVIDES SOME ENERGY STABILITY, BUT THE LACK OF DOMESTIC RESILIENCE REMAINS A KEY CONCERN.

Guatemala

RELIABILITY

ENERGY SERVICES ARE UNSTABLE, ESPECIALLY IN RURAL AREAS, WITH FREQUENT OUTAGES DUE TO HYDROPOWER'S DEPENDENCE ON SEASONAL WATER AVAILABILITY. URBAN AREAS ARE SOMEWHAT MORE RELIABLE BUT STILL EXPERIENCE DISRUPTIONS, PARTICULARLY DURING DROUGHTS OR ADVERSE WEATHER CONDITIONS.

SAFETY

RURAL AREAS HEAVILY DEPEND ON BIOMASS (FIREWOOD) FOR COOKING, LEADING TO INDOOR AIR POLLUTION AND SIGNIFICANT HEALTH RISKS SUCH AS RESPIRATORY ILLNESSES. ADDITIONALLY, GUATEMALA'S ENERGY INFRASTRUCTURE IS OUTDATED, INCREASING SAFETY CONCERNS IN RURAL REGIONS, WHERE ELECTRICITY SYSTEMS LACK PROPER MAINTENANCE.

ENERGY EFFICIENCY

GUATEMALA HAS MADE LIMITED ADVANCEMENTS IN ENERGY EFFICIENCY. MOST RURAL AREAS ARE UNDERSERVED BY EFFICIENCY PROGRAMS, AND SMART METERING OR ENERGY-EFFICIENT TECHNOLOGIES ARE RARELY IMPLEMENTED. THERE IS A LACK OF GOVERNMENT-LED INITIATIVES TO PROMOTE ENERGY-SAVING PRACTICES IN BOTH RESIDENTIAL AND INDUSTRIAL SECTORS. INVESTMENT IN MODERNIZING INFRASTRUCTURE IS SLOW, AND RENEWABLE ENERGY INTEGRATION REMAINS UNDERDEVELOPED DESPITE THE COUNTRY'S SOLAR AND WIND POTENTIAL.

SECURITY

GUATEMALA'S ENERGY INFRASTRUCTURE IS HIGHLY VULNERABLE TO NATURAL DISASTERS, ESPECIALLY DROUGHTS AND FLOODING, WHICH IMPACT HYDROPOWER. SECURITY MEASURES TO PROTECT THE INFRASTRUCTURE FROM ATTACKS OR CYBER THREATS ARE UNDERDEVELOPED, LEAVING KEY ASSETS EXPOSED. POLITICAL INSTABILITY AND CORRUPTION IN THE ENERGY SECTOR (E.G., THE JAGUAR ENERGY SCANDAL) HAVE DELAYED EFFORTS TO REINFORCE INFRASTRUCTURE, FURTHER WEAKENING THE COUNTRY'S ENERGY SECURITY. ADDITIONALLY, RURAL ENERGY INFRASTRUCTURE IS NOT ADEQUATELY GUARDED AGAINST THEFT OR SABOTAGE, EXACERBATING THE RISK OF DISRUPTIONS.

Potential Roadblocks to Addressing Energy Poverty

Ecuador

- **Political Instability:** Frequent government changes have stalled long-term energy projects, delaying renewable energy investments.
- **Financial Constraints:** Heavy reliance on oil revenue strains government resources and leaves little room for funding renewable energy projects or modernizing infrastructure.
- **Infrastructure**: Rural areas suffer from outdated and underdeveloped infrastructure, resulting in unreliable energy access and frequent blackouts.
- **Supply Chain Issues:** Import dependency for energy technologies (solar panels, wind turbines) slows renewable energy development.
- **Employment & Skills Gap:** Limited availability of skilled workers in the energy sector, particularly for renewable energy projects and infrastructure maintenance.

Guatemala

- **Political Instability & Corruption:** Corruption scandals (Jaguar Energy) and political instability have delayed essential infrastructure improvements.
- **High Energy Costs:** The high cost of electricity (USD 0.298/kWh) makes it difficult to fund new projects and expand access, especially in rural areas.
- **Underdeveloped Infrastructure:** Outdated infrastructure, particularly in rural areas, leads to frequent energy disruptions and inefficient delivery of services.
- **Supply Chain & Resource Limits**: Limited investment in energy technologies and dependence on imported fuels (coal, oil) create financial bottlenecks.
- **Skills Shortage:** A shortage of trained professionals and inadequate government support hampers the growth of renewable energy sectors.

Power Ecuador:

Meeting Electrification Needs Through Diversification

Solution Model

ELECTRIFICATION

4.77 Million Households with Energy Needs

3.02 Million Urban Households connected to grid	1.49 Million Rural Households connected to grid	

Connecting remaining 990,000 Households

Grid Expansion: - PV - Wind - Geothermal	Off Grid : - Micro-Grids (PV) - Small-Scale Solutions (PV, Hydro)

COOKING

1.65 Million Rural Households with LPG Needs

1.12 Rural Households with LPG Access	542,000 Rural Households with Unreliable LPG Access

LPG Grid Expansion: - Supply Chain Security - Purchase Centers in Bigger Rural Towns	Solar Cooking Solutions

Power Ecuador – PV Solutions

Completion of Continuing Projects

Completing all continuing projects will provide an additional *476.1MW* to the grid.

Reduce delays by:

- Streamlining funding
- Enforcing stricter codes
- Remain consistent in PV policy

On-Grid Guayas PV Farm

Costa Region has immense untapped PV potential, specifically in the Guayas province.

- High solar irradiation
- Vast open space
- Has pre-existing access to electrical infrastructure/grid-based transmission lines

Guayas Energy Demand = 1,200MW

Off-Grid Galapagos Islands PV Farm

Continuing with Costa Region PV potential

- Solar irradiance range from 5.5-6.0 kWh/m^2/day

Galapagos Islands Energy Demand = 20MW

- 97% of the land is a protected national park
- Most uninhabited land on Santa Cruz, San Cristobal, Isabela, and Floreana

Small Scale Off-Grid Solutions

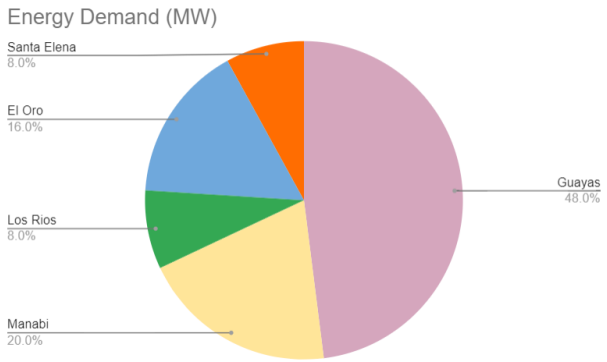
Developing custom solutions to support hard-to-reach populations:

1. Provide energy to indigenous populations with unique energy needs
2. Cost efficient by cutting costs related to grid connection
3. Adhere to strict environmental/land regulations

Power Ecuador – On-Grid PV

Solution

- Develop a **200MW grid connected farm**
- Reduces the strain on 1,200MW expected energy demand for Guayas



Source: Via Michelin (2024)

- Close to the transmission lines that supply the region
- Has large tracts of underdeveloped land along this corridor unsuitable for farming
- Annual solar radiation levels between 5.0-6.5 kWh/m^2/day

Timeline

2025-2028

- Scouting exact location
- Conducting zoning & compliance checks

2029-2035

- EPC selection, equipment procurement, and start construction
- Undergo & complete construction
- Connect the farm to the grid
- Begin testing and commissioning
- Operate, maintain, and optimize farm

Financial Breakdown

CAPEX	Other
Solar Panels and Equipment: **$150 million**	OPEX Cost: 1.5% of CAPEX **$2.93 million/year**
Mounting Structures & Electrical Systems: **$25 million**	Transmission Infrastructure: **$20 million**
Land Acquisition: **$5 million**	Substation and Transformer: **$5 million**
Labor and Construction: **$15 million**	Connection Fees: **$1 million**
Total CAPEX: **$195 million**	Synchronization and Control Systems: **$2 million**
Total Cost: **$225.93 million**	$ Budget Left: **$8.27 billion**

Power Ecuador – Off-Grid PV

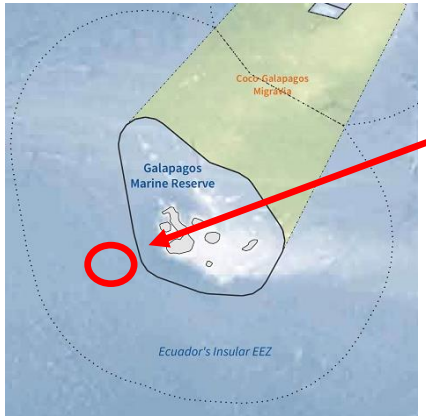
Galapagos Islands

Small-Scale PV Farms

Source: Hervig, D. (2022)

- **Developing 4 5MW> PV farms**
  - Implemented on rooftops existing infrastructure &
  - Primarily in Santa Cruz & Floreana
- Reduces dependence on unreliable diesel solutions

Aquatic PV Farm



Source: Galapagos Conservation Trust (2021)

- **15MW off-shore aquatic farm**
  - Located closest to Isabella Island
  - Connected through power transmission marine cables
  - Storing energy in batteries to supplement energy demand
- Reduces the overall energy need for the Galapagos Islands from 25MW to 10MW
- Utilizes 100 hectares of the EEZ

Financial Implications

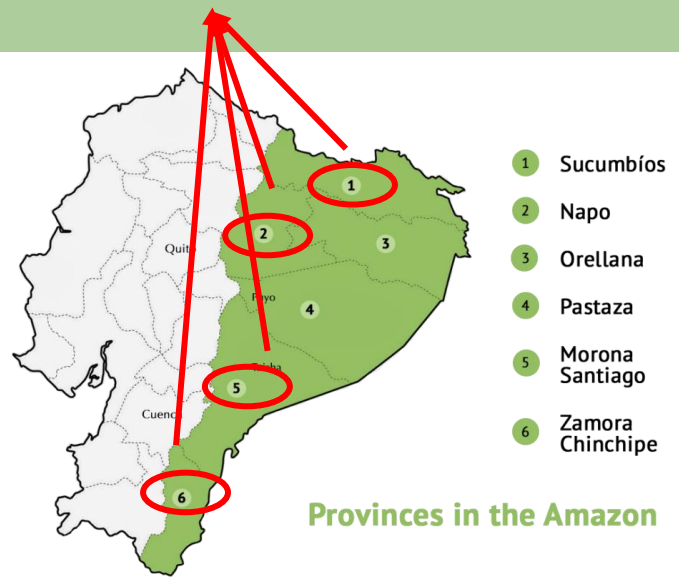
5MW> PV system: **$30 million**	Platform Infrastructure & Equipment: **$27 million**
Battery Storage System: **$40 million**	Marine Transmission Cables: **$20 million**
Labor and Construction: **$14 million**	Battery Storage System: **$24 million**
	Labor & Installation: **$18 million**
5MW> Total: **$84 million**	Aquatic Total: **$89 million**
Combined Total: **$173 million**	$ Budget Left **$8.10 billion**

Power Ecuador – Off-Grid PV

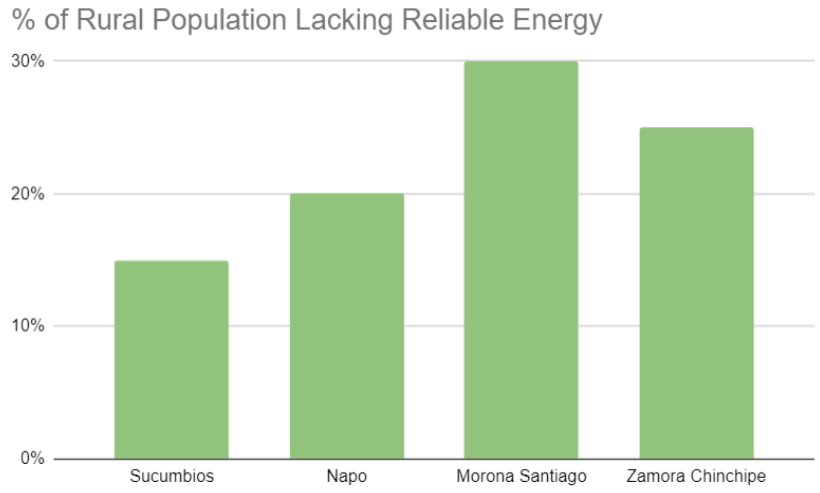
Amazon Region
(Sucumbios, Napo, Morona Santiago, and Zamora Chinchipe)

Solution

- Pilot Project = 4 5MW> Farms
- Providing rural communities with their own grid
- Expansion to 25 5MW> farms
- Infrastructure is currently over reliant on oil and/or hydroelectric



Source: The Water Bearers (2024)



Financial Implications

Pilot PV system: **$30 million** **$7.5 million per farm	Expansion PV system: **$157.5 million**
Pilot Battery Storage System: **$40 million** **$10 million per farm	Expanded Battery Storage System: **$210 million**
Labor and Construction: **$14 million**	Labor and Construction: **$73.5 million**
Pilot Total: $84 million	**Expansion Total: $441 million**
Combined Total: **$525 million**	$ Budget Left **$7.58 billion**

Power Ecuador – Off-Grid PV

	Project Initiation	Groundwork & Initial Development	Installation
Galapagos Small-Scale PV Farms	- Feasibility, site selection & license procurement	- Site preparation & supplier contracts finalization	- Installation and testing - Development & implementation of storage batteries

	Project Initiation	Consultation with Communities	Groundwork & Initial Development	Installation
Amazon Small-Scale PV Farms	- Feasibility, site selection & license procurement	- Understanding energy needs of rural populations	- Site preparation & supplier contracts finalization	- Installation and testing - Development & implementation of storage batteries

	Project Initiation	Groundwork & Initial Development	Aquatic Installation	Connecting to Islands
Aquatic PV Farm	- Feasibility, site selection & license procurement	- Site preparation & supplier contracts finalization	- Installation and testing of aquatic PV panels - Initial development of marine cables	- Potential for expansion to all remaining islands through marine cables

2025 → 2026-2028 → 2029-2032 → 2029-2032

Program Implementation

Power Ecuador – On-Grid Wind

Solution

- Develop **two 50MW grid connected farms**
  - 1 in Manta
  - 1 in Jama

Source: Google Maps (accessed 2024)

Source: Google Maps (accessed 2024)

- both have strong and consistent winds and large tracts on undeveloped land
- good connections to the national grid
- their wind resources are currently being underutilized

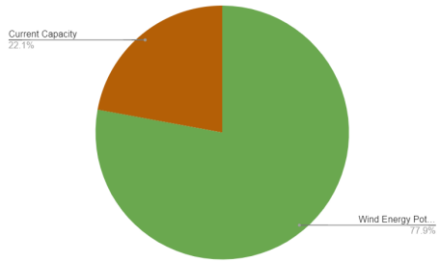
Timeline

- Scouting exact location
- Conducting zoning & compliance checks

2025-2028

- EPC selection, equipment procurement, and start construction
- Undergo & complete construction
- Connect the farm to the grid
- Begin testing and commissioning
- Operate, maintain, and optimize

2029-2035



Financial Breakdown

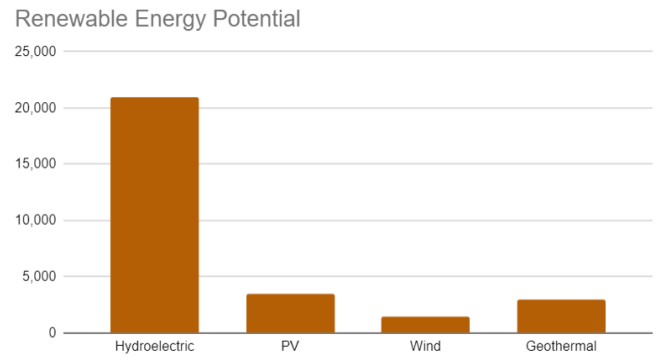
CAPEX	Other
Turbine Costs: **$110 million**	Grid Connection Costs: **$100 million**
BoS Costs: **$27.5 million**	Operational Costs: **$1 million/year**
Land Acquisition: **$225,000**	Zoning & Permits: **$1 million**
Labor and Construction: **$12 million**	
Total CAPEX: **$150 million**	
Total Cost: $252 million	**$ Budget Left: $7.32 billion**

Program Implementation

Power Ecuador – Geothermal Solutions

Med-Large Scale in Sierra Region

- Geothermal energy potential = 3,000MW



- Building a 400MW plant in Chachimbiro

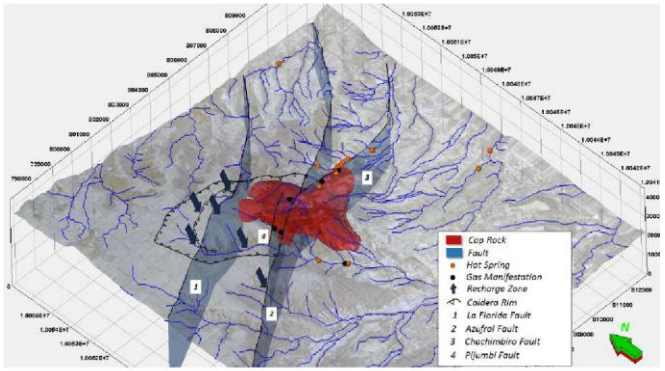


FIGURE 3: Hydrographic net at Chachimbiro volcanic complex and cold water recharge areas

Source: Masabanda, P. & Byron, F. (2017)

- Geo-physical studies
- Drilling production & injection wells
- Plant infrastructure construction: turbines, heat exchangers & cooling systems
- Grid integration & transmission line development

2025 | 2026-2028 | 2029-2032 | 2033-2035

Financial Implications

Exploration: **$80 million**
Drilling Wells: **$250 million**
Power Plant Construction: **$1 billion**
Grid Integration & Transmission Lines: **$50 million**
Licensing & Permitting: **$5 million**
Construction Labor Costs: **$277 million**
Operational Costs: **$15 million/year**
Total Cost: $1.67 billion
$ Budget Left: $5.65 billion

Program Implementation

Power Ecuador – Supplemental Education

Specialized Outreach

- Partnerships with Secretaría de Gestión de Pueblos y Nacionalidades & CONAIE
- Bringing in outreach personnel from CELCEC
- Development of Indigenous Outreach team at CNE & PetroEcudaor
- Work synchronized training (6-9 hours weekly)
- Theory & regulations
- Field Development training
- 2 weeks in field, 2 weeks off field
- Trained employees are placed on teams
- Scouting for communities begins
- Teams scout for communities & survey rural areas to determine:
  1. Local needs & energy demand
  2. Spend 2 weeks on-field, 2 weeks off-field while developing solutions
  3. implement

New Infrastructure Development

- Bringing in geothermal experts from CELCEC
- Developing partnerships with CELCEC
- Partnering with trades & engineering schools
- CELCEC specialists develop knowledge bases on Ecadorian resources
- Developing school courses & programs
- Short term conferences, workshops & training with current employees at CNE
- Trade school & engineering courses begin (2 year programs)
- Ideation & development of geothermal solutions
  1. Scouting land & potential areas for implementation
  2. Zoning & environmental
  3. Financial budget development

Maintenance & Upkeep

- Developing partnerships with trade schools
- Accumulating the Ecuadorian maintenance specialists
- Developing a financial plan to subsidize the maintenance programs
- Maintenance specialists to develop training programs
- Programs commence
  - 2 year educational programs
  - Can specialize
- New graduates enter the work field
  1. Survey current infrastructure
  2. Develop a maintenance plan based on most aged infrastructure
  3. Begin maintenance schedule

2025-2026 → 2027 → 2028 → 2029 → 2030 → 2031-2035

Program Implementation

Feeding Ecuador:

Reliable LPG Solutions for All

Feeding Ecuador - Solution

Modifications to Current LPG

Cylinder Tracking System

- LPG cylinder tracking system to monitor lifetime
- RFID tags to tracks cylinder movements
- Enhancing current regulations & increasing audit frequency

Financial Implications

RFID Tags	$3 million
Readers	$50,000
Software Integration	$100,000
Installation	$30,000
Total	$3.18 million

Transition to Market Pricing

- Current Subsidies place heavy burden on national budget
- Transition to market pricing + smart subsidies
- Directly provided to poorest through direct cash transfers or reductions on monthly energy bills
- **3 tier system**
  - **Standard**
  - **Reduced**
  - **customized**

Hybrid Solar Cooking

Pilot Program

- **Deploying 100,000 hybrid solar cooking units in rural households**
- **Evaluate impact & scale**

Expansion

- **Scaling to meet 900,000/1.2 million households without reliable access**

Financial Implications

Unit Costs	$10 million
Installation	$2 million
Training & Logistics	$500,000
Maintenance/5y	$5 million
Total	$17.5 million

Unit Costs	$270 million
Installation	$67.5 million
Training & Logistics	$36.5 million
Maintenance/5y	$45 million
Total	$419 million

Power Ecuador – Off-Grid PV

Cylinder Tracking System

2025

Project Initiation
- Feasibility & site sweeping

Reader Preparation
- Acquiring RFID tags

2026

Software Integration
- Development or customization of software to manage the RFID system

Installation
- setting up the RFID readers, integrating the software, and training personnel

2027-2029

Maintenance
- Fixing/ modifying

Pilot Program

2025

Project Initiation & Installation
- site selection & assessment of infrastructure

Training
- Educating locals on how to implement the units

Expansion

2030-2032

Project Initiation & Installation

Training
- site selection & assessment of infrastructure
- Educating locals on how to implement the units

2033 & On

Further Expansion
- Expanding if necessary to remaining population

Program Implementation

Financial Recap

Financial Recap

Power Ecuador

PV Solutions

On-Grid Total Cost:
$225.93 million

Galapagos Total Cost:
$89 million

Amazon Total Cost:
$525 million

Overall Total Cost:
$839.93 million

Budget After Costs:
$7.58 billion

Wind Solutions

Total Cost:
$252 million

Budget After Costs:
$7.32 billion

Geothermal Solutions

Total Cost:
$1.67 billion

Budget After Costs:
$5.65 billion

Power Ecuador – Supplemental Education

**The subsidies to fund the education program will vary based on enrollment numbers

Grants & reduced tuition rates:
Per 100,000 students ~ **1.2 billion**

Salary Costs to Bring over experts:
Per 10 experts ~ **$2 million**

Feeding Ecuador

LPG Improvement

Total Cost:
$3.18 million

Budget After Costs:
$5.64 billion

Hybrid Solar Cooking

Total Cost:
$436.5 million

Budget After Costs:
$5.21 billion

COST EFFECTS

Budget After ALL Costs:
$4.01 billion left

** this can be distributed in emergent cases/excess cost relief

A Two Country Plan?

Feasibility in Guatemala

Guatemala - Overview

A two-country plan – Energy Analysis

Accessibility

Connection:

- In 2021: 97.87% of the country had access to electricity, but 76% of Guatemalans lived in energy poverty and only 47% have access to clean cooking

Reliability and Quality

- In 2020, 52.3% of their electricity production came from hydro power. Due to climate change and changing weather conditions, their hydropower capacity factor has declined. With temperatures rising there has been a consistent decreasing of precipitation and runoff
- In more rural areas, policies for Rural Electrification placed an emphasis on local renewable energy sources

Environmental Impact

- Despite creating and using mostly renewable and low carbon sources of energy, the building of new plants tore into forested areas
- Jaguar Energy, their main electricity supplier (non-renewable) was guilty of dumping contaminated wastewater from a plant into Río La Mora
- While the country does not produce coal, they import from the US and Colombia, with a 153% jump in coal usage from 2000-2022
- Per capita, the CO_2 emissions is 1.1 tonnes
- Guatemala loses up to 2460 hectares of tree cover annually due to their high reliance on firewood when cooking

Guatemala - Overview

A two-country plan – Energy Analysis

Affordability

Prices per kWh (2024):

- Residential: $0.298 USD
- Businesses: $0.189 USD

- Canada in comparison has $0.124 USD per kWh
- The country possesses the highest household electricity price among Latin American countries while being the 5th poorest amongst the other Latine American and Caribbean countries
- The government has imposed a social tariff that gives subsidized rates of electricity to households consuming under 300 kWh per month

Security

- More infrastructure requires more land and many Indigenous Guatemalans are affected by these projects – it has led to protests and the companies overextending have been met with aggression

Safety

- Only 48.1% had access to clean fuels for cooking food
  - Some have to use charcoal or dung which can lead to illnesses and indoor air pollution

Potential for Roadblocks

Climate Change:

- This is an issue that affects the different parts of any plan to improve the country's energy poverty levels
- Slows or halts projects to expand energy infrastructure due to the rising temperatures and generally unpredictable extreme weather.

Source: The Great Climate Migration Has Begun [Online Image]. (2021). The New York Times. https://www.nytimes.com/interactive/2020/07/23/magazine/climate-migration.html

- Increasing levels of poverty due to lower agricultural yields, lower crop reliability brought on by droughts and changing seasons and rainfall times has impacted crop growth
- In the Pacific lowland region, water companies, hydropower plants among other organizations compete for water resources

Guatemala – Feasibility

A two-country plan?

Ecuador: 10 Year Plan

Early planning
- Create job opportunities for Guatemalans (especially those from rural farming communities)
- Between 2020 and 2022, 233 000 Guatemalans arrived at the US border

Educating those without access
- With an improved systems to distribute LPG cylinders, individuals in rural areas of Guatemala need to be educated on their usage

Indigenous and Rural Outreach
- A good start to building a relationship towards the populations that live in land that are either lacking in energy or are prime real estate to build new energy plants like strong flowing rivers

Small Scale PV Farms
- Beneficial to small to medium sized rural towns and largely not invasive
- Communities that are connected to the national energy grid saw high monthly charges of up to 400 GTQ or $50 USD when agricultural workers usually only earned $343 USD (2 644 GTQ) – a good way to decrease continuous costs

Maintenance and Education program
- Can decrease the unreliability by maintain existing structures to maintain a good energy baseline

Guatemala – Feasibility

A two-country plan?

Ecuador: 10 Year Plan

Indigenous and Rural communities → Creating new energy plants → Government involvement → LPG Pricing

Negotiating with the Rural and Indigenous populations

- The indigenous peoples of Guatemala make up around 44% of the population but no more than 10% of the members of the Congress are Indigenous, coupled with a history of corruption (ex. Jaguar Energy), there would need to be clear communication and negotiation when new projects are built on indigenous areas
- There would need to be more time spent building the trust of the communities around potential land for plants

Pricing

- Average wage of 10 500 GTQ, many especially those in rural areas are worried about the price of buying a full cylinder of LPG since they might not be able to afford all of it
- 1 liter of gas in Guatemala city is 12 GTQ

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