






THE HAITI SUSTAINABLE ENERGY PROGRAMME

Increasing energy access in Haiti and
supporting new solutions to energy poverty



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PARTNERS





GOALS

» To increase energy access in Haiti's rural south-west

» To demonstrate innovative, sustainable solutions to energy poverty

» To support sustainable national recovery

Introduction

The Republic of Haiti - that occupies a third of the Caribbean island of Hispaniola - became the first independent Latin American country in the early 19th century. Yet chronic instability and weak governments combined with natural disasters have left it the poorest nation in the western hemisphere.

UN peacekeepers were deployed in 2004 to restore order after an uprising, and today more than 8,000 personnel remain. Moreover, many Haitians are struggling with the aftermath of the 7.0 earthquake which devastated the capital, Port-au-Prince, and surrounding areas in January 2010. More than 200,000 people were killed and hundreds of thousands were left homeless.


Environmental and natural resource degradation is also a major concern. The country is extremely vulnerable due to deforestation, bad cultivation practices, erosion and the degradation of the watersheds. Vegetation cover has fallen to an estimated 2% of the land area (15%, if tree cultivation is taken into account), which has led to widespread biodiversity loss. The degradation of watersheds linked to deforestation is the main cause of floods. 80% of the country is mountainous, which can exacerbate natural disasters and poor land management practices. Rapid urbanisation has also taken its toll on the environment.


However, Haiti has significant tourism potential and there has been some success with exports of crops, including mangoes. Haiti is also taking steps toward strengthening its governance mechanisms and promoting economic development and social inclusion.


Renewable energy has the potential to meet more than 50% of Haiti's electricity demand by 2030. Haiti needs to harness this immense potential to jettison the instability and poverty of the past and transition from a fragile to a developing state.

SOUTH DEPARTMENT QUICK FACTS

 **Population:**
700,000 people

 **Surface:**
2,800 km² or 1,100 square miles

 **Main economic activities:**
agriculture (subsistence-level), vetiver production, fishing and services (mainly informal economy).

 **Capital:**
Les Cayes, population 70,000



ABOUT THE SOUTH DEPARTMENT

This southern region - known for its beautiful coastline and its proximity to the Pic Macaya National Park - is one of the few remaining bastions of primary forest and biodiversity in this largely deforested Caribbean nation. It is an area with high potential for tourism and business development, with active economic sectors such as the vetiver industry.

The department however is not immune to some of the environmental problems that plague Haiti. Deforestation, soil erosion, freshwater pollution and coastal and marine degradation all contribute to the chronic poverty and food insecurity in the area.

Specifically, marine and coastal resource management has not been widely considered in national and international efforts in dealing with poverty, disaster responses, risk reduction strategies and preservation of the country's natural resources. The greater Tiburon watershed, for example, has been identified as an area of severe environmental degradation and a priority for watershed restoration. This is especially urgent, as the conservation zone around Pic Macaya has considerable environmental consequences for the entire southern peninsula.

ABOUT CÔTE SUD INITIATIVE

Launched in January 2011, the Côte Sud Initiative (CSI) is a coalition of United Nations agencies that is spearheading the most ambitious initiative to date to support the sustainable recovery and development of south-western Haiti. The Haiti Sustainable Energy (HSE) programme is a key component of CSI.

The CSI's 20-year vision is to improve the livelihoods of more than 200,000 people in the South Department. This is being achieved through a diverse program which addresses the root causes of extreme poverty, including environmental degradation, vulnerability to natural disasters and limited access to social services.

Environmental restoration efforts include reforestation, erosion control, fisheries management and mangrove rehabilitation. Other activities target small business and tourism development, access to water and sanitation, and improvements in health and education.

CSI has five programmes: Gouvernance Sud, Energie Sud (HSE is part of this component), Mer Sud, Terre Sud, Route Sud. These programmes are executed under the authority and direction of the government of Haiti with the United Nations and partners providing support in coordination and implementation

Energy Access in Haiti



Between 12.5% and 25% of Haiti's 10.5 million people have regular access to electricity - one of the lowest electrification rates in the world, and the lowest in the western hemisphere.



Fuel, especially dirty fuels like wood, kerosene and charcoal, is a major cash expense for Haitian families; Dirty fuels also pose significant health and safety risks.



Nearly USD2 billion is sent to Haiti each year in remittances from the Haitian diaspora - and about 10-25% is used to pay for some form of fuel, mainly kerosene and petrol.

7



Haiti depends on fossil fuels for 85% of electricity generation. This represents 7% of annual GDP and makes Haiti vulnerable to volatile oil prices.



Over 65% of the total electricity production of Eléctricité de Haiti (EdH) - Haiti's state electricity provider - is lost to technical inefficiencies or used by Haitians unable or unwilling to pay.



Renewable energy has the potential to meet more than 50% of Haiti's electricity demand by 2030.



Many tree species are used in Haiti to make charcoal (used for cooking), including ecologically important hardwood species such as mangroves.





GRID-CONNECTED RENEWABLE ENERGY

Globally, renewable energies - wind, hydro, solar, biomass and geothermal - are expanding both in terms of investment, projects and geographical spread. In doing so, they are making an increasing contribution to combating climate change, countering energy poverty and stimulating green jobs. Yet in Haiti, renewable energy remains largely unexploited for grid-connected electricity. The notable exception is the Péligre hydroelectric plant that generates about 15 % of Haiti's current energy supply. As a result, UNEP is focusing on three main areas of grid-connected renewable energy: hydro, wind and municipal waste-to-energy.

Small-scale Hydropower

Haiti - and specifically the South Department - lacks robust historical and spatially distributed hydro-climatology data. As a result, UNEP is studying the hydroelectricity potential of several river catchments in the South Department in order to contribute to investment planning for much-needed hydroelectric schemes. The data is being gathered by local not-for-profit Haiti Environment Network, led by a research team from Columbia University (USA).

By mid-2015, UNEP will have completed the feasibility studies, including stream flow data, for micro-hydro plants in River Acul, Ravine du Sud and Lower Saut Mathurine.

As part of this work UNEP has installed nine weather and meteorological stations in the South Department in: Randel, Port-à-Piment, River Acul, Ravine du Sud, Saut Mathurine Dam, Upper Saut Mathurine, Lower Saut Mathurine, Port Salut and Ile à Vache. This research will also contribute to making informed decisions relating to water and land management which are vital to increasing resilience.



Saut Mathurine micro-hydro plant,
South Department, Haiti.

QUICK FACTS

» In remote and rural areas micro-hydro schemes can bring electricity for the first time to whole communities, providing lighting and communications for homes, schools, clinics and community buildings in addition to small businesses.

» Although initial construction costs are high, employment is provided to the local population during the construction phase.

» Small-scale plants have a minimal environmental impact on the river.

» Hydropower reduces greenhouse gas emissions and local pollution, compared to burning fossil fuels.

» Electricity production is continuous - as long as the water is flowing.

Wind Energy

The wind power potential for the South Department is being analysed by UNEP. A suitable site has been selected, on the east-facing ridge between Torbeck and Port Salut. UNEP has procured a SODAR (Sonic Detection And Ranging technology) wind measurement system and installed it on site in a secure compound.

The system was commissioned in June 2014 and will operate for 18 months, measuring the wind speed and direction. By end 2015, UNEP will analyse the data to provide a pre-feasibility assessment of the technical and economic potential for a wind power project at the site.



Measuring wind power potential,
South Department, Haiti

QUICK FACTS

- » Wind turbines convert the kinetic energy from wind into electric energy.
- » Onshore wind power in high wind areas with short transmission distances can deliver energy at 30-50% of the cost of equivalent solar PV systems.
- » Haiti has promising wind resources - with consistent wind directions and elevated wind speeds in some areas - but no wind farms to date.
- » Wind resources are extremely site specific and subject to both seasonal variability and daily intermittence.
- » Topography and obstacles highly impact wind speeds, so turbines are normally located along ridges and hilltops at a height of at least 10 meters to minimise the influence that buildings and trees can have on the wind profile. This is an important consideration, given the fact that Haiti's rural communities often are located on lower parts of slopes and in valleys.

Municipal Waste-to-Energy

UNEP provides capacity building and expert technical assistance to the government of Haiti in the field of sustainable energy. As part of this remit, in 2014 UNEP undertook a multi-stage, detailed and independent review of Project Phoenix, a large-scale waste management and waste-to-energy proposal. UNEP also worked with the project developers on behalf of the Haitian government to improve the anticipated benefits, economic value and feasibility of the project. The UNEP review was published in September 2014. UNEP technical assistance is ongoing.



Litter and waste have proliferated throughout Haiti, especially in the capital Port-au-Prince.

QUICK FACTS

» Recovering value from waste is being promoted by many governments and organisations across the globe. Incineration alone, without energy recovery, is not a preferred option due to cost and pollution. As a result there has been renewed interest in investing in waste management technologies for extracting energy from waste.

» Project Phoenix is a large-scale waste management and waste-to-energy proposal presented to the Haitian government by a private consortium led by International Electric Power LLC, a US private company.

» Project Phoenix proposes the collection of over 1,600 tonnes per day of municipal waste from the capital Port-au-Prince and surrounding area, to be injected into the national electricity grid for power generation, thus helping to resolve the dual problem of waste management and energy poverty. The electricity generated could potentially increase Haiti's current nationwide power generation capability by over 25%.

A group of construction workers wearing hard hats and work clothes are working on a dirt path in a rural, hilly area. They are using ropes and pulleys to lift a large log or pipe. The background shows lush green trees and a small building with a red roof. The scene is brightly lit, suggesting a sunny day.

MINI-GRIDS

The rural poor in Haiti - including those in the South Department - mainly live in remote areas beyond the national grid and depend on expensive, dangerous and dirty energy solutions such as burning wood or kerosene. Electricity - if at all available - is often provided through a diesel generator and only covers basic consumption for certain hours. In these areas it is economically more attractive to promote mini-grids that can provide electricity 24/7 to both households and local businesses.

A Hybrid Mini-Grid Demonstration Project

THE MINI-GRID

The construction of an innovative solar-diesel hybrid mini-grid system in Haiti's rural south-west that will provide reliable and affordable electricity seven days a week for up to 1,600 households, or 8,000 people, is underway.

The \$3.8 million UNEP project - funded primarily by the Government of Norway in addition to USAID, the Inter-American Development Bank and the National Rural Electric Cooperative Association (NRECA) International Foundation - aims to improve access to modern energy services and increase economic development in three coastal towns in the South Department, about 250km and a five-hour drive from the capital Port-au-Prince.

The mini-grid, being installed by the US not-for-profit NRECA International Ltd, includes 23km of line (that will connect Roche-à-Bateaux, les Côteaux and Port-à-Piment) and pre-paid metering systems.

NRECA's partner organisation, the Solar Electric Light Fund, has procured and designed the solar PV system as well as the streetlights in the towns, 80 of which will have batteries for all-night lighting and 150 of which will be lit until 10pm. Furthermore, there will be no limiters on the power provided by 120kW of solar and two diesel generators (120kW and 250kW), allowing the communities to set up small businesses that are needed in the area, such as bakeries, small convenience stores and ice-makers.

QUICK FACTS

» The mini-grid is an excellent opportunity to immediately provide some electricity to an area where customers are willing to pay for their consumption. A successful mini-grid system requires a strong management team, which could involve either the local community or a private operator.

» A mini-grid, powered purely by renewable energy or hybridised for reliability with diesel generators, can be deployed faster than a centralised grid, have the flexibility to upgrade capacity to meet a community's increased energy demands and can interface with the national grid when and if it reaches the area.

» Prepayment of electricity is a key aspect to the cost recovery of mini-grids. Just as most Haitians purchase credit for mobile phone minutes, many electricity consumers around the world purchase credit for electricity service in their homes and businesses. Large lump-sum utility bills are problematic because they do not fit with the way that people can afford to pay. Prepayment allows customers to purchase electricity as they purchase kerosene – in small quantities and as they need it.



Lineman Gedeon Huguevald helps to pike a pole in the town of Roche-à-Bateaux in Haiti's rural south.

THE COOPERATIVE

16

With the guidance of NRECA and UNEP, the three communities have also set up a member-owned cooperative, the Cooperative Électrique de l'Arrondissement des Côteaux (CEAC) - the first cooperative in Haiti's electricity sector. To date this community-based organisation has almost 700 members and will operate and manage the electricity system in the long term, based on the US model of electricity cooperatives.

While CEAC continues to face many challenges, it represents a huge opportunity for the three towns, which like most of rural Haiti, are not connected to the national grid.

From a human and economic development perspective, community-based operational models for mini-grids, in which locals are provided technical and accounting skills to manage a system, open the opportunity for local enterprise and new income generation. Combining energy access, human capacity building and micro-enterprise is a powerful tool.

UNEP also plans to support the design of a national regulatory framework for rural electricity cooperatives in Haiti, through its partner NRECA.



Rithot Thilus,
General Manager of CEAC



We had to teach people in the communities what a cooperative in the electricity sector was all about, because people had only had experience of financial cooperatives, and some of those experiences were not good. Now other communities are asking how they can copy the cooperative idea, and that is even before the electricity is turned on!

Everyone wants electricity and is fed up of living in the dark or using dirty fuels like kerosene that are bad for your health.

Solar-Powered Micro-Grid Using Smart Metering

EarthSpark International, a US not-for-profit, is spearheading a demonstration micro-grid in the town of Les Anglais, in Haiti's South Department with the support of UNEP and other donors.

The micro-grid provides affordable, reliable, and an environmentally sensitive electricity service using second generation smart meters developed by SparkMeter, an EarthSpark technology company that focuses on smart meter hardware and software.

Launched in November 2012 with just 14 customers (phase 1), today the grid has expanded to 54 customers (phase 2), and will be scaled to 500 households, or 2,500 beneficiaries (phase 3). The micro-grid currently taps into the excess capacity of a mobile phone tower from Digicel, one of the largest companies in Haiti, but will be primarily solar-powered after expansion.

EarthSpark's notable innovation is its effort to pair residential and commercial loads in a viable business model through highly intelligent prepaid smart meters, seeking to manage demand on a town-size scale in a way that makes the whole grid more efficient.

After the Les Anglais project has proven out the business model, EarthSpark sees the integrated town-scale approach as replicable and attractive to investors.



Walta Guerrier,
mother of three children,
and one of the beneficia-
ries of the microgrid



I was one of the first customers, and it has been a life-changing experience for me and my family to have electricity. The children have been able to do their homework, and just in general life is easier when you can see what you are doing after dark!

A photograph showing a complex power distribution system. In the foreground, there are several rows of orange plastic outlets or connectors. Behind them is a control panel with multiple red digital displays showing numbers like 170 and 165. The scene is dimly lit, with a strong red glow from the displays and outlets. The background is dark and indistinct.

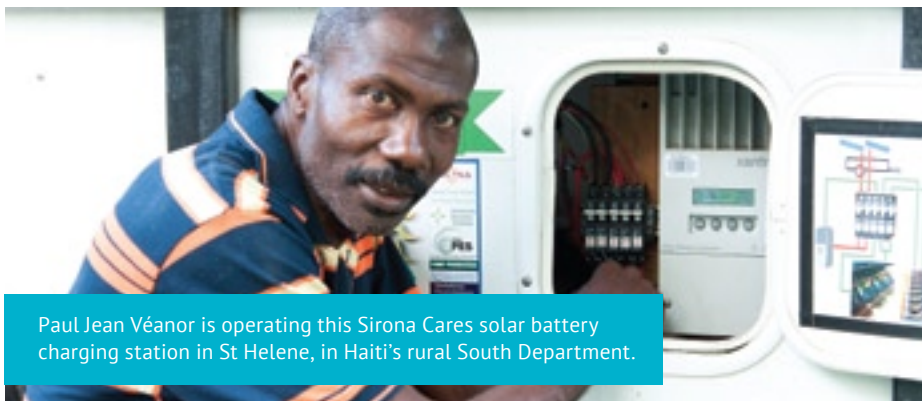
AUTONOMOUS POWER & LIGHTING

A key area of work of HSE is to support groundbreaking initiatives that aim to provide power and lighting to isolated communities with no access to the grid. The multiple challenges faced by Haiti's national electricity provider would appear to indicate that those living in remote areas of Haiti are not likely to have access to the grid in the near future. As a result, HSE is supporting organisations that are demonstrating new technologies in this field.

Solar and Grid Charged Battery Rental Scheme

US not-for-profit Sirona Cares is implementing a solar and grid charged battery rental scheme for 2,100 households in rural Haiti. A 1.5-kilowatt solar or EdH charging station is set up in an accessible community centre such as a school, clinic, store, or orphanage in towns without electrical infrastructure. Up to 100 nearby families then pay a monthly fee to rent a battery that they can recharge as often as they want. The cost of the monthly lease is based on a market evaluation that considers the price that a household is paying for kerosene, cell phone charging and candles. The goal is to set the monthly cost at, or below, the cost of kerosene. In Haiti the monthly cost is US\$6.25 per home.

Sirona's Ti Soley portable battery is a self-contained pack with power electronics, a plug, wiring with 2 LED lights, two DC outlets and two USB ports for charging cellular phones and small electronics. Each battery charge lasts from two to seven days, depending on use. The charging station, if properly maintained, will last for approximately 10 years. Sirona Cares aims to install units to support 2,100 households throughout the South Department. To date 10 units have been installed and Sirona is working to develop the Haitian institutional capacity.



Paul Jean Véanor is operating this Sirona Cares solar battery charging station in St Helene, in Haiti's rural South Department.

QUICK FACTS

» Solar and grid charged batteries can provide clean, sustainable and affordable electricity to Haiti's rural poor. These schemes promote the social enterprise model to facilitate economic empowerment and also encourage a shift from an informal economy to a formal economy in villages.

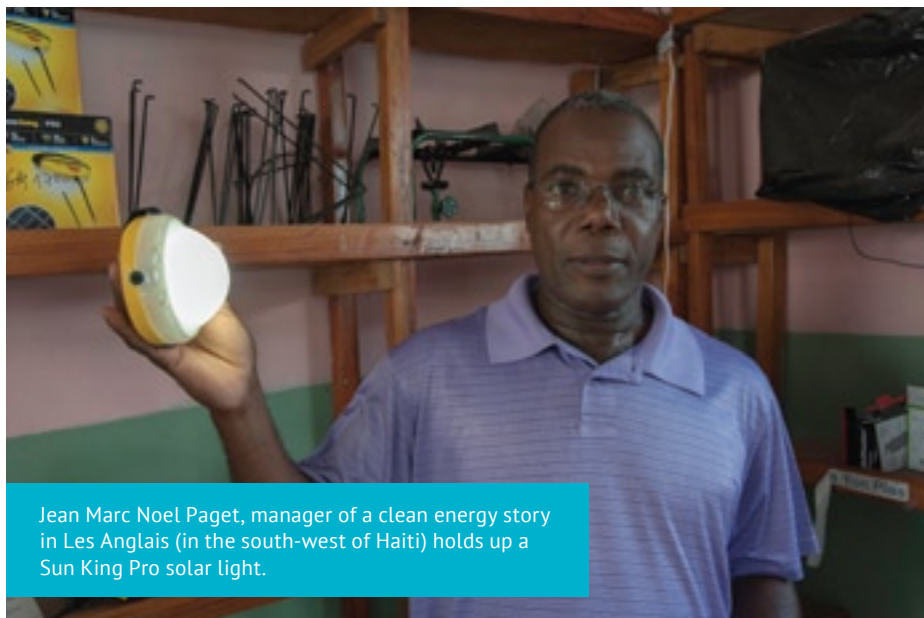
» Battery rental schemes also create sustainable local business by capturing the revenue that had formerly left the village economy for the purchase of kerosene.



Enèji Pwòp: The Sale of Clean Energy Products

Enèji Pwòp - a clean energy retail program run by international organisation EarthSpark - provides a product line of small-scale, clean and energy-efficient products for families who would otherwise rely on kerosene and candles to light their homes and businesses.

The solar products are sold through a growing network of about 75 local entrepreneurs - in shops and market stalls (including roving sellers) - including 40 in the South Department. Since the start of the initiative, about 12,000 solar products have been sold - about half of those in the South Department. The total revenue for 2013 was US\$97,000. The most popular product is the Sun King Pro, a combined lamp and mobile phone charger.



Jean Marc Noel Paget, manager of a clean energy store in Les Anglais (in the south-west of Haiti) holds up a Sun King Pro solar light.

QUICK FACTS

» Solar desk lamps offer over 5 times as much light output as a kerosene lamps, and can pay for themselves out of fuel savings in less than 6 months.

» Solar lights are much safer - the exposed flame of a kerosene lamp or candle is responsible for burning hundreds of children every year, and occasionally burns homes down.





BIOMASS

Biomass in the energy context refers to organic products from agriculture that are not sold as food nor used in the manufacturing of other goods. Mostly, this biomass is in the form of residual stalks from crops, leaves, roots, seeds and seed shells etc. Biomass can be an excellent source of energy to meet needs in Haiti's rural areas. Commercial use of biomass can also provide additional income to farmers and poorer sections of society, helping in poverty alleviation. Agricultural biomass is a clean source of energy, as the carbon cycle loop is closed, there are usually no harmful emissions, and it is renewable.

Forest Energy

A recent UNEP study looks at options for fuel wood and charcoal forests or plantations using fast-growing trees (such as acacia and cassia) that are specifically grown for charcoal and firewood production (or construction) by organised smallholders. This forest energy approach is relatively undeveloped in Haiti and needs improved approaches, techniques and organisation to meet socioeconomic and environmental requirements. Forest energy will only be successful if it is profitable to local rural populations - and the increasing demand for charcoal, spurred by growing urban populations, provides the opportunity.



Sacks of charcoal for sale outside a house in La Cahouane in Haiti's rural south.

QUICK FACTS

- » Commercially driven demand for fuel wood and charcoal is one of the main drivers of deforestation in Haiti.
- » The production and sale of fuel wood and charcoal is also one of the main income-generating activities across Haiti, but especially in the South Department.
- » Recent UNEP surveys indicate that many tree species are being used - including some ecologically important species such as mangroves and mature fruit trees. This poses a direct threat to vital ecosystems.



Vetiver Waste-to-Energy

UNEP is seeking to catalyse renewable energy investments in the vetiver industry - one of the most important economic sectors in the South Department. Medium and large-scale distillation processes currently depend on imported and expensive fossil fuels, and the potential to use waste roots to fuel the distillation process - delivering significant operating cost savings and cutting greenhouse gas emissions - remains largely untapped.



Vetiver grass is sometimes used as roof thatch in Haiti.

QUICK FACTS

» Vetiver (*Chrysopogon zizanioides*) is a perennial grass, native to India that is widely cultivated in Haiti mainly for the fragrant essential oil distilled from its roots. Vetiver is contained in most western perfumes.

» Haitian vetiver is widely considered by experts to produce the highest quality vetiver globally.

» Vetiver is also an excellent erosion control plant as the roots grow downward. It is also highly drought tolerant and grows in extremely poor soils.

» Vetiver processing was introduced to Haiti in the 1940s and today Haiti is the world's leading producer of vetiver essential oil, responsible for 80% of global production.

