Climate Investment Funds

SREP/SC.13/6
April 20, 2015

Meeting of the SREP Sub-Committee
Washington D.C.
Wednesday, May 13, 2015

Agenda Item 6

SREP INVESTMENT PLAN FOR NICARAGUA

PROPOSED DECISION

The SREP Sub-Committee, having reviewed document SREP/SC.13/6, *SREP Investment Plan for Nicaragua*,

a) endorses the investment plan as a basis for the further development of the projects and programs foreseen in the plan and takes note of the request for USD 30 million in SREP funding. The Sub-Committee requests the Government of Nicaragua, in the further development of the proposed projects and programs, to take into account comments made at the meeting and any additional written comments submitted by Sub-Committee members by May 29, 2015, and to respond in writing to questions raised during the meeting and in subsequent written comments;

b) reconfirms its decision on the allocation of resources, adopted at its meeting in November 2010, that all allocation amounts are indicative for planning purposes and that approval of funding will be on the basis of high quality investment plans and projects;

c) takes note of the estimated budget of USD 428,000 for MDB project preparation and supervision services for the project entitled, *Geothermal Development and Integral Development of Rural Areas Project* (IDB), and approves USD 214,000 as a first tranche of funding for such services; and

d) further takes note of the estimated budget of USD 428,000 for MDB project preparation and supervision services for the project entitled, *Geothermal Development Projec*t (IBRD), and approves USD 128,000 as a first tranche of funding for such services.

SCALING UP RENEWABLE ENERGY PROGRAM IN LOW-INCOME COUNTRIES **MDB Request for Payment of Implementation Services Costs**			
1. **Country/Region**:	Nicaragua/Latin America and the Caribbean	2. **CIF Project ID#**:	*(Trustee will assign ID)*
3. **Project Title:**	Geothermal Development and Integral Development of Rural Areas Project		
4. **Request for project funding (USD millions:**	*At time of country program submission (tentative):* US$15 million	*At time of project approval: n/a*	
5. **Estimated costs for MDB project implementation services (USDmill.):**	*Initial estimate - at time of Country program submission:* US$428,000	*MDB: IDB*	
	Final estimate - at time of project approval:	*Date: April 2015*	
6. **Request for payment of MDB Implementation Services Costs (USD.mill.):**	❖ First tranche: US$214,000 ☐ Second tranche: *n/a*		
7. **Project/program financing category:**	a - Investment financing - additional to ongoing MDB project ☐ b- Investment financing - blended with proposed MDB project ❖ c - Investment financing - stand-alone ☐ d - Capacity building - stand alone ☐		
8. **Expected project duration** (no. of years):	5 years		
9. **Explanation of final estimate of MDB costs for implementation services:**	***If final estimate in 5 above exceeds the relevant benchmark range, explain the exceptional circumstances and reasons:*** n/a		
10. **Justification for proposed stand-alone financing in cases of above 6 c or d:** n/a			

SCALING UP RENEWABLE ENERGY PROGRAM IN LOW-INCOME COUNTRIES **MDB Request for Payment of Implementation Services Costs**			
1. **Country/Region**:	Nicaragua/Latin America and the Caribbean	2. **CIF Project ID#**:	*(Trustee will assign ID)*
3. **Project Title:**	Geothermal Development Project		
4. **Request for project funding (USD millions:**	*At time of country program submission (tentative):* US$15 million	*At time of project approval: n/a*	
5. **Estimated costs for MDB project implementation services (USDmill.):**	*Initial estimate - at time of Country program submission:* US$428,000	*MDB: IBRD*	
	Final estimate - at time of project approval:	*Date: April 2015*	
6. **Request for payment of MDB Implementation Services Costs (USD.mill.):**	❖ First tranche: US$128,000 ☐ Second tranche: *n/a*		
7. **Project/program financing category:**	a - Investment financing - additional to ongoing MDB project ☐ b- Investment financing - blended with proposed MDB project ❖ c - Investment financing - stand-alone ☐ d - Capacity building - stand alone ☐		
8. **Expected project duration** (no. of years):	5 years		
9. **Explanation of final estimate of MDB costs for implementation services:**	***If final estimate in 5 above exceeds the relevant benchmark range, explain the exceptional circumstances and reasons:*** n/a		
10. **Justification for proposed stand-alone financing in cases of above 6 c or d:** n/a			

Climate Investment Funds

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Scaling-up Renewable Energy in low-income countries Program (SREP)

Nicaragua's SREP Investment Plan (PINIC)

Managua, Nicaragua, April 15th 2015

Managua, Nicaragua 16 de abril del 2015
MEM-SMC-287b-04-15

Ms. Mafalda Duarte
Program Manager
Climate Investment Funds, Administrative Unit
1818 H Street NW
Washington DC 20433, USA.

It is an honor to present the current Investment Plan to participate in the "Scaling Up Renewable Energy in low-income countries Program" (SREP) to the Climate Investment Funds (CIF).

The Republic of Nicaragua respectfully expresses its thanks to CIF for inviting our country to submit a Proposal to SREP, to the World Bank Group and the Inter-American Development Bank for their support in its development, and all the actors from the International Development community and our national energy sector who participated in the design and review phases of this Proposal, contributing with ideas, projects, lessons learned and commitments to create an Investment Plan with transformational outcomes.

SREP's support to Nicaragua comes at a key moment of the development of our energy sector. In less than 10 years (2007-2014), our country has made considerable efforts to increase the proportion of population with access to electricity (from 65% to 80%) and to increase the share of renewables in the energy mix from 25% to 52%. Nicaragua has every intention of continuing to promote sustainable development and consequently joined in 2013 the Sustainable Energy for All Initiative of the United Nations (SE4All). Although our country generates very few emissions, we acknowledge the key role of renewable energy, energy efficiency and access to modern energy services to contribute to the global effort of mitigating climate change. Specifically, we aim to generate 90% of our electricity from renewable resources by 2027, and to exceed 90% of electricity coverage by 2030.

However, we still face major challenges. Our country continues to depend on oil imports, there are approximately 1.2 million people who do not have access to the national network, and 54% of our population has no access to modern energy services for cooking. We recognize on one hand the substantial benefits of renewable energy for socio-economic development, energy independence, and cleaner environment, and on the other hand the need to respond to the needs of our people with limited energy access. Therefore, we aim to further develop our vast untapped renewable energy potential: in particular our energy strategy includes increased generation from geothermal sources to benefit on-grid users, while providing clean and efficient technologies for cooking and greater participation of renewable energy technologies in remote off-grid areas.

We therefore request CIF's support for the two strategic components of our Investment Plan (geothermal energy and access to energy services in remote areas), which will allow us to

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promote sustainable projects with high potential for scaling and replication in the while planning Nicaragua's energy future.

Salvador Mansell Castrillo
Ministry of Energy and Mines

MINISTERIO DE ENERGÍA Y MINAS
REPÚBLICA DE NICARAGUA AMÉRICA CENTRAL
MINISTRO

Cc. Ing. Humberto Reyes, Dirección de Electricidad y Recursos Renovables
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ACRONYMS AND ABBREVIATIONS

BCN	Central Bank of Nicaragua
CABEI	Central American Bank for Economic Integration
CIF	Climate Investment Fund
CNA	Capacity Needs Assessment
CNDC	National Energy Dispatch Center*
CNE	National Energy Commission*
COP	Conference of the Parties
CRIE	Regional Electric Interconnection Commission*
DAI	Import duties, Spanish Acronym
DGRER	General Directorate for Renewable Energy resources*
ECLAC	Economic Commission for Latin America and the Caribbean
EE	Energy Efficiency
EIB	European Investment Bank
ENATREL	National Electrical Transmission Company*
ENEL	National Electrical Company of Nicaragua*
ENLCV	National Firewood and Charcoal strategy*
EOR	Regional Operating Agency*
EU	European Union
FDI	Foreign Direct Investment
FOB	Freight on Board (or Free on Board)
FODIEN	National Electrical Industry Development Fund*
GCBP	Geothermal Capacity Building Program
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse Gas
GMI	Global Methane Initiative
GNI	Gross national income
GoI	Government of Iceland
GoN	Government of Nicaragua
HDI	Human development Index
HFO	Heavy Fuel Oil
IBRD	International Bank for Reconstruction and Development
ICEIDA	Icelandic International Development Agency
IDB	Inter-American Development Bank
IDEPEZAN	Identification of the electrical demand and Generation potential in remote areas*
IEA	International Energy Agency
IFC	International Finance Corporation
INATEC	Nicaraguan Institute of Technology*
INE	Nicaraguan Energy Institute*
INETER	Nicaraguan Territorial Studies Institute*

INIDE	Nicaraguan Institute of Development Information*
IP	Investment Plan
IPLS	LaSalle Polytechnic Institute*
IRENA	International Renewable Energy Agency
IT	Income Tax
ITF	Fiscal stamp tax*
ktoe	Kilo tons of oil equivalent
LAI	Latin American Initiative (European Union)
LCoE	Levelized Cost of Energy
LPG	Liquefied Petroleum Gas
MDBs	Multilateral Development Bank(s)
MEM	Ministry of Energy and Mines
MER	Regional Electrical Market*
MHP	Mini hydro power plant
MIF	Multilateral Investment Fund
MUSD	Millions of US$
MW	Mega watt
NDF	Nordic Development Fund
NGO	Non-governmental Organization
PINIC	Nicaragua Investment Plan*
NREL	National Renewable Energy Laboratory
PERZA	Rural electrification in off-grid areas*
PLANER	National rural electrification plan*
PNDH	National human development plan*
PNESER	National Sustainable Electrification and Renewable Energy program*
PV	Photovoltaic
RRA	Renewables Readiness Assessment
SHP	Small hydro power plant
SICA	Central American Integration System*
SIEE	Energy economics Information system*
SIEPAC	Electrical System Integration of Central American Countries*
SIN	National Grid*
SINIA	National Environmental Information system*
SREP	Scaling-Up Renewable Energy Program
SWERA	Solar and Wind Energy Resource Assessment
t	Metric ton
UCA	Central American University*
ULSA	LaSalle University*
UN	United Nations
UNAN	Nicaraguan National Autonomous University*
UNI	National Engineering University*
VAT	Value-added Tax

* Spanish Acronym

EXECUTIVE SUMMARY

Nicaragua's SREP Investment Plan (PINIC)

This document presents the rationale and proposal for an Investment Plan for Nicaragua (PINIC, Spanish acronym) to implement a comprehensive and transformative program that will be financed by the Scaling-Up Renewable Energy Program (SREP), supported by the Climate Investment Fund (CIF), Multilateral Banks, International Cooperation donors, and that is also expected to leverage resources from the private sector. In addition to SREP, PINIC proposals will seek long-term support from the Green Climate Fund (GCF).

PINIC will contribute through two main components –geothermal power generation and integral development of rural areas – towards a transformational impact that will deliver short-term results while also paving the way for Nicaragua's green energy future. It will help build human, technical and institutional capacities, overcome critical barriers to and drive the market of renewable energies through pilot projects with potential for scalability and replication, as well as facilitate the path to introducing sustainable business models that include all of the country's socio-economic development actors. The program shall focus on directly improving the quality of life of all Nicaraguans, including social and environmental benefits. The main components of PINIC are:

1) Component #1: Scale-up of Nicaragua's geothermal electricity

Component #1 proposes an action plan for selected priority projects, and financial mechanisms/instruments to speed-up mobilization of the large investments required to unlock the geothermal sector in Nicaragua. The main goals of this component are:

- Confirm the geothermal resource in two promising sites for which ample information is already available:
    a. Casita-San Cristóbal with production wells
    b. The most promising field to be chosen among Volcán Cosigüina, Volcán Mombacho and Caldera de Apoyo.
- Develop a robust pipeline of potential fields for further exploitation that currently have limited information:
    c. Caldera de Masaya via 3G[1] surface studies and slim-holes[2], and technical assistance.
    d. Volcán Mombacho and Caldera de Apoyo – which currently have superficial 3G studies underway – with slim-holes and technical assistance.

2) Component #2: Integral development of rural areas

Component #2 shall support the power supply of remote areas through rural electrification and promotion of renewable energies for productive uses, including the following subcomponents:

<u>Universal Access:</u>

- 2A: Financing photovoltaic (PV) solar systems for rural electrification

[1] 3G refers to surface level geological, geophysical and geochemical assessments.

[2] Small-diameter exploration wells

- 2B: Adoption and transfer of improved cookstoves for use by households.

Productive uses and transmission:

- 2C: Development of renewable technologies in communities and their promotion for productive uses in small and mid-sized companies such as small hydropower plants, more efficient use of firewood in productive processes, biogas, and PV or thermal solar usage.
- 2D: Improvement of the infrastructure for electric transmission for the interconnection of existing and future renewable generation sources.

The amount requested by PINIC to the SREP program is US$30 million, generating an estimated US$325 million that could be leveraged during SREP execution and US$515 million with the GCF and other sources.

Components / Sub-components	PINIC - Funding (millions of US$)															
	PHASE 1											PHASE 2				
	SREP-IDB		SREP-World Bank		GoN	IDB	WB/ IDA	JICA	Private sector	GCF	TOTAL PHASE 1	GCF and other sources	IDB	WB	TOTAL PHASE 2	GRAND TOTAL
	Grants	Loans[a]	Grants	Loans[a]												
0) Project elaboration	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	**0.30**
1) Geothermal Development	0.75	6.75	8.25	6.75	0.00	20.00	30.00	20.00	70.00	15.00	177.50	100.00	0.00	0.00	100.00	**277.50**
2) Development of rural areas	7.50	0.00	0.00	0.00	25.20	45.00	0.00	40.00	0.00	30.00	147.70	50.00	40.00	0.00	90.00	**237.70**
TOTAL	**8.25**	**6.75**	**8.25**	**6.75**	**25.20**	**65.30**	**30.00**	**60.00**	**70.00**	**45.00**	**325.50**	**150.00**	**40.00**	**0.00**	**190.00**	**515.50**

Nicaragua in the world

Nicaragua has a multiethnic population, estimated at 6 million, 42.5% of which live in poverty. In 2013, it ranked 132 out of 194 countries on the UN's Human Development Index, mainly due to its high level of poverty.

Nicaragua's economy had a positive performance during 2014, characterized by employment and economic growth, subdued inflation, and sustainable public finances and public debt. The country's Gross Domestic Product (GDP) reached US$11.256 billion in 2013 and an estimated US$11.762 billion in 2014 (in current prices).

Nicaragua's energy sector

During the past decade, Nicaragua's energy demand has increased considerably, in line with its economic development: primary energy consumption was 2,500 kilotons of oil equivalent (ktoe) in 2000, reaching 3,000 ktoe in 2010 and 3,310 ktoe in 2013. The consumption of biomass – basis of Nicaragua's energy supply (nearly 50% of the total)- has grown relatively slowly (less than 200 ktoe in 2000), but the country's peak electric power demand has risen at an average 4% a year, from 397 MW in 2000 to 620 MW in 2013. Total electricity sales from the National Grid have doubled since 2000 reaching 2,920 GWh by the end of 2013.

Nicaragua's power infrastructure is currently being reinforced by two projects: the Electrical System Interconnection for Central America (Spanish acronym SIEPAC[3]) and the National Sustainable Electrification and Renewable Energy program (Spanish acronym PNESER[4]) which seek to increase transmission capacity and improve the system's reliability in order to supply power to the country's

[3] Sistema de Interconexión Eléctrica para América Central.

[4] See Annex (4)

largest population centers. Electricity infrastructure development is still far from adequate, leaving Nicaragua with a power coverage rate of nearly 80% in 2014.

Renewable Energies in Nicaragua

Nicaragua has a large unexploited potential for renewable energy production. It has been estimated that renewable energies could add at least 5,500 MW of power supply -over three times the current installed capacity.

In 2013, over half the electricity generated in Nicaragua (50.3%) was produced by fossil fuel-based thermal power plants. Geothermal power took second place (16%), closely followed by wind power (15%), hydropower (12%), and biomass (7%).

This report evaluates the potential of each resource –in potential installed capacity in MW and expected energy generation per year in GWh- ordered by increasing LCoE (US$/MWh), which shows geothermal generation leading with over 1,500 MW of estimated potential to be developed, representing 10 TWh per year to be exploited.

Besides on-grid renewable energy, renewables in remote areas have an important market yet to be exploited, especially in rural on- or off-grid settings. In this context, there are several options to promote the use of renewable energies. For a country with massive agriculture and livestock production, Nicaragua has also an enormous unexploited potential for thermal applications of biomass and solar energy.

Sustainable energy is crucial to Nicaragua's development

Sustainable development is not possible without a sustainable energy sector. One out of every five people in Nicaragua lack power to light up their homes or to provide energy for their work. Nearly 60% of the rural and 20% of the urban population continues to use firewood, charcoal or animal waste to cook meals, using primitive equipment that cause toxic fumes responsible for pulmonary diseases, affecting mostly women and children. Increasing the grid's coverage and the productive sector's expansion require higher generation capacity. Higher input of renewable energies –wind, hydro, solar, biomass, and geothermal- to the energy mix offers increased access to a clean and sustainable resource.

Since the creation of the Ministry of Energy and Mines (MEM) in 2007, significant steps have been taken towards strengthening the energy sector. The GoN has promoted investment in renewable energies financed by the public and private sectors both national and foreign, as well as several programs such as the National Sustainable Electrification and Renewable Energy program (Spanish acronym PNESER), the National rural electrification plan (Spanish acronym PLANER), the National Firewood and Charcoal Strategy (Spanish acronym ENLCV), and technical assistance to update its Master Plan of Geothermal Energy, but there is still much left to do.

The current context of a significant and potentially lasting fall in oil prices in international markets (US$58/bbl in February 2015) must not compromise Nicaragua's strategic goal of reaching 90% of power generation from renewable sources by 2027.

Barriers to the development of renewable energies

Nicaragua is still highly dependent on firewood and fossil fuels and has a smaller electricity coverage than neighboring countries, lower installed capacity, and a strong presence of thermal power plants due to a series of barriers that cannot be overcome but by state intervention: knowledge barriers,

market and financial barriers, barriers in the legal framework, technical barriers and lack of human resources, and social barriers.

Overcoming these difficulties with the support of the SREP program shall not only assist the country in satisfying its growing power demand, improve its energy security, reduce costs and increase access to modern energy services such as rural electrification and sustainable cooking, but it will also bring about high-impact economic, social and environmental side-benefits in the regions where the program is implemented.

Process to select strategic investments

The government of Nicaragua, together with the International Bank for Reconstruction and Development (IBRD), the International Finance Corporation (IFC) and the Inter-American Development Bank (IDB), launched a consultation process to identify priority investments for the PINIC. Participative sessions took place around the focal point for the SREP Program in Nicaragua, with energy sector institutions, NGOs and the private sector –including local banks. The criteria identified to select projects proposed for SREP support were presented for approval to the Multilateral Development Banks (MDBs), the focal point for the SREP Program in Nicaragua, energy sector institutions and the private sector during public consultation workshops.

SREP's transformative impact

The PINIC supported by SREP has the opportunity to bring to the fore renewable energy options that up to now have been accorded a lesser priority because they faced greater obstacles. Some renewable energy technologies such as wind and large-scale hydro do not need to be prioritized by SREP because private investment has already found them attractive. Moreover, in the case of wind power, installed capacity has reached its maximum possible penetration level in the system, considering its intermittent nature without the addition of further base-load capacity. Additional regulation capacity would be needed in order to increase generation.

MEM's Indicative Power Generation Expansion Plan envisages the addition of more than 1,000 MW of renewable generation until 2027 to face growing demand (mid-range demand scenario). This plan considers adding 737 MW of hydroelectric projects, 131 MW of geothermal projects –in four different fields, given that they can provide a steady base load capacity year round- 114 MW of biomass –part of which can provide base load capacity- and 140 MW from fossil fuels. The plan is ambitious considering last decade's additions: since 2002 less than 20 MW of hydroelectric, 70 MW of geothermal and 90 MW of biomass plants have been installed.

Specifically, SREP's support of PINIC will allow additional resources to be leveraged in order to achieve the following goals:

- Catalyze mobilization of risk capital for the initial stages of geothermal power development, that is, to confirm actual geothermal potential of several sites of interest and leverage and facilitate private financing for developing generation capacity. Nicaragua has to further exploit its geothermal resources in order to achieve the 90% clean energy goal set for 2030 –but developers are challenged to invest in the absence of some form of risk mitigation that would reduce their exposure during the higher risk phases; and the availability of financing in order to achieve quick financial closure.
- Bring modern electricity service to scattered rural communities not included in current financing plans for electrification, which are, to a great extent the poorest in the country.

- Significantly improve the standard of living of an estimated 1.8 M people whose homes are permanently exposed to toxic fumes from traditional firewood stoves that are especially harmful to women and children. Another consequence would be increased productivity for rural SMEs that could boost their energy efficiency when using firewood. These substitutions would also help reduce deforestation.
- Promote productive uses of electricity in isolated rural areas through the development of new small- or medium-scale hydro power plants or other adapted technologies, to improve the quality of life of the beneficiaries in communities, improve the quality, reliability and stability of the supply, reduce CO_2 emissions and meaningfully increase the renewable energy quota in the national energy matrix.
- Reinforce the country's electricity transmission infrastructure in order to connect existing and future generation facilities using renewable energy sources, and ensure a low-emission development.

Implementation, learning and risk mitigation

Regarding potential risks, Nicaragua possesses a modern regulatory regime, a working energy market and energy institutions, as well as a good track record in renewable energy projects. Therefore, the foreseeable main risks associated with renewable energy projects to be financed by SREP are few, and mitigation mechanisms are being proposed in technology and environmental issues.

Capacity building and reinforcement of technology management activities will allow: (i) to ensure that knowledge management processes provide learning opportunities applicable to similar programs within the country and region, (ii) to improve the enabling framework for renewable energy production and use, and (iii) to increase investment in renewable energy –both private and public.

PINIC projects shall be implemented under a full monitoring and evaluation scheme seeking to obtain, analyze, process and communicate key information regarding its activities and projects as well as their results, impact and lessons learned. This framework will be a significant tool to plan and oversee PINIC activities.

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1. COUNTRY CONTEXT

GEOGRAPHY AND DEMOGRAPHY

Geography

The Republic of Nicaragua is the largest country in Central America in terms of territory with over 130,373 km2 -10,506 of which correspond to water bodies made up of: 4 lakes, 8 lagoons, 36 coastal brackish lagoons, 3 dams, 33 "lagunetas", and 2 brackish-water wintry lagoons.

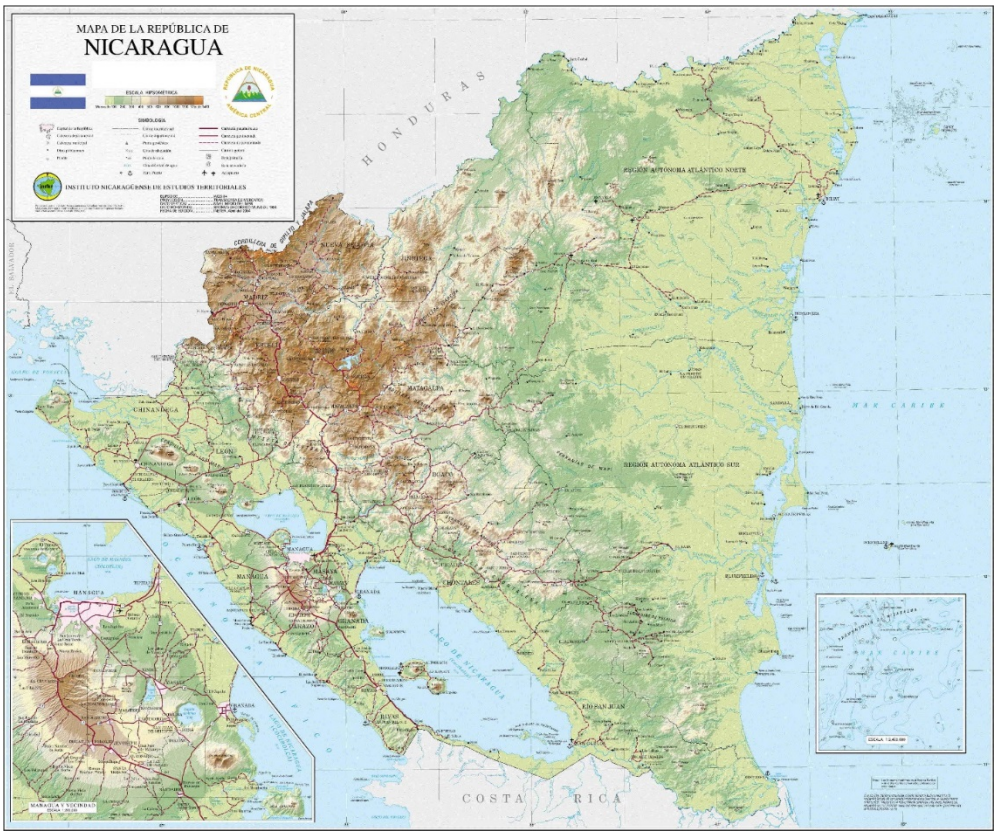

Figure 1: Map of Nicaragua
Source: INETER, 2010

The largest water masses are: Lake Nicaragua (Cocibolca), 8254 km²; Lake Managua (Xolotlán), 1020 km² in the Pacific region; and Pearl Lagoon, 518 km², located in the Southern Autonomous Atlantic Region (RAAS). The Pacific coastline is 324.5 km long, the Caribbean coastline is 509.5 km long, and the Fonseca Gulf is 78 km. Its sea extension is of 200 nautical miles and its continental platform is 75,500 km², considering both coasts.

Demography

Nicaragua has a multiethnic population of about 6 M inhabitants, 42.5% of which are currently living in poverty[5]. Women account for 50.6%[6] of the total population. In 2013, the country ranked 132 out of 194 on the UN Human Development Index, mainly due to its poverty levels[7]. Nicaragua has a population growth index estimated at 1.2% per year and most inhabitants are young –the average age in Nicaragua is 22.9 years.

The Nicaraguan Institute of Development Information projects that the country will have 6.2 million people by 2015, 6.8 million by 2025, and 7.6 million by 2040. The distribution of the population by areas of residence shows that 56% live in cities and 44% in rural areas. The predominant ethnic groups are Mestizo (69%), Caucasian (17%), Afro-Descendant (9%), and Indigenous (5%). Some 34.5% of the population is under14 years of age and 4.6% over 65, which result in a dependency ratio of 64.2%. Life expectancy at birth is 73 years, ranging from 70 for men and 76 for women. The migration rate is high and reaches -3.5 per every thousand inhabitants.

Demographic structure	Amount	Unit	Year(s) of reference
Total population (in thousands)	6,152	Thousands of people	2014
Annual population growth rate	1.4	%	(2010_2015)
Urban	1.6	%	(2010_2015)
Rural	0.6	%	(2010_2015)
Gross birth rate	23.2	0/00	(2010_2015)
Gross mortality rate	5.1	0/00	(2010_2015)
Migration rate	-4	0/00	(2010_2015)
Life expectancy	73	years	(2010_2015)
Women	*76*	Years	*(2010_2015)*
Men	*70*	years	*(2010_2015)*

Table 1: Demography of Nicaragua

Source: (ECLAC, 2013)

Gender context

Nicaragua is placed sixth in the Global Gender Gap Report 2014 (World Economic Forum, 2014) making it the country in Latin America where women have the most equitable access to education and healthcare, and have higher chances of fully participating in the country's political and economic life. Nicaragua has signed international agreements such as the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the Belem do Pará Convention. Additionally, Nicaragua's Constitution offers the same protection under the law to men and women, and newly-passed laws promote equal rights between genders, such as the Equal Rights and Opportunities Act.

Women represent 36.6% of the workforce in the productive sector. The salary gap is 19.8% in favor of men. Women occupy 40.2% of the benches at the National Assembly and 55.6% of all ministerial

[5] Word Bank, Database, 2014, www.worldbank.org

[6] INIDE. National, Departmental and Municipal Estimates and Projections . Revised 2007

[7] United Nations Development Programme, Human Development Report 2013, http://hdr.undp.org/en

positions. (See Annex (3) to further read about social context, legislation and gender sensitive institutions.)

NICARAGUA'S NATIONAL PLAN AND ECONOMIC PERSPECTIVES

Nicaragua's economy had a good performance in 2014, with growing GDP and employment, subdued inflation, and sustainable public finances and public debt. The country's GDP reached US$11.256 billion in 2013 and US$11.762 billion is expected for 2014 (in current prices).

Gross Domestic Product	Figure	Unit	Year(s) of reference
Annual GDP in current prices	11,256	Millions US$	2013
Per capita	1,856	US$	2013
Variation rate	4.5	%	2013 a 2014

Table 2: Nicaragua's GDP

Source: (ECLAC, 2013)

The country's performance benefited from strong Foreign Direct Investment (FDI) -with a growing flow over the past few years, reaching US$741 M in 2013 (ECLAC, 2013)-, and the strengthening of the USA economy –main destination (31%) of Nicaragua's exports - (with US$605 M in 2013, see BCN, 2013, page 148). The negative factors were mainly due to natural phenomena –including several earthquakes and floods- and an adverse international environment with a drop in the price of its main exports, important oil price fluctuations, and the slow performance of Nicaragua's other trading partners, most of them emerging economies (Central America 25%, rest of Latin America also 25%).

The Central Bank of Nicaragua (Spanish acronym BCN) announced in December 2014 that the 2015 outlook included "an expected increase in the dynamism of the economy, with a forecasted growth rate of between 4.5 and 5%". According to the BCN this acceleration will be based on more favorable conditions in the global economy, terms of trade improvements, and renewed vitality of the construction sector. The World Bank's 2014 economic outlook report predicts 4.4% growth in Nicaragua's economy both in 2015 and 2016 (World Bank, 2014).

The National Human Development Plan (Spanish acronym PNDH) is the GoN's referential framework for national planning (PNDH, Government of Nicaragua, 2012). It sets as goals "economic growth with higher employment rate and reduction of poverty and inequity; the reinstatement of values; the restitution of economic, social, environmental and cultural rights of the people, especially to the groups that have been historically excluded; and the increase in the capacities of Nicaraguan families."

IMPLICATIONS OF THE NATIONAL PLAN FOR THE ENERGY SECTOR

General challenges for the energy sector

Energy and the environment are essential for the country's sustainable development. Despite being among the countries with the lowest per capita GHG emissions in the world (0.8 tCO2 per year, World Bank, 2013), the Global Climate Risk Index (GermanWatch, 2014) ranked Nicaragua fourth among the countries with the highest risk for extreme climate events, and the fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) alerts on changes that are already taking place regarding rains and temperature in the Central American region (IPCC, 2014, Chapter 27 LAC Region). Populations under the poverty line are most vulnerable to environmental degradation and have less access to modern and affordable energy services.

Sustainable development is not possible without a sustainable energy sector. One out of every five people in Nicaragua lack power to light up their homes, or to work. Nearly 60% of the rural and 20% of the urban population continues to use firewood, charcoal or animal waste to cook meals, using primitive equipment that causes toxic fumes responsible for pulmonary diseases affecting mostly women and children. Increasing the coverage of electricity service, and the expansion of the productive sector, require greater generation capacity. Higher input of renewable energies –wind, hydro, solar, biomass, and geothermal- to the energy matrix offers access to a clean and sustainable resource.

Since the creation of the Ministry of Energy and Mines (MEM) in 2007, there have been significant steps towards strengthening the energy sector. Installed electricity generation capacity has grown above peak demand, total coverage has increased, progress has been made in transforming the energy matrix by incorporating renewable resources, and the performance of power distribution has improved through measures directed to reduce fraud and improve the regulatory framework. Nevertheless, there is still much left to do.

The current context of a significant and potentially lasting drop in the price of oil in the international market (US$58/bbl in February 2015) must not compromise Nicaragua's strategic goal of reaching 90% power generation from renewable sources by 2027. When oil prices go back up -to over US$200/bbl. by 2030 according to the IEA's forecasts- renewable energies will make possible energy autonomy and security based on low-cost technologies. Another advantage of renewable energies is that they enable decentralized use, work with low environmental-impacts, reduce emissions and may even contribute to employment to favor regional development.

Sustainability Challenges for the Electricity Subsector

While economic expansion has produced an increased demand for power stimulating its sustainability, the country's insufficient coverage, technical and non-technical losses (power theft) and dependence on fossil fuels –which have been the primary means to satisfy the demand for stable power and generation of base energy over the past decade- have kept consumer prices amongst the highest in the region (ECLAC, 2012). Nicaragua's electricity coverage reached only 80% of the population in 2014 (ENATREL, 2014) limiting demand growth and hampering an equitable socio-economic development. Finally, even with a progressive move towards a renewable-dominated

energy matrix, fossil fuels will continue to be necessary to balance and regulate the power system, a situation that will impact consumer prices and cause instability in generation costs.

All these factors produce high and unpredictable electricity prices and affect the system's sustainability as a whole. As Figure 2 portrays, end-consumers in Nicaragua on average pay the highest electricity rates in all of Central America. For example, residential end-users that consume over 300 kWh in Nicaragua pay 154% as much as their neighbors in Costa Rica and 310% as much as those in Honduras.

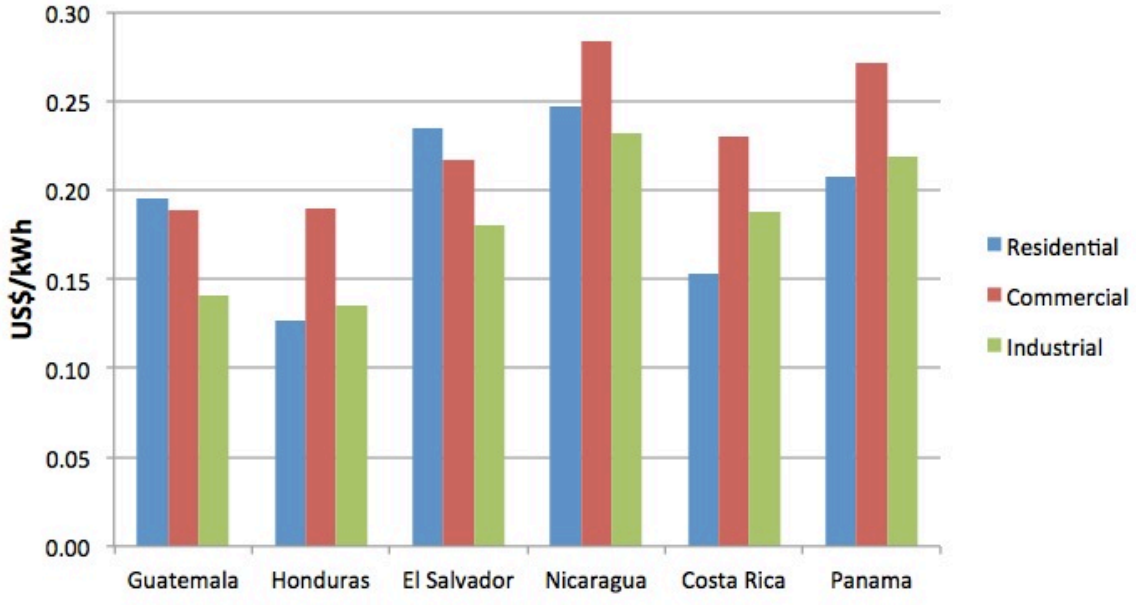

Figure 2: Average electricity price in Central America, 2014

Source: World Bank (Consultant: Angel Baide). 200 kWh monthly residential consumption and 50% load factor for industrial consumers.

Government Actions to transform the Energy Sector

Risk management, adaptation to climate change, and environmental issues are government priorities included in the PNDH and the National Strategy and Action Plan on Environment and Climate Change. The PNDH specifically establishes that the "fundamental purpose of the energy policy being implemented since 2007 is to increase the supply of energy generated from renewable resources and to transform the energy matrix, as well as rural electrification." As a result, in less than 10 years (2007-2014), Nicaragua has increased the proportion of population with access to electricity from 65% to 80% and the share of renewables in the energy mix from 25% to 52%.

Nicaragua also contributed through the Central American Integration System (Spanish acronym SICA) to the construction and commissioning of the Electrical Interconnection System for Central America (Spanish acronym SIEPAC), with a high-voltage (230 kV) transmission line that connects Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama through a 1,790 km long corridor. Guatemala is interconnected with Mexico through a 400-kV line, and Colombia could be connected in the future, expanding the market and therefore the economies of scale.

SREP SUPPORT TO THE TRANSFORMATION OF THE ENERGY SECTOR

Nicaragua's economy has developed steadily for the past two decades, but the disparity in both coverage and access to modern energy services combined with the high cost of electricity for the productive sector, could weaken this trend. According to a 2010 World Bank poll on infrastructure quality in Nicaragua, 24% of participating companies identified electric power as the number one limitation for their businesses, and 39% of them considered power supply quality as a major obstacle for their development (World Bank, 2010).

Having access to stable and affordable power is essential to the country's competitiveness and socio-economic development. Inheriting a significant amount of heavy fuel-oil plants built over the past twenty years as demand grew, and also during the power crisis of the 2000's, have resulted in a far from optimal generation mix, resulting in high power rates, less power reliability, and greater GHG emissions. This gave rise to the need to transform the energy matrix incorporating renewable energies. The government recognized this need and has promoted investments in renewable energies since 2007. However, there is still much left to do. Power sector planning has been coordinated by MEM, letting project developers compete on price within the Indicative Plan. This favored the implementation of those projects that could best assess their risks, be built faster, and required the lowest prices in their PPAs. Since 2007, four wind farms have been built, for a total of 187 MW, plus two small hydro plants for a total of 32 MW. But in order to ensure the grid's stability it was also necessary to incorporate diesel plants. In the future, renewable energy technologies must be reinforced, given their transformative, scalable and sustainable nature.

SREP provides the opportunity to expand electricity supply to areas not yet covered, as well as to help transform the energy matrix and expand use of the country's renewable sources. Therefore, within the requested support of the SREP program, the government stresses the following lines of its National Energy Strategy as defining the context of its request for support from the CIF. It is important to mention that energy efficiency is also part of the strategy but it is not being considered as part of the SREP Program in this opportunity.

Transforming Nicaragua's energy matrix to include more renewables

Transforming the energy matrix towards renewable energies is one of the top priorities for Nicaragua, and has been established in the PNDH and the National Energy Strategy. The efforts to transform and diversify the energy matrix are reflected on Figure 3, which shows a trend for increasing penetration of power plants based on renewable sources in the total power generation matrix.

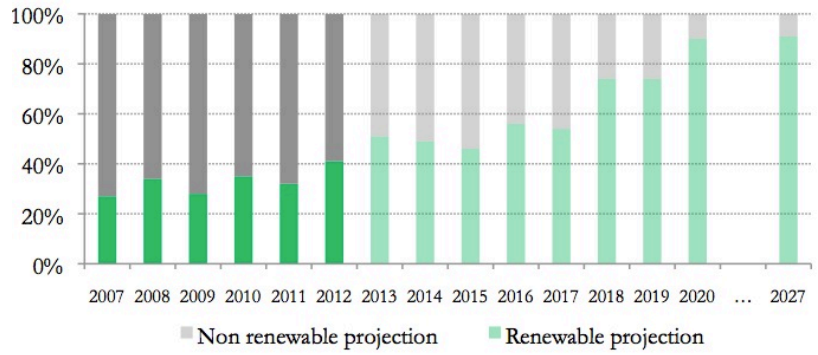

Figure 3: Renewable generation in Nicaragua's Power Generation Matrix

Source: Nicaraguan Energy Institute (INE) / Note: for the 2013-2027 period MEM forecasts are displayed

The Government of Nicaragua is committed to strengthening the transformation of the energy matrix and has set ambitious goals for the exploitation of the remaining potential of renewable resources. The goal is to achieve 91% of renewable penetration in the power matrix by 2027 (MEM, 2013, page 15). SREP's support to the geothermal sector will contribute to reach this goal.

Increasing the National Grid coverage

Nicaragua continues to be the country with the lowest electricity coverage of all Central America. According to Law No. 272- Law of the Electric Industry- the Government is responsible for rural electrification. During the past seven years, the national government achieved significant improvements (See Figure 4). Nevertheless, the country's power infrastructure still presents significant challenges that have to be overcome: by the end of 2014, 80% of the people of Nicaragua had electricity (ENATREL, 2014) leaving 1.2 million people still lacking modern power supply. This represents an important limitation for socio-economic development and a gap to bridge in order to achieve the 90% coverage by 2020, of each country in Central America, agreed on under the Central American Sustainable Energy Strategy 2020 supported by SICA[8].

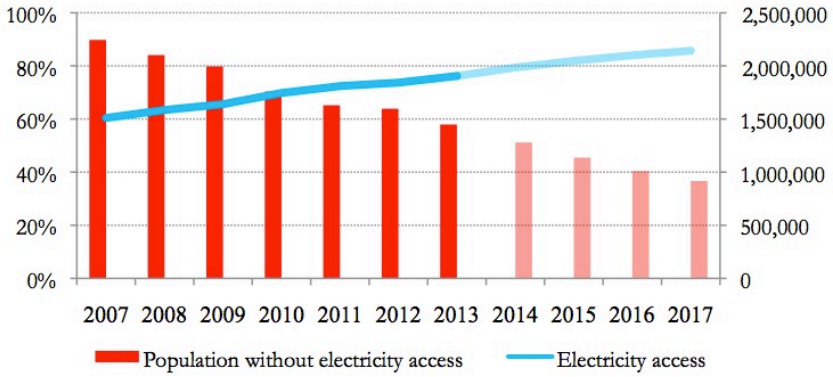

Figure 4: Nicaragua's coverage index and number of people still lacking power supply

Source: MEM, 2013 -- Note: For the 2014-2017 period forecasts are displayed [9].

[8] Central American Integration System, Sustainable Energy Strategy 2020, page 102, Goal B.A.1.

[9] ENATREL, Avances informativos, 2013, www.enatrel.gob.ni

The global coverage rate hides great differences between rural and urban areas, and on- and off-grid areas. In general, there is virtually a 100% coverage rate in cities, 40-60% in most rural areas and 0-20% in the autonomous regions of Nicaragua's Caribbean and in the department of Jinotega. In other words, most of the 1.2 million inhabitants that lack access to electricity live in rural areas; solutions to reach each of them are being evaluated. In most cases, isolated solar PV - either solar home systems or incorporated in micro-grids - or hydroelectric systems have lower costs than Diesel-powered plants. In others, combined mini-grids (hybrids) are required to supply larger demands while ensuring power stability. SREP's support to small hydro plants and rural grids can contribute to meet this goal for productive uses.

Ensuring universal access to modern energy services

Universal access to modern energy services continues to be a challenge in rural areas where grid extension isn't financially feasible. In many of Nicaragua's departments, the MEM and the National Electrical Transmission Company (Spanish acronym ENATREL) have identified the need to promote the installation of home power generation systems based on renewable sources, with the possibility of combining several of them in mini-grids in appropriate places. In all these cases, the legal framework and price structure must be defined in order to ensure equitable access to power – including possible cross-subsidies between users on the National Interconnected System and users served from isolated systems. Via the National Rural Electrification Plan, ENATREL is aiming to reach 100,000 households -15% of total population- over the next ten years.

Regarding thermal energy usage, approximately 400,000 households -60% of the rural and 20% of the urban population of Nicaragua (MEM, 2007, page 27)- cook meals using wood-fired stoves, impacting negatively on health and the environment. Aware of the challenge, MEM is carrying out the National Firewood and Charcoal Plan 2014-2022 to deploy hundreds of thousands of improved stoves that will increase the efficiency of biomass usage and the health conditions of families. SREP's support of solar PV projects in rural areas and of the dissemination of improved cookstoves will help strengthen these action plans.

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2. NICARAGUA'S ENERGY SECTOR

ENERGY SECTOR AND CONSUMPTION

During the past decade, energy demand in Nicaragua has increased considerably, mirroring the country's economic development: in the year 2000, primary energy consumption was 2,500 kilo tons of oil equivalent (ktoe), by 2010, it had increased to 3,000 ktoe and reached 3,310 ktoe in 2013, according to the International Energy Agency (IEA, 2014). The use of biomass, the basis of energy consumption in Nicaragua, accounting for about 50% of total consumption- has grown relatively slowly: less than 200 additional ktoe since 2000, maintaining an important weight in the energy balance. But the country's peak demand for electricity has been rising at an average 4% a year, going from 397 MW in 2000 to 620 MW in 2013 (INE, 2014a). At the same time, total power sales in the Interconnected System have doubled since 2000, closing at 2,920 GWh in 2013.

An unbalance between power supply and demand in the 2000's culminated in a supply crisis in 2007. From that moment on, the Government of Nicaragua took concrete actions to boost national production and meet consumer needs. To this effect, it launched a two-pronged quick response strategy leading to the installation of almost 200 MW of Heavy Fuel Oil (HFO) based engines between 2007 and 2010[10] (INE, 2013b), and to the implementation of a longer-term new energy strategy promoting deployment of generation capacity based on renewable energies. The result has been a growing participation of renewable sources, despite which the country continues to be a net importer of fossil fuels (oil and its derivatives), which has a negative effect on its economy. Transportation accounts for the largest share of fossil fuel consumption, followed by the power sector. The oil and derivatives import bill rose to US$1,186 M in 2013 (total CIF[11]) representing over 10% of the country's GDP (Central Bank of Nicaragua, 2013, page 149) and nearly half the FOB[12] value of exports.

Total final energy consumption was 2,180.5 ktoe in 2012, which means the total final energy consumption per inhabitant was 0.356 toe per capita (MEM, 2012a). The growth index for final energy consumption was about 3.5% per year. The nation's primary energy supply went up to 2,028 ktoe in 2012 (MEM, 2012a). Oil imports represented an estimated 25.9% of the total primary energy supply, while still nearly half of it (49.5%) is covered by firewood and other forms of biomass (See Figure 5).

[10]Being 192 MW the total production of ALBANISA plants installed between 2007 and 2010

[11] Cost, Insurance, and Freight

[12] Free On Board

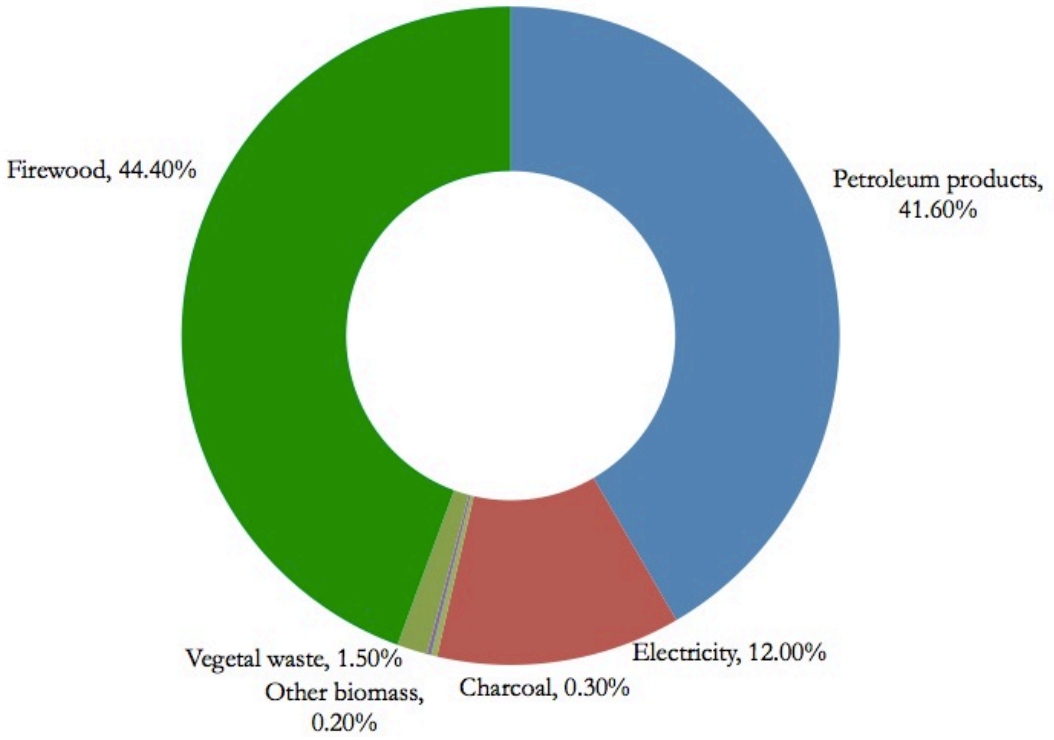

Figure 5: Total energy consumption by source in 2012 - Nicaragua
Source: National Energy Balance 2013 (MEM, 2012a).

The residential sector is the country's largest energy consumer, representing 46.3% of total energy consumption in 2012, or 1,009.1 ktoe. Within this sector, firewood represents 87.1% of energy consumption, followed by electricity with 8.5%, liquefied petroleum gas with 3.8%, and charcoal with 0.4%. The industrial sector, with 12.8% of total consumption in 2012, mostly utilizes fossil fuels (46%) and firewood (19%). The commercial area and public services took up 10.5% of energy supply.

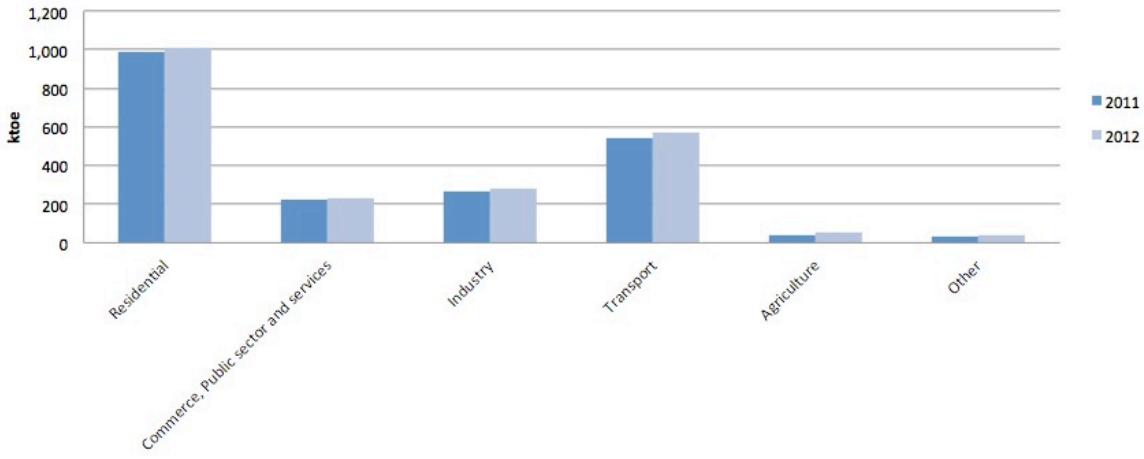

Figure 6: Total energy consumption by sector 2011 and 2012
Source: National Energy Balance 2013 (MEM, 2012a)

Structure of the energy sector and of the electricity subsector

The energy sector is regulated by Law No. 272- Law of the Electric Industry- which determines the creation of a wholesale market based on contracts among generators, distributors and end users. In general, prices reflect payments both for power and for energy. The wholesale market includes a spot market (that balances supply and demand by dispatching supply offers in merit order. The basic provisions of Nicaragua's electricity legislation aim to ensure open competition, attract private capital, and promote efficiency, which result in a highly open market.

Electric generation is carried out both by public and private enterprises in the context of open competition, with the INE as regulator. Distribution was privatized in 2000, leaving transmission and system operation under public management through the public company ENATREL. In 2007, the MEM was created with the purpose to formulate, propose, coordinate and execute the Strategic Plan and Public Policies for the Energy, Geological Resources, Mining Resources, Geothermal Resources, Hydroelectric Resources and Hydrocarbons sectors, and to direct the operation and management of state-owned companies operating in the energy sector. The General Directorate for Renewable Energy Resources (Spanish acronym DGRER) is a technical body depending hierarchically from the Superior Directorate and functionally from the Ministry.

Electrical integration of Central American countries is being achieved through the Regional Transmission Grid and the Regional Electricity Market created by the SIEPAC project and operated by a regional System Operator: EOR. Each country's authorized agents can participate in international electric power transactions in Central America under the policies and regulations established by the regional regulatory agency –the Regional Electric Interconnection Commission (Spanish acronym CRIE). Figure 7 summarizes the organization of the national power sector and the Regional Electricity Market.

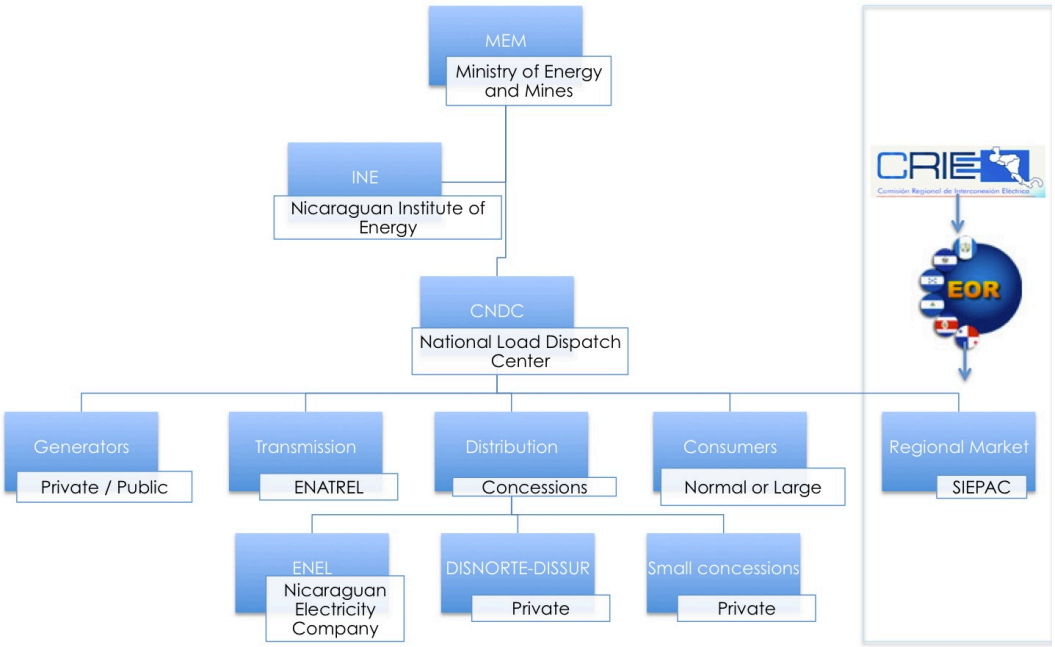

Figure 7: Organization of the National and Regional Electrical Markets (Spanish acronym MER)

Source: MEM, ENATREL

In sum, Nicaragua's power sector fulfils the conditions typically desired for investors: (i) the functions of policy formulation, regulation and power operations are separated; (ii) the business structure favors efficiency by separating the institutions which are natural monopolies from those which can be carried out in competition; (iii) there is an independent regulatory agency; (iv) adequate management models have been adopted by both public and private agents, operating under business structures; and (v) the Government maintains its long-term commitment to sustainable economic development through the use of renewable resources and the promotion of universal access to electricity.

MAIN PROGRAMS TO IMPLEMENT ENERGY STRATEGY

In support of the energy strategy the Government has been implementing to promote the sustainable use of biomass, achieve sustainability in the power sector, consolidate economic growth and reduce poverty, several key programs have been launched that SREP can extend, support or complement, with the most significant ones listed below:

National Sustainable Electrification and Renewable Energy Program, PNESER

To achieve increased electrification, the Government in 2010 launched its flagship multilateral multiannual program: PNESER. This program spearheads most of the current rural electrification efforts and its main goal is to support the government's efforts to reduce poverty by promoting access to an efficient and sustainable electricity service, while supporting a change in the energy matrix to help reduce the adverse effects of climate change. Through its second component, the PNESER also tackles the normalization of electricity service to 164,000 households located in irregular settlements, including upgrading the distribution grid, service drops and power metering in order to reduce technical and non-technical losses (theft that overloads the demand), and chronic under-investment. For further details please see Annex (4).

A group of bilateral and multilateral organizations led by the IDB have decided to support authorities in the implementation of the Program, which has received a total of US$419 M and is supported by the IDB, CABEI, EIB, NDF, EU/Latin American Initiative, among others. PNESER will end in 2017: SREP's support would make it possible to continue with additional tasks of this successful and transforming program.

National Rural Electrification Plan, PLANER

The general goal of the PLANER (2014-2024) -developed within the framework of the National Electrical Industry Development Fund (Spanish acronym FODIEN)- is to "produce a National Rural Electrification Plan that establishes an investment program for works that must be executed every year in each of the country's municipalities and communities, together with the respective demand projections."

PLANER's specific objectives are:

- an investment plan for home generation systems based on renewable resources;
- an investment plan for distribution mini grids and small hydro plants (SHP and MHP);
- proposals for the sustainability of isolated systems; and
- an investment plan for electrification based on grid expansion.

SREP Program's support to Nicaragua's rural electrification can rely on the planning foundations that are complemented by the need of distribution and transmission pipelines, electric substations, off-grid systems and generation plants of PLANER.

In this context, PLANER has launched the project IDEPEZAN-Phase 1(2014-2015) whose goals include producing pre-feasibility, feasibility studies and final design for power plants (small hydro, home PV systems) for ulterior development of these power supply alternatives for rural communities. In its initial phase the sphere of action was in the North Atlantic Autonomous Region and financial resources are expected to be channeled in order to conduct studies for the subsequent phases.

National Firewood and Charcoal Strategy, ENLCV

Through the ENLCV, Nicaragua is developing a participative, inclusive process, which supplements all actions from other instruments for managing forest resources. Their gradual implementation over the course of ten years will contribute to the transformation of the forest energy sector into one of the pillars of environmentally sustainable socio-economic development.

The strategy establishes key guidelines for all productive and social sectors of the population involved in the value chain of firewood and charcoal, directs the forest sector towards sustainable production, optimal commercialization of forest energy products, and their efficient transformation into heat energy.

The multiannual program derived from the ENLCV is currently going through its final design phase. The program includes, among others, baseline studies, pilot projects, technical regulation, and test centers, and is linked to the Regional Program for Sustainable Use of Firewood and Charcoal for 2014-2022. Both the regional and the national programs are supported by the World Bank and the Global Alliance for Clean Cookstoves (GACC), among others. SREP support would help launch the plan and generate a key change that should in the long-term benefit 400,000 Nicaraguan families, through the transfer and adoption of improved stoves, and help 5,700 SMEs install efficient kilns.

Geothermal Master Plan: technical assistances

The World Bank is currently supporting the Government of Nicaragua with a Geothermal Technical Assistance Program.

MEM, on behalf of the Government of Nicaragua, also signed a contract with the Icelandic International Development Agency (ICEIDA) representing the Government of Iceland (GOI) in January 2008. This made possible to carry out during 5 years (2008-2012) a Geothermal Capacity Building Program. ICEIDA's goal was to help the country improve the use of its geothermal resources for electricity generation, in line with Nicaragua's energy policy. The project recommended updating the geothermal Master Plan and developing several sites over the next few years.

ELECTRIC POWER SUBSECTOR

High electricity prices present an obstacle for social development. Changing the power matrix can help lower prices as fossil fuels are replaced by renewable energies.

The INE, the regulator for the electric power sector, determines indicative electricity tariffs, calculated to cover the full supply costs, but the tariffs actually applied to consumers are lower. The government provides subsidies. Some target low-income consumers and rural electrification, and are designed to achieve broad national goals of social equity. Others cover the tariff gap and are financed from the government's budget and with loans from CARUNA –a credit and savings national cooperative that manages Venezuela's oil cooperation resources (World Bank, 2014a).

The National Interconnected System is a well-defined grid covering most of the west and central areas of the country, which transports about 99% of the electricity produced and consumed. The remaining 1% is produced in off-grid systems where regulations allow the integration of generation, transmission, distribution and retailing of electricity, subject to tariffs approved by INE. The State of Nicaragua has the responsibility and commitment to expand electrification to rural areas, which do not present an interest for distribution companies. The map of Nicaragua's main grid is shown in Figure 8.

Figure 8: Nicaragua's main electric grid in 2013
Source: ENATREL, 2013

The current electricity demand and supply situation of Nicaragua is detailed below.

Electricity demand

The peak demand for the national grid was 620 MW in 2013 (INE, 2014a). The country's total electric power consumption was 2,950 GWh on-grid and off-grid combined, by the end of 2013 (INE, 2014c) with a per capita power consumption of nearly 500 kWh.

Figure 9 shows how demand increased faster in the residential sector, which accounted for 34% of total power sales in 2013. Industrial clients represent 24%. Electricity purchase for both residential and industrial clients has been increasing at an estimated rate of 7% yearly. Residential consumption has boosted since 2007 due to the country's economic development as well as to the expansion of supply coverage. Consumption among commercial clients, which also represents 24% of total purchases, has grown steadily although at a slower pace of approximately 4% per year. This trend is expected to continue. MEM projects that total electricity demand will grow at a rate of 4.7% in the 2013-2027 period (MEM, 2012c).

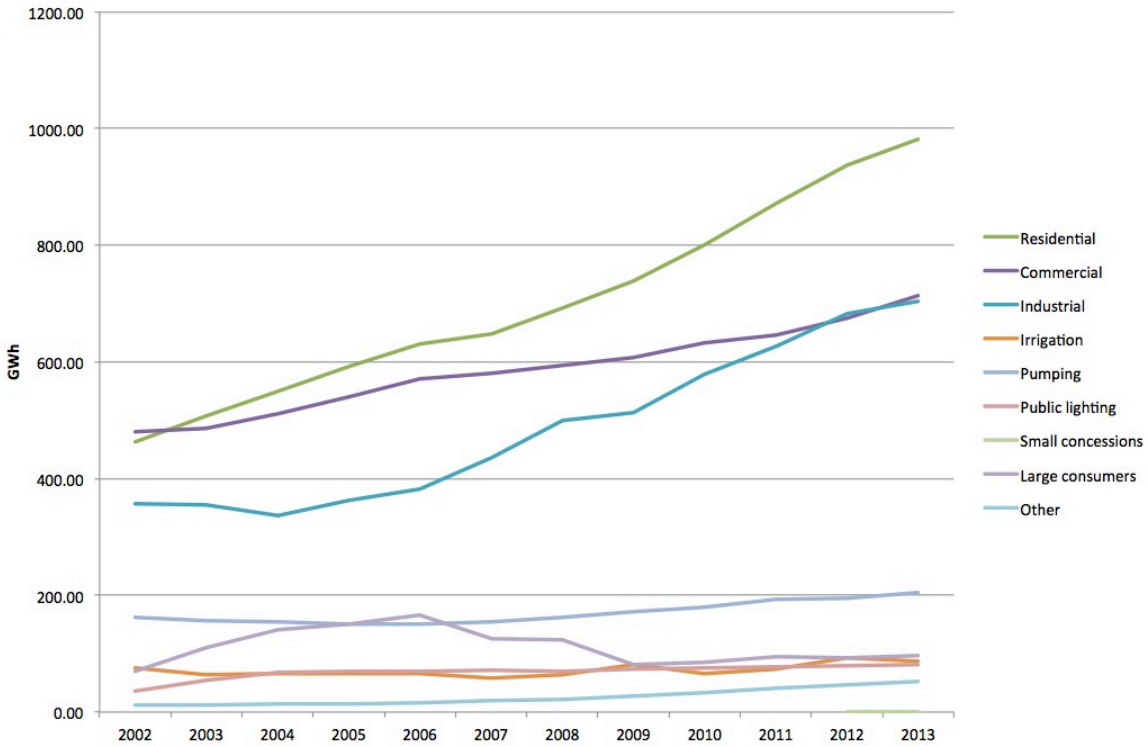

Figure 9: Evolution of power sales by sector

Source: (INE, 2014c)

Electricity supply

Total installed capacity in 2014 was 1,380 MW (INE, 2013b). Of these, 1,362 MW are in the National Interconnected System and 18 MW in diesel plants serving isolated rural grids managed by the National Electrical Company of Nicaragua (Spanish acronym ENEL), and some small hydro power plants (SHP) of less than 1 MW, which also supply isolated rural areas (National Energy Dispatch Center, 2013). Table 3 shows the consolidated summary of the power plants connected to the grid. Details are shown in Annex (9):

	Effective capacity in 2013 (MW)	Nominal capacity in 2013 (MW)
Fossil-based thermal power	570.16	717.5
Biomass-based thermal power	124.8	133.8
Hydroelectricity	111.9	119.7
Gas-turbine power	0	65
Geothermal power	69.34	154.5
Wind power	179.56	186.6
Total Grid production	**1,015.76**	**1,377.10**

Table 3: On-grid installed capacity of Nicaragua (2013)

Source: (INE, 2013b) Nominal and effective installed capacities

Power plants based on renewable sources accounted in 2013 for about 43% of total installed capacity. Up to 2010, most installed capacity was in thermoelectric power plants using heavy fuel oil. However, this trend is quickly changing and renewable-energy based installed capacity is growing at a fast pace.

According to INE, in 2014 Nicaragua had an installed wind capacity of 187 MW, geothermal capacity of 154.5 MW, biomass capacity of 133.8 MW, hydropower capacity of 120.1 MW (including the Santa Barbara and Central America plants), and 1.4 MW of installed capacity in the single on-grid solar power plant (ENATREL, 2014 and INE, 2014). Wind generation is concentrated in the country's southwest in which 100% of the existing wind power plants are located in a 100 km^2 range, in the department of Rivas.

Energy losses in the national grid continue to be high, reaching up to 20% to 30% in recent years. Power distribution companies estimate that 14 percentage points of such losses are due to illegal connections, fraud or power theft, while the rest is technical losses. The government is promoting actions, particularly with the support of the PNESER to make specific investments aimed to reduce power losses, allowing fares to include a higher percentage of the system's loss –with incentives for loss reduction through improvements in energy efficiency-, and towards adoption of more strict regulations to act against power theft.

Priorities of power sector development

Projects SIEPAC and PNESER are currently strengthening Nicaragua's power infrastructure, increasing transmission capacity as well as redundancy and robustness of the main grids supplying the country's largest population centers.

Even so, the development of power infrastructure is still insufficient, leaving Nicaragua with a coverage rate of approximately 80% by 2014 (ENATREL, 2014). This global coverage rate hides large differences between the urban and rural areas, as Figure 10 shows.

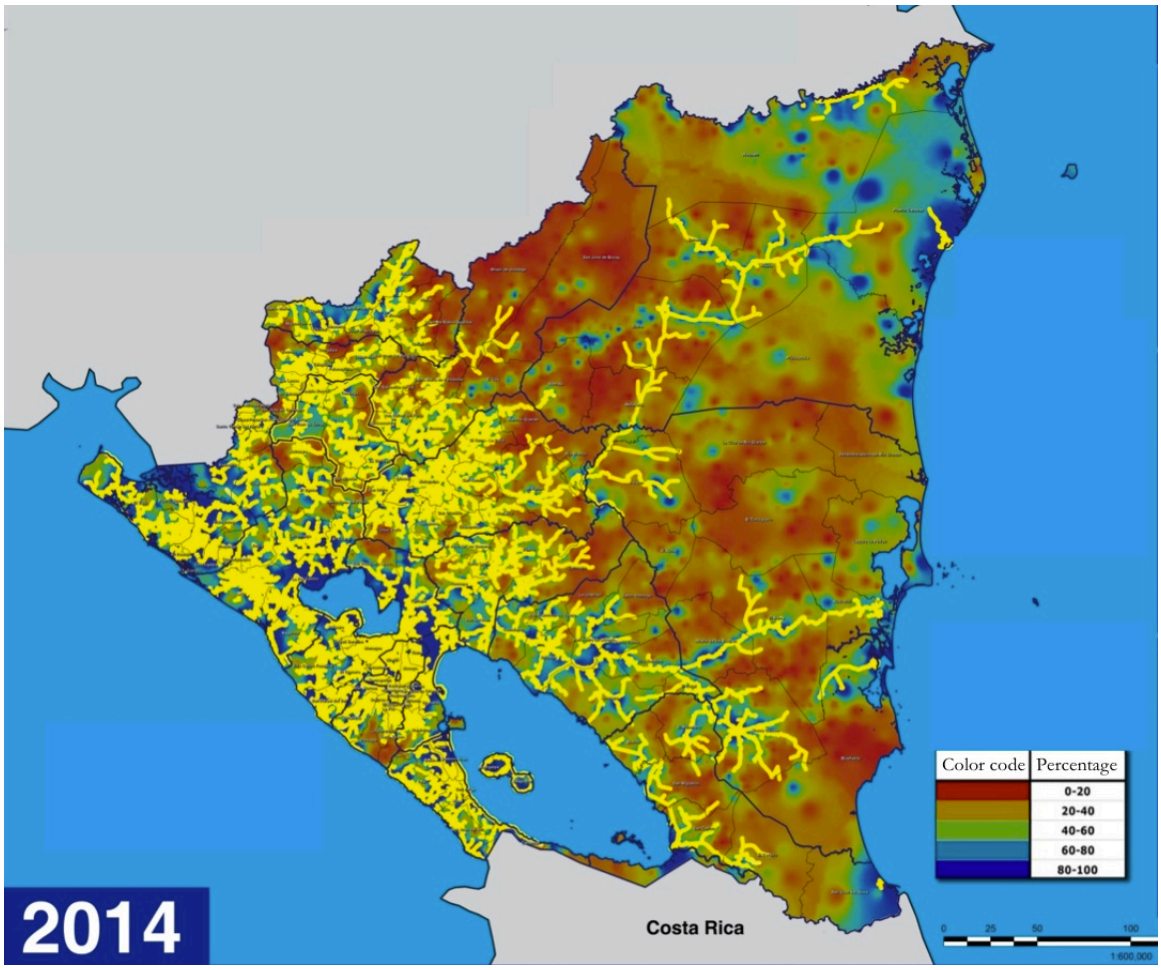

Figure 10: Power coverage and main grid distribution map
Source: ENATREL, 2014

Reinforcing the grid will increase the system's capacity to manage the random variations of intermittent renewable generation, allowing for more run-of-river hydro plants, wind farms and, potentially, solar power plants. Indeed, the incorporation of intermittent renewable generation requires the system to equip itself with the means to manage that variability, which presents challenges.

Electrical Expansion Plan

The MEM's *Indicative Plan for Expansion of Electrical Generation 2013-2027* proposes to incorporate 1,161.4 MW of renewable generation to respond to demand growth (average demand scenario, Figure 11).

This Plan envisions adding 737 MW in hydroelectric projects, 131 MW in geothermal projects -from 4 different fields given that it can provide base load capacity consistently throughout the year-, 114 MW of biomass -part of it providing base load capacity-, 40 MW of wind projects – already installed in 2014-, and 140 MW from fossil-fired thermal plants. This is an ambitious plan, if one compares it to actual developments of the past decade. Indeed, since 2002, less than 20 MW of hydroelectricity, 70 MW of geothermal power and 90 MW of biomass plants were installed (INE, 2014b).

The goal is to substantially reduce the use of fossil fuels, while maintaining enough firm thermoelectric capacity to ensure meeting peak demand and to compensate for the variability of wind power and run-of-river hydro.

It is expected that, on this basis, electricity production will grow steadily, as shown on Figure 11, towards a matrix dominated by renewables, which should reach 90% of the total by 2027 (MEM, 2013). This is also an ambitious goal and its achievement will require the support of the MDBs and continuous involvement of the private sector.

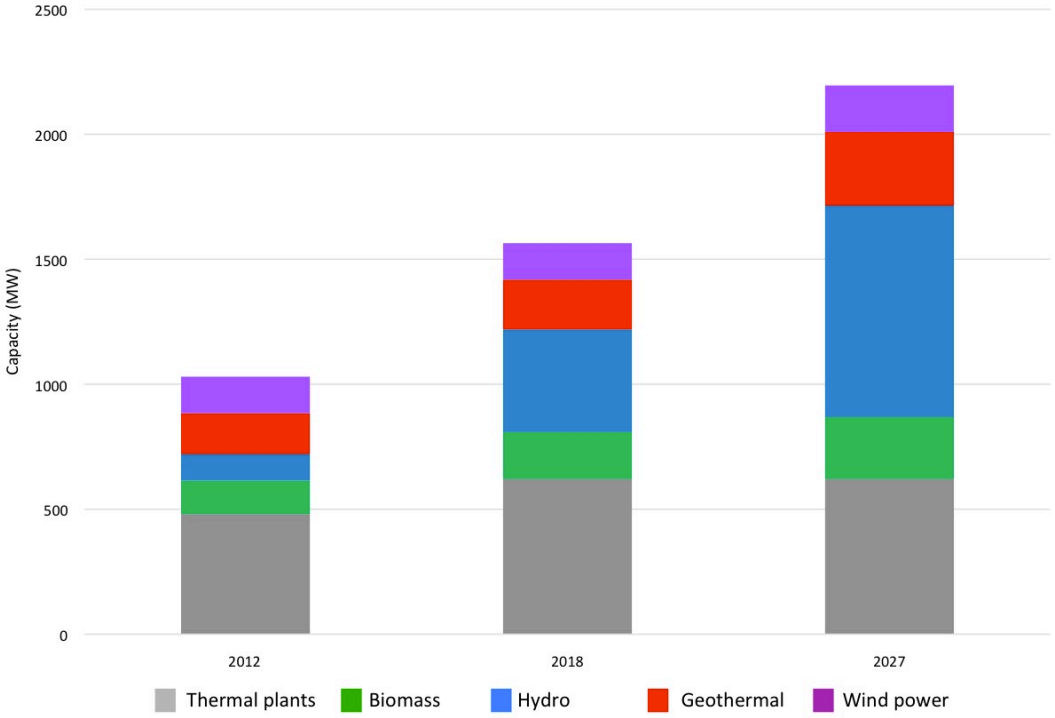

Figure 11: Generation matrix evolution forecast – average-demand scenario
Source: (MEM, 2013)

LEGAL FRAMEWORK FOR THE PROMOTION OF RENEWABLE ENERGY

Nicaragua's legal framework is designed to attract foreign investment and to support the involvement of private actors both for energy projects and for other purposes. Through the Foreign Investment Promotion Law (344), investors are offered fundamental guarantees such as free currency convertibility, the right to repatriate all the capital and profits, full protection of intellectual property, patent and trademarks, and no discrimination against foreign investors.

Nicaragua has a specific legal framework to promote renewable energy investments: Renewable Energy Promotion Law (No. 532-05) includes fiscal and contractual incentives aimed to encourage the development of new renewable power generation projects and the expansion of existing ones, regardless of the scale or the renewable technology involved.

This law gives the MEM the faculty to set the quantity of energy that distributors must purchase from renewable sources during the bidding processes. In principle, this legal framework ensures the expansion of generation capacity based on private financing and also the gradual transformation of the energy matrix towards a higher penetration of renewable energies.

The fiscal incentives included in Law No. 532 are: (i) exoneration of import duties during project construction; (ii) exoneration of the value-added tax during construction; (iii) exoneration of the income tax during the first 7 years of operation; (iv) exoneration of municipal taxes in gradually decreasing manner over a 10-year period; (v) exoneration of natural resource exploitation taxes for up to a maximum of 5 years after operations begin; and (vi) exoneration of revenue stamp taxes generated by project construction, operation or expansion for 10 years. There are other specific laws for the renewable energy subsectors.

Apart from Law No. 532, other laws that outline the legal framework for the renewable power sector in Nicaragua are: Law No. 443 - Law on Exploration and Exploitation of Geothermal Resources, Law No. 467 - Law for the Promotion of the Hydroelectric Sub-sector, and Law No. 695, - Special Law for the Development of the Hydroelectric *Tumarín* Project.

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3. STATE OF RENEWABLE ENERGY IN NICARAGUA

POWER GENERATION FROM RENEWABLE SOURCES AND ITS POTENTIAL

The National Grid's use of Renewable Sources

Figure 12 shows the national grid's net electricity generation for the past 10 years. Power generation has progressively shifted from diesel-based towards wind and geothermal power.

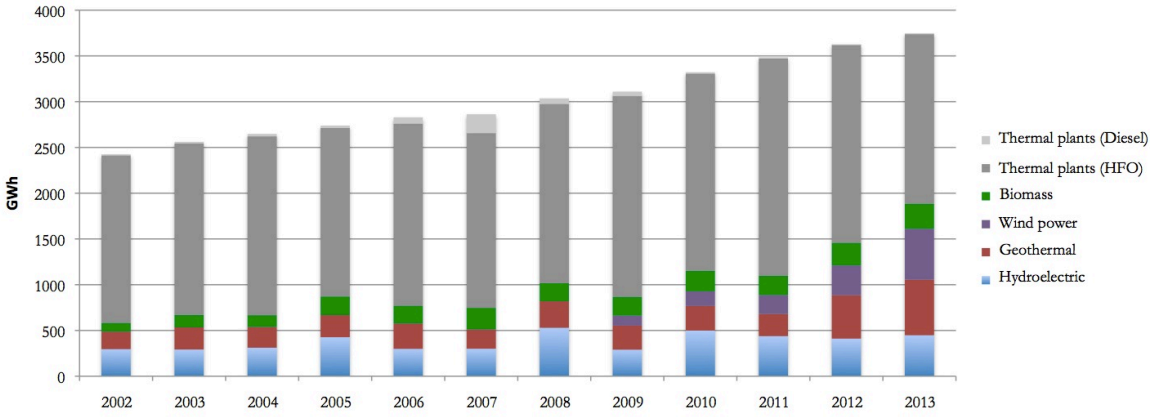

Figure 12: Evolution of net power generation of Nicaragua, 2002-2013

Source: INE, 2014

During 2013, Nicaragua's power generation was dominated by thermal plants using fossil fuels (50.3%) –responsible for over half the power generated, as shown in Figure 13. Geothermal power was the country's second energy source (16%), followed by wind power (15%), hydroelectricity (12%), and biomass (7%).

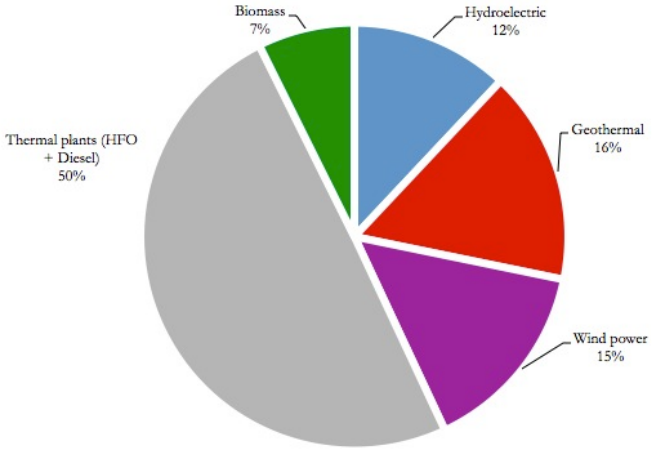

Figure 13: Net power production by source, 2013

Source: (INE, 2014)

The potential of Nicaragua's Renewable resources

Nicaragua has a huge untapped potential of renewable power generation. An estimated minimum of an additional 5,500 MW[13] could be generated from renewable sources –over three times the current installed capacity, as shown in Figure 14.

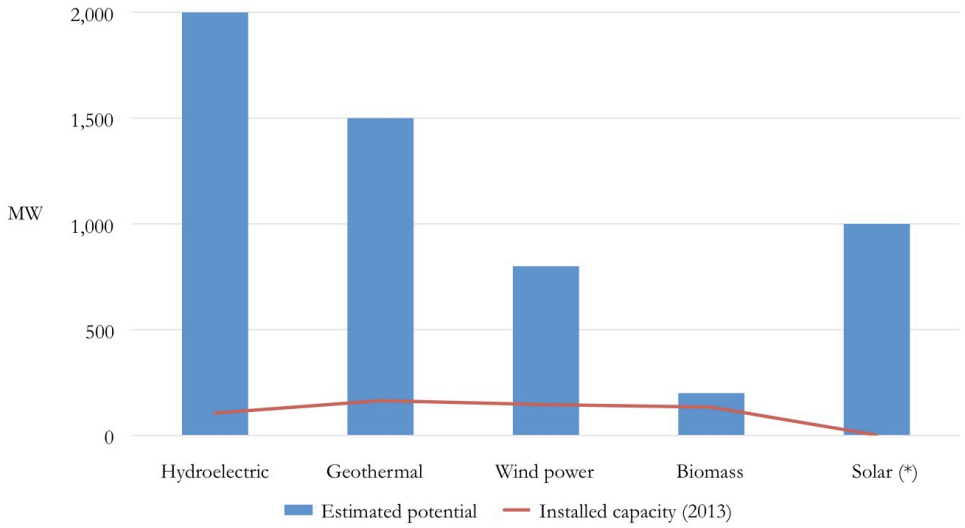

Figure 14: Estimated renewable energy potential and installed capacity in 2013

Source: Potential, see Table 4– Installed capacity: (INE, 2013b)-(*) solar: estimated by authors

The following figures on Table 4 represent the estimated potential:

Renewable source	Estimated potential (MW)	Study or source	Actual capacity 2013 (MW)	Utilization rate 2013 (%)
Hydroelectric	2,000	Master Plan for Electrical Development (IECO-LAHMAYER), as of 1980	112.12	5.61%
Geothermal	1,500	Geothermal Master Plan for Nicaragua (National Energy Commission, 2001)	69.34	4.62%
Wind	800	SWERA, see Annex (1)	187[14]	23.38%
Biomass-based	200	Silvio Binato, 2003-2004	124.8	62.40%
Solar*	1,000	Estimated by author, based on SWERA data, see Annex (1), taking into consideration that it occupies 1% of the national territory (roofs and unproductive land)	1.37	0.14%

Table 4: Estimation of usable power by renewable energy source and current state – 2013

Source: MEM, (INE, 2013b), various - (*) Solar: estimated by authors

[13] Considering only the estimated potential for hydroelectricity, geothermal, wind, and biomass power.

[14] Including Alba Vientos (2014)

Based on this estimation, Figure 15 shows the levelized cost of energy (LCoE) in US$/MWh for each source against its potential in MW (the details of LCoE calculations are shown in Annex (8)).

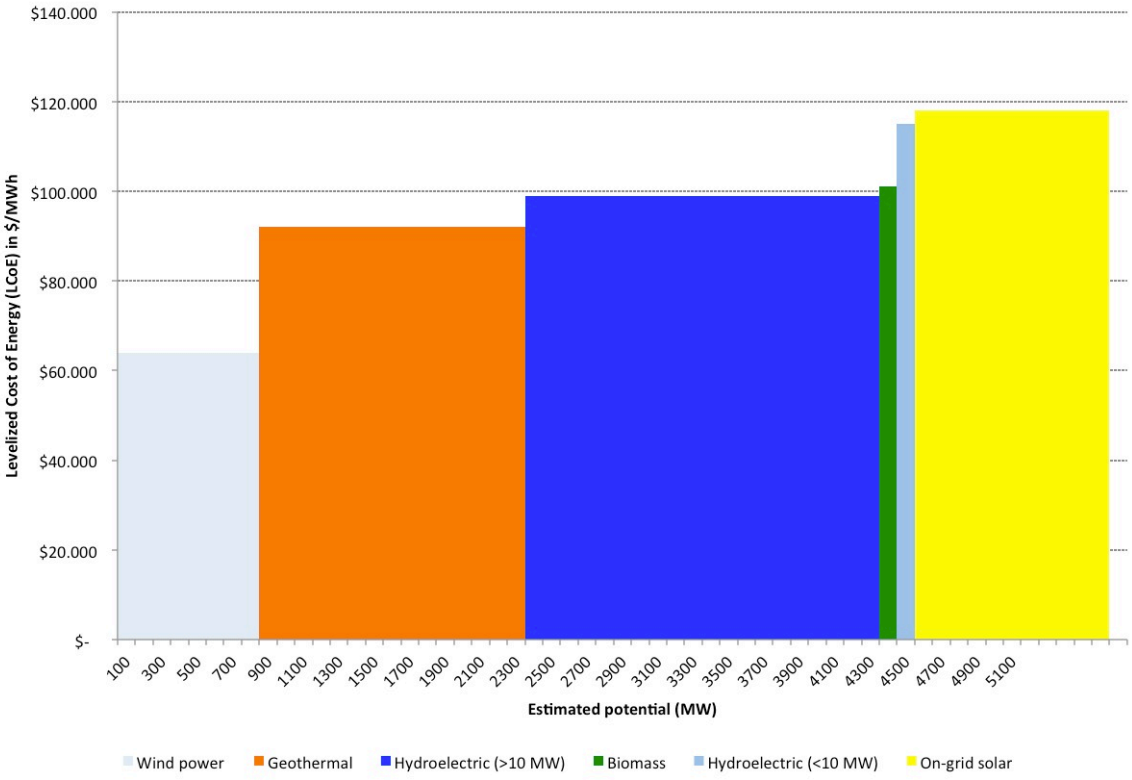

Figure 15: LCoE for renewable energy sources in Nicaragua (capacity)
Source: Potential: Ibid. LCoE models in Annex (8)

SWERA provides specific resource evaluations for wind and solar power for Nicaragua. Another key source to estimate renewable resource potential in the region is the World Bank's analysis Remaining Effective Potential of Renewable Resources, which evaluates the market's long-term potential to implement projects, and seeks to give an idea of the potential likely to be developed.

The comparison between electricity actually generated through renewable resources (2013) and the remaining effective potential is presented in Table 5:

Renewable resource	Estimated potential (MW)	Power generated by the end of 2013 (GWh per year)	Typical capacity factor	Remaining Effective Potential of Renewable Resources - as of 2015 (GWh per year)
Hydroelectric generation > 10 MW	1,982	448.23	56%	8,269
Hydroelectric generation < 10 MW	118*		45%	465
Geothermal generation	1,500	607.31	95%	11,906

Wind power generation	800	555.00	42%	2,255
Biomass-based generation	200	275.18	60%	395
Solar generation*	1,000	N/A	23%	2,012

Table 5: Comparison between current generation and Remaining Effective Potential

Source: (INE, 2013a) World Bank, 2009; and authors' estimations (*) Total SHP projects identified by ENATREL, 2015.

Based on these estimations, we can establish the equivalent of Figure 15 but referring LCOE to expected energy generation per year. This is presented in Figure 16.

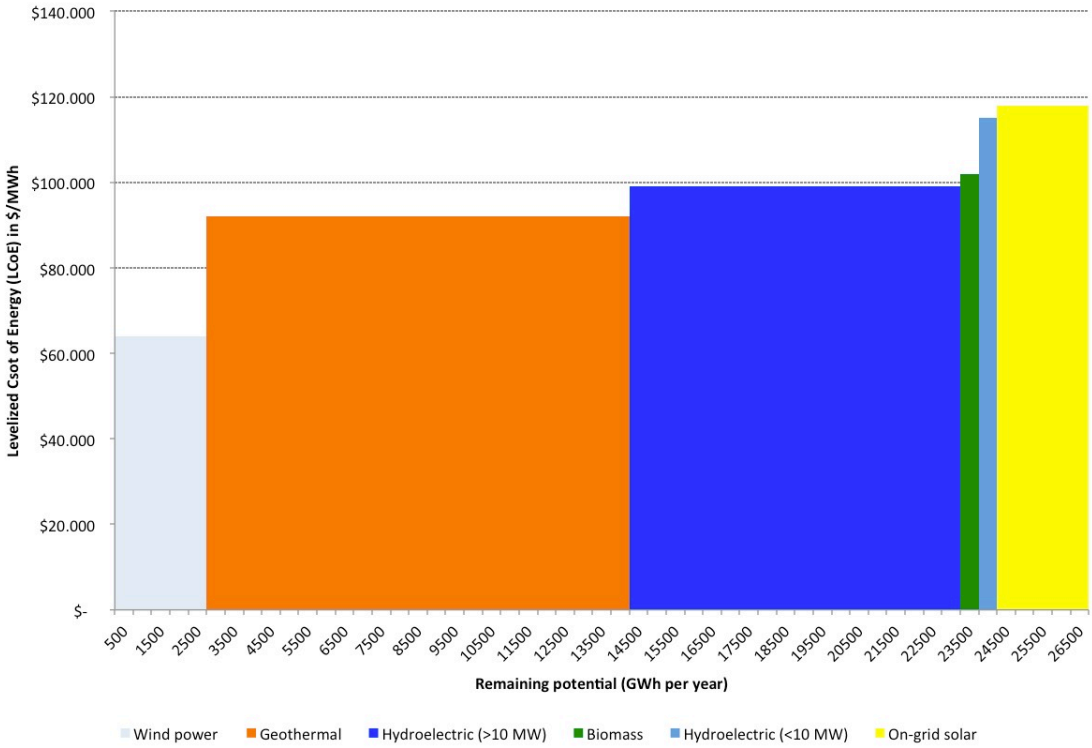

Figure 16: LCoE of renewable energies in Nicaragua (unexploited energies)

Source: Potential: Ibid. LCoE models in Annex (8)

The production capacity cost curves displayed on Figure 15 and those by unexploited energy displayed on Figure 16 reveal the importance and favor the prioritization of geothermal generation.

Potential maps can be found in Annex (1).

1) Hydroelectric potential

Nicaragua's potential for larger-scale hydroelectric developments is estimated to be as much as 2,000 MW.

The projects planned to be undertaken next are indicated in Table 6:

Project	Power (MW)	Planned date
Larreynaga	17	2015
El Diamante	5	2015
Piedra Puntuda	15	2018
Tumarín	253	2019
Boboké	70	2020
Salto Y-Y	25	2020
Copalar Bajo	150	2021
El Carmen	100	2022
Piedra Cajon	22	2022
Valentin	28	2024
Corriente Lira	40	2025
Total	**725**	

Table 6: List of hydroelectric projects planned until 2027

Source: (MEM, 2012c)

The potential of small- and middle-scale hydroelectric projects was calculated by the program *Development of Small Scale Hydropower for Productive Use Outside of Power Grid Zones* 2004-2015, financed from the government's budget, the Swiss Agency for Development and Cooperation in Central America, and the Royal Norwegian Embassy. Additionally, other studies have been conducted by PERZA – Spanish acronym for Rural Electrification in Off-Grid Areas Program- (World Bank, 2012). The remaining unexploited hydroelectric potential that could be exploited in SHPs (< 10 MW) could rise up to 40 MW, 30 MW of which correspond to plants destined to supply productive uses. By 2013, there were seven SHPs in operation, adding 9.83 MW, and 11 micro hydro power plants managed by private enterprises, developed and financed from the government's budget and international cooperation.

The indicative plan for Nicaragua's hydroelectric potential is attached on Annex (1).

2) Geothermal potential

Geothermal resources are distributed over 340 kilometers, along the volcanic mountain range of Los Maribios, which runs parallel to Nicaragua's Pacific coast, as shown on Annex (1). Average heat flow over Nicaragua's territory is estimated at 78 mW/m^2, which is above the conservative limit of 50 mW/m^2 generally considered valid for a geothermal project (IDB /DNVL, page 21, 2014)- over 57% of the territory is above that limit. Nicaragua's geothermal potential to produce electricity has been estimated at between 1,519 MW (National Energy Commission, 2001) and 3,194 MW (ICEIDA, 2013). It's important to point out that most of the fields are not explored by drilling, therefore the estimated geothermal power generation capacity, being mostly based on indirect information provided by surface studies, is somewhat uncertain.

In Nicaragua there are 12 identified areas with geothermal potential (CNE, 2001), but only two of them (Momotombo and San Jacinto-Tizate) have been developed so far, with total installed geothermal generation capacity of 155 MW. Three among the undeveloped areas, (Chiltepe, El Hoyo-Monte Galán and Casitas) have been explored by private companies, which conducted surface

studies and drilled few exploration wells, while three other geothermal areas (Cosigüina, Caldera de Apoyo and Mombacho) are currently being investigated by the GoN with technical and financial support from the IDB and JICA. All other areas are only known at preliminary reconnaissance level.

3) Wind power potential

Nicaragua has wind resources believed to exceed those of all other Central American countries. NREL has estimated that 6% of Nicaragua's territory –equivalent to 7,600 km² -has a wind power resource categorized as good or excellent (classes 4 – 7) which means that the average wind speed year round is above 7.0 m/s at a height of 50 meters. The best resources are found in the southwest, particularly in the department of Rivas. There are also numerous sites with an excellent quality along the hills extending northeast from Chontales towards Estelí. Nicaragua's total potential wind power has been estimated to be over 800 MW. The map of potential wind power is included in Annex (1).

Several private projects in Rivas already utilize this resource on a commercial scale: Projects *Amayo I* and *II* (63 MW) started in 2009, Blue Power (40 MW) has been in production since 2012, EOLO (44 MW) since January 2013, and *Proyecto Alba Vientos* (40 MW) since 2014. The current trend to invest in renewable energy projects is still strong, but more firm generation capacity is needed to be able to incorporate additional variable renewable generation.

As far as small-scale wind turbines are concerned, their numbers have not grown, despite a number of attempts and the good historical penetration of water wind pumps in the country's southwestern region.

4) Biomass potential

Regarding biomass residues for large-scale power generation, the study conducted by Silvio Binato in 2004 estimated the potential of sugar-cane bagasse at 200 MW.

There are two industrial projects already operating: the sugar mills of *San Antonio* –with an installed capacity of 79.3 MW- and *Monte Rosa –Pantaleón*, with an installed capacity of 54.5 MW. Other middle size projects operating as auto-producers were also launched recently, injecting up to 10 MW excess into the national grid. By 2027, 114 MW of biomass-based generation capacity are expected to be added, as stated in the Indicative Plan for Electric Generation Expansion, 2013-2027, which considers among other plants the CASUR sugar mill -with 24 MW- and the *Montelimar* project -with 42 MW- expected to go online in 2015 and 2016, respectively.

MEM has also recently granted provisional licenses for power generation based on solid urban waste[15], particularly in *León* and *Chinandega,* of 90 MW each.

5) Solar power potential

Measurements taken from 1982 to 1983 indicate a yearly average horizontal global radiation of approximately 5.5 kWh/m² per day (2,007 kWh/m² per year). In the Pacific region, horizontal global radiation is on average 2000 - 2100 kWh/m² per year; 1,825 kWh/ m² per year in the Central area; and 1,643 kWh per m² per year in the Atlantic region (Nicaragua Solar Maps, 1994). Maps are included in Annex (1).

[15] *MSW : Municipal Solid Waste*

Harnessing off-grid renewable sources

Apart from renewable energy generation connected to the grid, renewable energy sources in remote areas could serve an important market yet to be exploited, particularly in off-grid rural applications.

Total installed capacity in isolated systems in Nicaragua in 2013 included 17.95 MW in diesel plants (INE, 2013b) supplying rural grids managed by ENEL, and some SHP of less than 1 MW supplying small rural distribution concessions.

These systems are located in areas characterized by extreme poverty, low HDI and the lowest income per capita in the entire country. There are small urban centers within these areas supplied from mini-grids. However, most of the population lives in small rural communities with a few dozen to a few hundred houses far apart from each other. Given this context, there are several options to provide electricity service to those communities, using renewable energies:

1) Rural electrification projects using home PV systems to supply remote communities with dispersed houses.
2) Rural electrification projects for small and middle-sized population centers using mini-grids supplied from hybrid diesel-PV or diesel-wind generation.
3) In the future: the interconnection of dispersed SHPs at the medium voltage level to incorporate them to the national grid.

THERMAL APPLICATIONS

Thermal use of biomass

In rural areas, most households use firewood for cooking (more than 90%, according to MEM, 2007). Historically, firewood, charcoal and other biomass have played an important role in helping meet basic energy needs such as cooking. Firewood is also used for domestic heating but to a much smaller extent and its use hasn't been thoroughly evaluated. As per the latest update of the National Firewood Survey (MEM, 2007), firewood represented 55% of the net consumption of final energy; charcoal 1%, and oil derivatives 27%. According to this study, firewood consumption was somewhere between 1,500,000 and 1,800,000 TM, 89% of which was used by households and small businesses, 5% by industries and 6% in the production of charcoal. It was also reported that 1.8 million people –representing about 400,000 households- used firewood as their main fuel (MEM, 2011).

Without a recent update of the National Firewood Survey, we have to assume that these figures have changed little percentage-wise, having only increased in volume due to population growth. At the household level, the traditional use of firewood and charcoal for cooking is associated with pulmonary disease. Improved stoves present a viable alternative, and the government and some NGOs are promoting their use. It is estimated that some 20,000 efficient cookstoves are currently in use in Nicaragua (PROLEÑA, 2013).

Additionally, being a country with a strong agricultural profile, Nicaragua has a huge potential for biogas applications, which can become a substitute for firewood and LPG. In order to encourage the use of biogas in every sector –residential, commercial and industrial- the country has joined The Global Methane Initiative (GMI) through the MEM in September of 2010 and has developed a National Action Plan for Biogas (MEM, 2012b).

Thermal uses of solar power

Urban populations very frequently use electric water heaters. Regarding modern technologies for thermal applications, one immediate opportunity to be seized is the development of a market for solar collectors for water heating, replacing electric water heaters. This would contribute to reduce peak electricity demand during the morning. Also, it could strengthen national industry since collectors could be produced locally.

Potential market penetration for this technology is significant, but hard to estimate. To date, there are no market studies quantifying the quantity of heaters that could be installed. The PNESER has encouraged the installation of 13 solar water heaters: 5 in hospitals, 3 in hotels and 5 in industrial installations, as a pilot program.

OBSTACLES, CHALLENGES AND MITIGATION MEASURES FOR THE DEVELOPMENT OF RENEWABLE ENERGIES

Nicaragua is still highly dependent on firewood and fossil fuels, having lower electricity coverage than its neighbors. Compared to other countries in the region, Nicaragua has the lowest installed capacity, with a strong presence of thermal plants (see Figure 17).

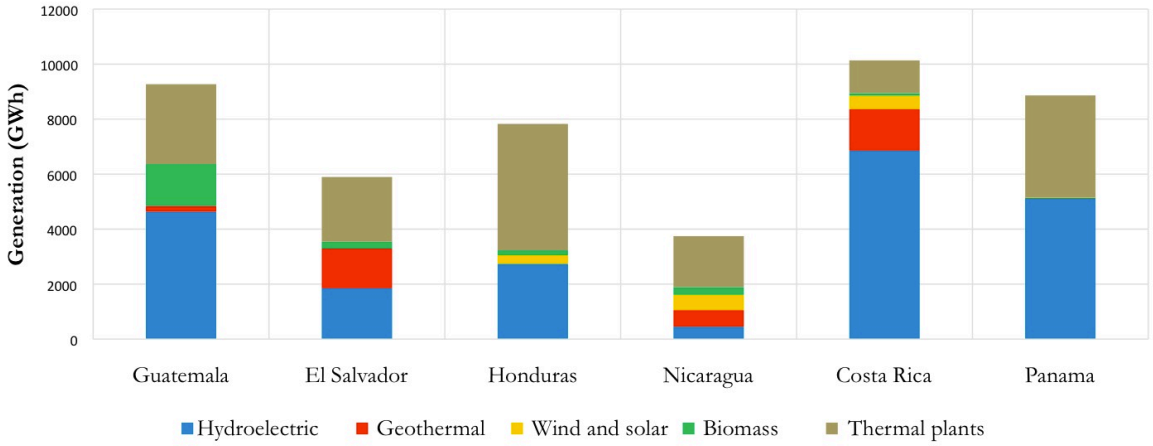

Figure 17: Power generation matrix for the countries of the Regional Electrical Market, 2013
Source: ECLAC, 2014

Nevertheless, a very positive change has been taking place in the last few years, partially due to the importance given to renewable resources. The present energy strategies at the regional, national and programmatic levels are perfectly in line with SREP's goals. But there are still barriers to be overcome that can be grouped as follows: knowledge barriers (geothermal potential); market and financial restrictions; legal framework barriers; (v) technical limitations and lack of human capacities; and social barriers. The most relevant to the SREP Program in Nicaragua are:

(i) Knowledge barriers: actual geothermal generation potential

Assessing Nicaragua's geothermal potential requires drilling in sites of interest to characterize the actual resource; however recent international experience and the geothermal developments in Nicaragua itself highlight the challenges that private developers face to mobilize investment into the

sector. The uncertainty associated with geothermal exploration, plus the costs of steam extraction constitute important obstacles for developing this resource. Given that future geothermal developments in Nicaragua will take place in mostly untested fields (greenfield), risks are likely to be high, creating a significant barrier to mobilize funding from the private sector. This can jeopardize the government's vision of an expanded use of geothermal resources and could result in substantial delays. Therefore, it is urgent to provide financing mechanisms for exploration drilling to confirm effective existence of comercially exploitable resources in identified fields, and carry out geophysical studies to identify new areas.

(ii) Market barriers: lack of commercial interest in remote areas

The market alone has not produced expanded electricity coverage in remote areas. Entry costs are high, due to the lack of basic infrastructure and an enabling environment for ESCOs: difficult access to remote areas, and high unit transaction costs for very dispersed users, discourages projects where they are needed the most.

(iii) Financial barriers: technology-sensitive solutions

To ensure financing for MEM's Expansion Plan 2027, the Energy Strategy foresees maintaining an environment conducive to high levels of direct foreign investment. The current policies of Foreign Direct Investment (FDI) incentives for investment in renewable energy projects must continue. Investment security should be institutionalized in order to reinforce a change in the perception of Nicaragua as a high-risk country for investors. Instruments adapted to the reality of each technology are also necessary.

For the geothermal sector, while the resource risk faced by developers at the exploration phase is a significant obstacle, there is still a considerable amount of residual resource/drilling risk in the subsequent production-drilling phase. Investments needed at this stage are typically much larger than those during exploration, and developers are required to raise addition risk capital (albeit less risky) in the form of additional equity. Commercial debt financing is often difficult to obtain at this stage (including due to other risks such as off-take and pricing), placing on developers a considerable burden that can stall geothermal projects or lead to considerable delays. However, the availability of some level of debt can greatly facilitate the scale-up of geothermal by: a) overcoming limitations in sponsor's equity availability, b) enhancing project financial viability by reducing the cost of financing, and c) speed-up development by helping projects quickly achieve financial closure.

In the case of small-scale hydroelectric projects, one of the concrete barriers for replication that SREP may help reduce is access to an adapted debt market. There are no loan tenures in excess of ten years to finance small hydropower, and interest rates are generally too high for a satisfactory return on investment.

(iv) Legal framework barriers: isolated systems

1) Technologies for Isolated Systems

Regarding residential use of electricity, existing regulations do not include any specific statutes allowing implementation of a sustainable model for rural electrification using renewable sources. There is a need for more precise regulations establishing the conditions to grant and to supervise distribution concessions over a given territory or area to be served, including service quality

standards, and rights and duties of the actors in rural electrification, amongst others. Under current legislation, when an isolated system is eventually connected to the main grid, an investor in PV or small wind technology is not entitled to economic compensation for any power fed back into the grid, neither through feed-in tariffs nor through net metering. In short, the legal and regulatory framework is not helping the competitiveness of small-scale generation technologies in rural areas, and in many cases the prices in a liberalized market would not match the purchasing power and willingness to pay of rural populations.

2) Improved cookstoves

To promote access to legally retailed and sustainably harvested firewood, it must be recognized that today, a large quantity of firewood is sold illegally and harvested in an unsustainable manner. There needs to be a legal framework that helps organize and regulate the value chain.

Concerning access to technologies that are efficient and not harmful for the health of users, there is very little penetration of improved cookstoves in rural areas due to lack of knowledge on the part of potential users, a situation which could be improved through actions to promote their use.

To promote a legal framework conducive to sustainable use of firewood and charcoal, the recommendations of the National Program for Sustainable Energy Use of Firewood and Charcoal 2015-2020 should be supported and followed.

(v) Technical barriers: developing technical skills in Nicaragua

The supply at the national level of technicians trained in management, operation and maintenance of renewable energy systems must be strengthened. It is especially important to support long-term planning of renewable energies in the national grid and their balance, in order to guarantee operational stability. There must also be an integrated plan to develop human capacity coordinated with technical institutions -such as the Nicaraguan Institute of Technology and the LaSalle Polytechnic Institute- and universities that promote these topics –such as the UNI, UCA, UNAN and ULSA- in a concerted manner. It would be convenient to select a technical school and, in the case of specialties, to choose from universities according to their respective strengths who will lead engineering and specific curricula. It is also recommended to support the institutional strengthening of MEM and ENEL to accompany these measures. A recent specific study on educational needs was conducted with the support of the IRENA (IRENA, 2015).

(vi) Social and management model barriers: sustainability of isolated systems

Today, the manner in which the government deals with integral rural development projects, which include isolated power systems supplied from renewable energy sources and the promotion of improved cookstoves is reduced to providing an immediate and subsidized solution to the problem in communities with a high level of poverty. In the general case, this is done through state programs supported by International Cooperation, that promote the installation of home PV systems in the houses of isolated communities and the introduction of improved cookstoves. However, this work model has encountered barriers to finance the technology in remote areas characterized by high access costs, social barriers to awareness and to the appropriation of the technology by the users, and the lack of proven management models that can ensure the continuity of operation of systems once installed, given the difficulties to procure spare parts, the lack of qualified technical personnel and bad operation of the systems.

PLANER has studied several cost models for technology and operation and has suggested that "the state consider the electrification of rural communities far away from the grid as a public service, (…) with the obligation to provide such a service despite the fact that in some cases it will not be profitable financially." The support of the SREP Program can help to close this gap.

To increase the rational use of firewood and charcoal, it is recommended to support pre-investment and investment within The National Program for Sustainable Energy Use of Wood and Charcoal 2015-2020.

The transformative role of SREP to eliminate barriers in Nicaragua

Eliminating these barriers, with SREP support, shall not only help the country satisfy its growing electricity demand, improve its energy security, lower costs and improve access to modern energy services –through rural electrification and improved cookstoves- but it shall also bring about substantial economic, social and environmental side-benefits.

As Table 7 shows, SREP could help transform the energy sector, promoting new market models and encouraging projects that could be replicated and scaled up, while overcoming the previously mentioned barriers, which would lead to higher sustainability of future investments in the sector.

Barrier	SREP Program's role to overcome barrier
Lack of knowledge of actual geothermal generation potential	SREP can help minimize exploration risks by supporting drilling in the most advanced projects and reconnaissance studies to improve resource identification in poorly explored areas.
There are no loans adapted to renewable energy technologies	SREP can offer financial mechanisms specifically adapted to each renewable technology for productive uses: PV solar or thermal, biogas, improved cookstoves, SHP
There are market barriers that cannot be overcome without State intervention	SREP can deal with some market barriers by providing specific funding to geothermal development and rural electrification
Insufficient technical capacities to handle technologies	SREP can help build technical abilities through technical assistance programs and training
Inadequate framework for small-scale systems	SREP can help out with the adaptation of the legal framework and recommend best practices
Insufficient funding to strengthen public service capacity	SREP can support the development of the public sector's capacities through technical assistance programs
Sustainability of isolated systems is unattainable	SREP can finance pilot projects potential to be scaled-up and recommend best practices and lessons learned.

Table 7: Summary of barriers and the role of SREP in Nicaragua

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4. EVALUATION AND PRIORITIZATION OF INVESTMENT OPTIONS

SELECTION AND SCREENING PROCESS FOR STRATEGIC INVESTMENTS

The main goal of the SREP Program is to prove –as a response to climate change- the economic, social and environmental viability of a low-carbon development model for the energy sector. At the same time, it seeks to create new economic opportunities and boost energy access through the use of renewables.

SREP Program guidelines indicate that the highest priority for support will be given to projects that increase the installed capacity of renewable sources, provide greater access to energy from renewable sources, enable low-emission development, facilitate affordability and competitiveness of renewable sources, promote productive uses of energy, prove to be economically and financially viable, have the potential to leverage additional resources, and have side-benefits in the economic, social –including gender-related issues- and environmental spheres. The goal is to produce a national impact and generate a transformative change in the country (World Bank, 2011).

The GoN with the WB, the IFC and the IDB carried out a consultation process to identify PINIC investment priorities. Several sessions were held with the focal point of the SREP Program in Nicaragua, institutional actors of the energy sector, NGOs and the private sector. The GoN validated top priority activities and the selection criteria to identify renewable technologies that can best meet its goals while satisfying the Program's general philosophy –of being transformational, scalable and sustainable- in order to benefit from their financing and their business models.

Some renewable energy technologies such as wind power and large-scale hydroelectricity do not need to be prioritized by SREP because private investment has already found them attractive and/or in the case of large-scale hydroelectricity, the technology is not eligible for SREP funding. Moreover, in the case of wind power, installed capacity has reached the maximum possible penetration considering its intermittent nature. This technology is further limited by a need to install additional firm generation capacity would be needed to compensate variability in order to incorporate more of that source. The case of the on-grid solar energy (solar farms) is similar: the intermittency of generation limits their potential contribution to the energy matrix, while their levelized cost still remains higher than other renewable sources, see Annex (8). In the case of biomass, scalability is an issue as it is limited by the availability of biofuel and/or green waste.

For geothermal energy, however, SREP can provide a decisive push, given its large potential: an increase in installed capacity could lower and stabilize the cost of electricity, improve energy security, minimize GHG emissions, contribute firm capacity, and provide base power. Current market barriers are keeping this from happening by itself. As we shall explain, the main obstacle to its development is the financial risk during the exploration phase.

SREP can also contribute to create a favorable environment for the construction of small hydro plants both in remote rural areas which will not be connected to the national grid by the Government of Nicaragua in the medium-term, and in other cases where –due to its geographic proximity- the necessary infrastructure to connect to the grid exists already. It can also promote higher penetration

of PV systems in rural areas where the grid won't reach in the mid-term because they are remote or too far apart.

We present in Table 8 below a summary of the screening process of investment options to be considered by PINIC:

	Technology	Potential (MW)	LCoE ($/kWh)	Considered for PINIC?	Justification
On-grid technologies	Small hydro power	118	115	**Yes**	See Table 9
	Geothermal power	1,500	92	**Yes**	See Table 9
	Wind power	800	64	No	Private investment has already flowed for this technology, and intermittency prevents further integration to grid.
	Biomass power	200	102	No	The scalability of the technology is limited by the availability of biofuels and/or green waste.
	Solar power	1,000	118	No	The intermittency limits PV contribution to the energy mix, and LCoE still remains higher than other renewable sources
Off-grid technologies	Solar home systems	N/A	>300	**Yes**	See Table 9
	Community PV systems with or without mini-grid and Diesel hybrid	N/A	>200	**Yes**	See Table 9
	Efficient cookstoves/kilns	N/A	N/A	**Yes**	See Table 9
	Biodigesters	N/A	N/A	**Yes**	See Table 9
	Solar pumping	N/A	N/A	**Yes**	See Table 9
	Solar water heating	N/A	N/A	**Yes**	See Table 9

Table 8: Initial screening of investment options for PINIC

Source: LCoE, see Annex (8)- Potential, see Table 4

PRIORITIZATION PROCESS FOR STRATEGIC INVESTMENTS

The criteria identified to prioritize projects proposed for SREP support were presented for approval to the MDBs, SREP's Focal Point in Nicaragua (ENATREL), institutional actors in the energy sector, and the private sector, during public consultation workshops. The prioritization exercise was mainly used to guide the allocation of SREP funding among possible investment. The proposed criteria were the following:

SREP Criteria	Description
(1) Scalability potential (to expand the projects)	Space available for the growth of projects supported by SREP. For example, estimated potential of a renewable resource compared to its current installed capacity.
(2) Potential beneficiaries	There are direct and indirect beneficiaries. They are all the users of the proposed system.
(3) Elimination of market barriers	Market barriers are classified into price, infrastructure, and regulation barriers.
(4) Promotion of a low-emission development model	Options are measured in terms of their potential to avoid tCO_2 equivalent.
(5) Strategic relevance and social inclusion	The project's relevance for the country in the long-term and its ability to promote a more equitable development.
(6) Contribution to leveraging new investment	The project's potential to attract other donors/funders to co-finance its implementation.
(7) Synergy with existing programs and minimizing duplication	The degree of alignment with existing programs without overlapping efforts or funding.
(8) Financial sustainability (viability)	The financial return of the project and its capacity to be financially self-sustainable.

The transformational impact driven by SREP is defined as the combination of these eight criteria. Furthermore, in Annex (3) these projects are described following additional quantitative criteria (when applicable) and evaluated for their side-benefits:

(1) Social and environmental side-benefits, including gender issues
(2) Cost effectiveness of electrification projects: in US$ per kWh, based on the LCoE
(3) Project's state of readiness (for example: availability of studies)

INVESTMENT OPTIONS

The GoN prioritized certain investment options early on in this process[16]. However, after multiple discussions, the investment options to be prioritized are the following:

(1) Geothermal power.
(2) Rural electrification with PV systems (home or community systems).
(3) Access to improved cookstoves for use by households.
(4) Renewable Energy for Productive Uses: small-scale hydropower projects (SHP), solar energy (PV pumping and solar thermal), and clean technologies utilizing firewood (efficient kilns).

ASSESSMENT OF THE OPTIONS ACCORDING TO SREP CRITERIA

These five options were evaluated applying the previously listed general criteria. The evaluation is shown in Table 7.

[16] These projects were included in the Expression of Interest of Nicaragua to participate in SREP dated April 11, 2014, and confirmed at the meeting held Nov. 6, 2014 in Managua by representatives of the GoN and SREP joint mission of the World Bank, the IFC and the IDB.

SREP Criteria	Geothermal energy	Rural electrification with PV	Access to Improved Cookstoves	Renewable Energy for Productive Uses
(G1) Scalability potential (to expand projects)	**High:** there are 10 areas with identified potential that remain unexploited.	**High:** dispersed communities in Nicaragua share similar characteristics making successful pilot projects easy to replicate.	**High:** living conditions across Nicaraguan households are very similar, making successful pilot projects easy to replicate.	**Middle:** there are up to 40 MW in potential from SHPs that could be developed, solar technologies for hotels and agro-industry has some potential..
(G2) Potential in beneficiaries	**High:** 4.8 M people in Nicaragua connected to the national grid that could benefit from lower rates.	**High:** 1.2 M people lack access and 900,000 are not being considered in current plans.	**High:** +1M people cook using inadequate stoves. Also	**Middle:** around 200,000 people are estimated to live in areas with potential for SHPs, many producers could improve firewood use efficiency. Some 100 companies could benefit from solar heaters. According to the agricultural census (CENAGRO IV) of 262,546 surveyed producers only 4.42% (equivalent to 11,599 producers) had an irrigation system.
(G3) Role of the market barriers	**High:** the risk in the exploration phase is a strong market barrier that holds back this sector's development.	**High:** projects' low commercial profitability is a strong market barrier.	**Middle:** The population's lack of awareness hinders fast adoption of improved stoves.	**High:** low commercial profitability due to lack of adapted legal framework and poor quality of service in rural distribution grids constitute strong market barriers. The distance and lack of basic infrastructure in isolated areas elevate PV and efficient firewood project costs and worsen the barrier.
(G4) Promotion of a low-emission development	**High:** up to 500 clean GWh per year in the medium-term (see MEM, 2013) and +10,000 GWh per year in total (see **Table 5**).	**Middle:** the impact of 15 MW of small-scale PV projects will produce less than 30 clean GWh per year.	**Middle:** adopting 400,000 improved stoves would allow a 30% reduction in emissions. But the greatest challenge is to use only sustainably harvested firewood.	**Middle:** cutting 40 MW of GHG emissions through SHP projects would produce a maximum of 170 clean GWh per year. Introducing efficient kilns in rural SMEs would allow a 30% reduction in emissions.

(G5) Strategic relevance and social inclusion	**High:** today, only a small fraction of the energy generated by renewable sources is base-load generation and provides firm capacity. Geothermal power has this potential.	**High:** universal access to electricity is a key pillar of Nicaragua's development (see Government of Nicaragua, 2012).	**High:** universal access to modern cooking means is a fundamental axis of Nicaragua's energy strategy (see MEM, 2011). The poorest populations are the most vulnerable.	**Middle:** SHPs built in other countries have proven their adaptability to local conditions and have contributed positively to local development (Practical Action, 2012). Thermal use of solar energy represents a new technology, which has a market niche in Nicaragua.
(G6) Contribution to leveraging new investment	**High:** given the reliance on private concessions for natural resource based generation, facilitating geothermal investment will have a strong leveraging effect on the private sector. Other International Cooperation actors are also interested in supporting this field.	**Middle:** favorable conditions for the creation and expansion of ESCOs devoted to PV in rural areas would allow private co-financing. Other International Cooperation actors are also interested in supporting this area.	**Middle:** increasing awareness and creating favorable conditions for the massive dissemination of improved cookstoves and efficient kilns for SMEs will create an important market. Other International Cooperation actors are also interested in supporting this activity.	**Middle:** creating favorable conditions for the construction of SHPs in rural areas has the potential to attract private co-financing – including the very beneficiaries in the community. Generating favorable conditions for the dissemination of solar collectors in urban shops and solar PV for pumping in the agricultural sector has the potential to attract private and users' co-financing.
(G7) Synergy with existing programs and minimizing duplication	**High:** the development of geothermal power is a central axis of Nicaragua's Indicative Generation Expansion Plan. It is in line with the support program of the World Bank/IFC and IDB, with IRENA and there is no duplication of any existing program.	**High:** The expansion of electrical coverage is planned and implemented from PLANER. PV rural electrification projects do not duplicate other programs and are not entirely financed.	**High:** the promotion of improved cookstoves and efficient kilns was planned in the pre-investment and investment projects of the ENLCV. These programs are not fully funded and require SREP's support. The World Bank supports the regional initiative for improved cookstoves (CACCI).	**High:** building SHPs in rural areas is planned from PLANER. It does not duplicate other programs and is not entirely financed. Solar collector projects in urban shops are part of Nicaragua's Action Plan SE4All, in line with PNESER's pilot projects. They have not yet been funded.
(G8) Sustainability	**High:** geothermal projects will provide a service affordable for grid's users.	**Middle:** Generally speaking, rural electrification projects require cross-subsidies to be sustainable.	**Low:** The support of the GON and of the Cooperation is required to fund campaigns and donations. In the long-term, value chains with private sector participation are feasible.	**Middle:** isolated SHPs require the support of the GON and of the Cooperation to finance their debt in favorable conditions, and tariffs adapted to rural areas. The private sector can almost entirely fund the development of this market niche.

Table 9: Assessment of SREP Program's investment options

RANKING PROJECT ALTERNATIVES

The following ratings have been used to classify the expected impact of each option: High = 3, Middle = 2, Low = 1.

Therefore, the resulting order of priority of the submitted projects is the one presented in Table 10:

Project alternative	Total Scores
1. Geothermal power	24
2. Rural Electrification with PV	22
3. Access to improved cookstoves	19
4. Renewable Energy for Productive Uses	18

Table 10: Prioritized investment alternatives for SREP Program

As detailed in the next section these scores were used to allocate resources to each program taking into consideration their needs and maximizing their impact.

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5. PROGRAM DESCRIPTION

PROGRAM'S GOALS AND COMPONENTS

The goal of PINIC, supported by the Strategic Climate Fund SREP Program is to accompany and strengthen the transformation of Nicaragua's energy matrix and to promote universal access to modern energy services. PINIC will promote the use of not yet exploited geothermal, biomass, solar, and hydroelectric resources, and will leverage resources from the MDBs, International Cooperation and the private sector.

PINIC will contribute to developing technical capabilities -both human and institutional-, trigger a transformational change through pilot projects with the potential to be scaled up and replicated, and create the conditions to introduce sustainable management models involving all the actors of the country's socio-economic development. The projects' main focus is to directly improve the quality of life of the people of Nicaragua, seeking social and environmental side-benefits. The goal is to help Nicaragua's current efforts towards a renewable energy matrix with universal access in a manner that could be replicated adapting to the different conditions in each part of the country.

This way PINIC will contribute to the global effort against poverty and climate change, helping bring about a low-carbon, equitable development of the country.

Formulation of the Program and its Components

Taking into account the ranking of the proposed projects presented in Table 10, an effort was made to combine the highest-ranked projects with an estimation of the time required to achieve the transformative impact expected of SREP:

PINIC components and subcomponents	Estimated time to achieve transformative impact
1) Geothermal power	Long-term (> 10 years)
2) Integral development of rural areas	
Rural Electrification with PV	Short-term: 1 to 5 years
Access to improved cookstoves	Short-term: 1 to 5 years
Renewable Energy for productive uses	Medium-term: 1 to 10 years

To overcome some of the barriers to Nicaragua's renewable energy development described in the preceding section, the GoN –having consulted with the interested parties, including private organizations and civil society- has identified the following two components and respective subcomponents to constitute the PINIC – to be considered by the SREP Program for funding – that comply with the investment criteria mentioned and combine the options prioritized in the preceding paragraph:

(1) Component #1: Nicaragua' geothermal energy development (U$22.5 million)

Component #1 will propose an action plan for selected priority projects, and financial mechanisms/instruments to speed-up mobilization of the large investments required to unlock the geothermal sector in Nicaragua. The main goals of this component are:

- Confirm the geothermal resource in two promising sites for which ample information is already available:
    a. Casita-San Cristóbal with production wells
    b. the most promising field to be chosen among Volcán Cosigüina, Volcán Mombacho and Caldera de Apoyo.
- Gather further information about the geothermal potential of three less studied sites:
    c. Caldera de Masaya via 3G surface studies and slim-holes, and technical assistance.
    d. Volcán Mombacho and Caldera de Apoyo – which currently have superficial 3G studies underway – with slim-holes and technical assistance.

(2) Component #2: Integral development of rural areas (U$7.5 millions)

Component #2 will support with UD$7.5 million the provision of energy services to isolated areas by means of rural electrification and the promotion of renewable energies for productive uses, with the following subcomponents:

<u>Universal access:</u>

- 2A: Financing of PV systems for rural electrification.
- 2B: Adoption and transfer of improved cookstoves for use by households.

<u>Productive uses and transmission:</u>

- 2C: Promotion of renewable energy for productive uses both in communities and in small and medium enterprises (SHPs, better use of firewood in productive processes, biogas and PV or thermal uses of solar energy).
- 2D: Improvement of the electric transmission infrastructure to interconnect generation units from existing and future renewable sources.

COMPONENT #1: DEVELOPMENT OF NICARAGUA'S GEOTHERMAL ENERGY

Approach of Component #1

Geothermal energy is a reliable renewable energy alternative to complement the expansion of hydroelectric generation and support GoN's development goals. Geothermal generation has a lower levelized cost than fossil fuel based power plants (see Annex (8). Unlike other renewable sources which tend to be intermittent –such as wind, solar, and run-of-river hydroelectricity- geothermal power provides firm capacity, and can therefore supply non-polluting renewable base-load generation, which is still not abundant in Nicaragua.

The challenge to mobilize private investment towards this sector arises from the uncertainty surrounding the availability of a sufficient geothermal resource, its long-term durability, and the cost of extracting steam with sufficient quality for power generation. There is a considerable degree of uncertainty in the initial exploration stages in a geothermal field. Therefore, two complementary subcomponents are proposed to face this barrier: surface studies and slim-holes in sites with limited information, and resource confirmation in sites with advanced exploration. The role of the public sector to provide incentives to developers and to catalyze investment during the initial stages of development has proven to be critical for successful geothermal expansion (World Bank, 2014a, page 17).

Investments to confirm resources in fields where preparation is advanced

The first subcomponent aims to spend US$17.75 million of SREP funds to confirm the geothermal resource in at least two promising sites that already have ample information:

- Casita-San Cristobál: full-size production wells (commercial)
- The most promising site among Volcán Cosigüina, Volcán Mombacho and Caldera de Apoyo: production wells (commercial).

Surface reconnaissance to advance geothermal sites with limited information

The second subcomponent has the longer-term goal of preparing the energy future of Nicaragua, supporting the surface recognition work and scientific studies that can advance the development of three promising geothermal sites with no characterization yet. The information currently available for these sites is limited. According to the World Bank, (World Bank, 2014a, p17), it would be beneficial to conduct geological, geophysical and geochemical studies satisfying industry standards.

PINIC proposes to assign a portion of the support offered to Nicaragua to a Fund for the direct financing of geothermal surface studies. In addition, PINIC will support the strengthening of the capacities of ENEL (geochemistry and geology laboratories) for the implementation of this subcomponent.

It is proposed to spend US $4.75 million of SREP grant funds for feasibility studies, technical assistance and to develop surface studies and improve knowledge of the geothermal potential of three less studied sites:

- Volcán Mombacho: slim-holes based on the conclusions of the ongoing 3G surface studies
- Caldera de Apoyo: slim-holes based on the conclusions of the ongoing 3G surface studies
- Caldera de Masaya: 3G surface studies.

Expected Outcome for Component #1

- To start a program of geothermal energy development –which has recently seen a limited expansion—, and allow the sector's progressive growth. The program seeks to contribute to an initial expansion of approximately 60 MW in Phase I that would enable some of these fields to go through a second quick-expansion phase of up to an additional 150 MW.
- To show innovation in the design and structuring of public-private schemes for the implementation of a shared-cost risk-mitigation scheme, in the geothermal power sector. Its successful implementation could serve as a model to be replicated in other countries in the region that are facing similar slow-exploration challenges regarding geothermal resources. This will allow future projects to access new international sources like the GDF -LAC or the GCF.
- To build a solid project portfolio in line with the industry's practices, following international standards which would help attract qualified developers with high technical and financial capabilities to mobilize investments needed to fully develop the country's geothermal potential.
- To support Nicaragua's permanent efforts to develop renewable energies and draw away from fossil fuels. More use of geothermal power would directly mitigate GHG emissions and also bring about local environmental benefits. Just as important, it will provide the necessary base-load to integrate intermittent renewable resources without destabilizing the grid, improving the power supply's reliability.
- Diversifying the country's power matrix, which will enable long-term rate reduction and stability. This will improve the investment climate and boost companies' competitiveness while also improving the quality of life of residential end-users. Adding reliable base-load capacity will also help the grid's expansion so the access to modern electricity can be provided progressively to a larger percentage of the population, rising people's quality of life and reducing extreme poverty.

Management and Implementation Framework

Nicaragua is one of the few countries in the world to have an integral geothermal master plan that identifies and details twelve areas of geothermal development, and -based on available information - the potential generation capacity of each site. This information is the basis for establishing priorities and to guide developers.

In addition, there is a geothermal law that provides specific legal security to developers, and a framework to supervise the sector's development. MEM, ENEL and ENATREL, represent the public sector in the work with developers to satisfy energy needs, and meet national development goals.

This component will reinforce the qualifications of public authorities, together with the Program for the Development of Human Resources in the Geothermal Sector with the support of the IDB, NDF, IRENA and the Government of El Salvador through LaGeo -El Salvador's geothermal power generating company-, as well as with the GGDP[17], which proposes a global coordination of activities.

Gender

For the integration of gender in this component, the SREP Nicaragua team will work during the project design and implementation phases on the following: consultations, job creation and loss of livelihood. It will also analyze how women can be encouraged to more actively pursue technical careers and studies that would allow them to work in the geothermal sector. It will also support a horizontal link between components 1 and 2 to strengthen the institutions responsible for SREP coordination and to obtain indicators on gender and renewable energy. (See Annex (5) for details).

COMPONENT #2: INTEGRAL DEVELOPMENT OF RURAL AREAS

Approach of Component #2

Despite the enormous progress towards increasing access to modern energy services (electricity and liquid fuels), over 1.2 million people continue to lack access to electricity[18], especially in rural areas (ENATREL, 2014) and over 400,000 households cook using firewood in open stoves.

Access to electricity focusing on rural areas offers an opportunity to deploy isolated PV systems (both home systems or in mini-grids). To popularize the use of off-grid solar systems, the public and private sectors must collaborate closely and work with the local communities. By integrating the private actors in the design, planning and implementation of rural electrification, the chances of success increase.

Access to modern cooking technologies and the development of a sustainable value chain for firewood requires coordinated action: generating awareness in target populations to enable users' appropriation of such technologies, introducing appropriate business models to ensure massive diffusion of improved stoves, and adapting the legal framework on firewood and charcoal use.

In addition, the use of renewable energy technologies for productive uses can help the socio-economic development of many isolated areas in the country. Small hydro plants, solar PV or solar thermal systems, efficient stoves, or biodigesters can be promoted depending on the local potential identified and on the possibility of one day achieving grid connection.

Lastly, power transmission infrastructure is today insufficient to connect some of the existing generation units using renewable resources, as well as future ones to be developed in the northeastern and eastern regions of the country.

Therefore, the four following complementary subcomponents are being proposed in order to close the access gaps and attain full development of underserved rural areas: financing PV systems with the promotion of specialized ESCOs for rural electrification, promoting improved cookstoves for households throughout the country, promoting the use of renewable technologies for productive

[17] Global Geothermal Development Plan

[18] According to ENATREL, coverage reached 80% of the country

uses, and reinforcing transmission infrastructure to connect existing and future renewable power generation capacities.

2A - Financing photovoltaic (PV) solar systems for rural electrification

The areas with least coverage comprise municipalities that typically present extreme poverty, low HDI rates, and the lowest income per capita in the entire country. There are in those municipalities small urban centers served from small distribution grids. Yet, most people still live in rural communities comprising anywhere from tens to a few hundred houses very distant from one another. In this context, several alternatives exist to provide renewable energy through solar PV systems. This requires feasibility studies in order to move forward with the following options:

1) Rural electrification projects using home PV systems to supply energy to remote communities and dispersed households.
2) Rural electrification projects using distribution mini-grids and hybrid generation systems, diesel-solar PV (SREP would only support the PV element).

SREP support is requested to start with solar home systems in 18 communities in the municipality of Waspam, specifically in the areas near the banks of the Coco River upstream of the town of Waspam. Because of the difficult access, long distance from the grid and other socio-economic conditions, the recommended solution is the use of home photovoltaic systems.

This can be complemented by directly financing a community pilot project, such as the proposed community solar plant in the Gracias a Dios Cape, on the Caribbean coast, close to the border with Honduras, which could be replicated in other communities if deemed successful.

SREP also will make it possible to open a market for private actors (ESCOs) that can install and maintain projects that meet the goals of a durable and reliable public service and satisfy the Program's criteria.

US$2.8 million are to be set aside for this subcomponent, which will include technical assistance support to develop capacity building, engage community stakeholders, train potential ESCOs and beneficiaries.

2B - Adoption and transfer of improved cookstoves for use by households.

PINIC shall dedicate a part of the resources destined to Nicaragua to directly finance projects to promote improved cookstoves and raise awareness about their use, as the National Firewood and Charcoal Strategy proposes in its Action Plan.

Concerning cooking, the models of improved cookstoves that are mostly distributed in Central America can be grouped into two: those built *in situ* within the house, and those manufactured in series. Each of these has its peculiarities and presents both advantages and disadvantages. Generally, those manufactured in series have better quality control. Supply has to be increased, so that families can choose the stove that better suits their needs, preferences and taste.

Experience in firewood-stove programs in Central America is limited to local initiatives financed by local governments, international institutions, or regional agencies – implemented by Civil Society, individuals and even religious groups. Most of these projects have been carried out without sufficient base studies, information on technology, and a complete lack of control and follow-up of the technology and its adoption.

Due to this situation, SREP resources will be utilized to structure a larger program for 400,000 stoves on a national level. SREP resources will be used for assessing the feasibility and dimensioning such a program, and to start with a pilot phase of this program by means of full or partial financing of the distribution of 5,000 to 8,000 improved stoves. Climate financing schemes and payment by results models will be explored in order to ensure maximum scale up of the program at a national level.

US$1.2 million are destined to this subcomponent.

2C - Renewable Energy for Productive Uses

PINIC will promote a program to develop renewable technologies in communities, and promote productive uses of energy in SMEs in rural areas. SREP will support direct financing of renewable energy projects, as well as studies to accelerate the deployment of adequate technologies.

PINIC will support the carrying out of studies and will provide mechanisms for the dissemination of renewable energy technologies such as small hydro plants, PV systems, biodigesters and efficient kilns. The following is specifically proposed:

- Feasibility studies for small hydro power plants
- Feasibility studies and diagnostics to dimension and select efficient kiln models
- Determination of the base-line and market potential for renewable energy technologies for productive uses in the rural sector of Nicaragua
- Implementation of pilot projects for productive uses in the rural sector of Nicaragua with full or partial financing of efficient kilns in SMEs (about 250 SMEs)
- Creation of a specialized financing line for organizations and producers, which could include non-reimbursable funds for pilot projects.

US$3.5 million are to be destined to this subcomponent, which will include technical assistance support to develop capacity building, engage community stakeholders, train beneficiaries and disseminate knowledge.

2D - Improvement of electricity transmission infrastructure

The plan to reinforce electrical transmission infrastructure in the northeastern and eastern regions of the country contemplates building 102 km of transmission lines and four substations by 2020:

- Construction of the Waslala substation (El Cuá), 48.3 km of single-circuit line, and related works
- Construction of the Santa Clara substation and 47.3 km of 138-kV line (Ocotal-Santa Clara).
- Construction of the 138-kV Jinotega substation, and 6 km of 138-kV double-circuit line, from Jinotega-Intersección to the line Planta Centroamérica-Sébaco.
- Construction of the 138-kV Corinto substation, and 0.5 km of double-circuit line.

No SREP funds are required for this subcomponent.

Expected Outcome for Component #2

- Improved quality of life for men and women in rural areas and a reduction of extreme poverty, with improved human development indicators, socio-economic, health and environmental indicators in the country's most vulnerable areas.

- Increased access to modern electricity service in several departments of Nicaragua, from isolated power generation systems based on renewable sources, with the possibility of combining several of them in mini-grids in appropriate sites.
- A boost to the National Firewood and Charcoal Program 2015-2022.
- Feasible business models selected and pilot projects implemented, leading to the definition of a safe path adapted to the conditions of each region to attain real universal access. A tested regulatory framework with tariffs that assure equitable access to electricity, possibly including cross-subsidies between users connected to the main grid and users served from isolated systems.
- Use of renewable energy technologies by SMEs in rural areas through better financing options, making these investments profitable and sustainable. Improved environment for investments and improved competitiveness of businesses.
- Greater development of renewable energy from the communities, with reduced GHG emissions and local environmental benefits.

Management and Implementation Framework

Concerning universal access, the GoN is putting together an Action Plan known as "Sustainable Energy for All 2030", which includes drafting a National Strategy for Universal Access. MEM, ENEL and ENATREL have a clear mandate to implement it, in coordination with municipal governments and the private sector.

Regarding electrification, the planning and execution mechanism is PLANER. The goal is to reach over 100,000 households (15% of the country's total population) over the course of the next 10 years. The plan will require a yearly update.

For thermal uses, the planning mechanisms are the National Firewood and Charcoal Strategy and the National Firewood and Charcoal Action Plan (2015-2022).

Gender

This component will incorporate the gender perspective in project design and implementation through consultations, job creation and self-employment, women's role in tariff negotiations, financing, and decision-making bodies. It will also support a horizontal link between components 1 and 2 that will allow the strengthening of the institutions responsible for SREP coordination, as well as obtaining indicators on gender and renewable energy. (See Annex (5) for details).

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6. INVESTMENT PLAN AND INSTRUMENTS

Table 12 below shows a financing plan for PINIC's investment proposals, including the two main components— the participation of the Nicaraguan Government and of additional funds expected from the multilateral development banks, other development associates, and the private sector. The total cost of the interventions is estimated at US$325 million in the first phase and at US$515 including the second phase, with the latter including support from the (GCF). SREP funds will help leverage additional financial resources from the multilateral lending agencies, other development associates –including their commercial loans windows—, and the private sector in a 1/10 ratio, not counting the GCF support. Table 12 includes funds directly associated with the projects to be supported by the program, but does not include the leverage of potential private sector funds that could be invested after these projects are completed.

The initial allocation requested from SREP is US$30 million. This allocation would support (i) development of geothermal resources (US$22.5 million) in collaboration with other development partners and (ii) integral development of rural areas (US$7.5 million). The total amount expected to be requested from the GCF to expand the projects proposed to SREP is US$190 million.

The portion of SREP donated funds amounts to US$16.5 million (or 55%), and the portion that is reimbursable to US$13.5 million (or 45%).

Components / Sub-components	PINIC - Funding (millions of US$)															
	PHASE 1											PHASE 2				
	SREP-IDB		SREP-World Bank		GoN	IDB	WB/ IDA	JICA	Private sector	GCF	TOTAL PHASE 1	GCF and other sources	IDB	WB	TOTAL PHASE 2	GRAND TOTAL
	Grants	Loans[a]	Grants	Loans[a]												
0) Project elaboration	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	**0.30**
1) Geothermal Development	0.75	6.75	8.25	6.75	0.00	20.00	30.00	20.00	70.00	15.00	177.50	100.00	0.00	0.00	100.00	**277.50**
2) Development of rural areas	7.50	0.00	0.00	0.00	25.20	45.00	0.00	40.00	0.00	30.00	147.70	50.00	40.00	0.00	90.00	**237.70**
TOTAL	**8.25**	**6.75**	**8.25**	**6.75**	**25.20**	**65.30**	**30.00**	**60.00**	**70.00**	**45.00**	**325.50**	**150.00**	**40.00**	**0.00**	**190.00**	**515.50**

[a] It may be in the form of contingent resources, ie refundable in case that the exploration is successful
[b] Green Climate Fund (RFP planned for 2015)

Table 11: Summary of Investment Plan

The financing modalities for the projects submitted to SREP will include a combination of grants, soft loans, contingency grants and possibly guarantees. The modalities will be defined at the time of appraisal in accordance with SREP's guidelines. The decision will take into account, among other things: the specific barriers to the renewable energy technology being considered, the country's debt situation, and possible income generation, as well as the financial rate of return on investment.

PINIC Components / Subcomponents	SREP	PINIC - Funding (millions of US$)															
		PHASE 1											PHASE 2				
		SREP-IDB		SREP-World Bank		GoN [b]	IDB	WB/ IDA	JICA	Private sector	GCF [c]	TOTAL PHASE 1	GCF and other sources	IDB	WB	TOTAL PHASE 2	GRAND TOTAL
		Grants	Loans [a]	Grants	Loans [a]												
SREP project preparation							**0.30**					**0.30**				**0.00**	**0.30**
Component #1: Scale-up Nicaragua's Geothermal Power Development																	
Surface studies and slimholes (Resource identification)	4.00	0.75	3.25					15.00		3.00		22.00				0.00	**22.00**
Production wells (Resource confirmation)	17.25		3.50	7.00	6.75		20.00	15.00	20.00	22.00		94.25				0.00	**94.25**
Feasibility studies	0.50			0.50								0.50				0.00	**0.50**
Investment	0.00									45.00	15.00	60.00	100.00			100.00	**160.00**
Technical assistance	0.75	0.00		0.75								0.75				0.00	**0.75**
Subtotal Component #1	**22.50**	**0.75**	**6.75**	**8.25**	**6.75**	**0.00**	**20.00**	**30.00**	**20.00**	**70.00**	**15.00**	**177.50**	**100.00**			**100.00**	**277.50**
Component #2: Integral development of rural areas																	
2A Financing photovoltaic (PV) solar systems for rural electrification	**2.80**	**2.80**	**0.00**	**0.00**	**0.00**	**13.00**	**0.00**	**0.00**	**0.00**	**0.00**	**10.00**	**25.80**	**10.00**	**10.00**	**0.00**	**20.00**	**45.80**
Feasibility studies for solar PV and hybrid plants	0.50	0.50										0.50				0.00	**0.50**
Solar home systems for 18 communities of the Waspam municipality (Río Coco)	1.50	1.50				13.00					10.00	24.50	10.00	10.00		20.00	**44.50**
Off-grid solar plant for the Cabo Gracias a Dios community (160 households)	0.30	0.30										0.30					**0.30**
Technical assistance	0.50	0.50										0.50				0.00	**0.50**
2B Adoption and transfer of improved cookstoves for use by households	**1.20**	**1.20**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**10.00**	**11.20**	**5.00**	**10.00**	**0.00**	**15.00**	**26.20**
Viability studies and diagnosis for sizing and selection of improved cookstove models	0.20	0.20									0.50	0.70				0.00	**0.70**
Total or partial financing of improved cookstoves (5,000 to 8,000)	1.00	1.00									9.50	10.50	5.00	10.00		15.00	**25.50**
2C Renewable energy for productive uses	**3.50**	**3.50**	**0.00**	**0.00**	**0.00**	**12.20**	**5.00**	**0.00**	**40.00**	**0.00**	**10.00**	**70.70**	**35.00**	**0.00**	**0.00**	**35.00**	**105.70**
Feasibility studies and final design of the Auas Tigni and El Tortuguero MHPs	1.00	1.00										1.00				0.00	**1.00**
Viability studies and diagnosis for sizing and selection of efficient stove models	0.20	0.20										0.20					**0.20**
Total or partial financing of efficient stoves for SMEs (≈250 SMEs)	0.80	0.80										0.80					**0.80**
Financing of other efficient technologies for SMEs (biodigesters, productive uses of PV, and irrigation systems)	0.00	0.00					5.00					5.00					**5.00**
Partial financing for the construction of SHP Salto Labú and Salto Putunka (RAAN)	1.00	1.00				12.20					8.10	21.30					**21.30**
Financing for the construction of SHPs									40.00		1.90	41.90	35.00			35.00	**76.90**
Technical assistance	0.50	0.50										0.50					**0.50**
2D Transmission infrastructure reinforcement	**0.00**	**0.00**					**40.00**					**40.00**	**0.00**	**20.00**		**20.00**	**60.00**
Subtotal Component #2	**7.50**	**7.50**	**0.00**	**0.00**	**0.00**	**25.20**	**45.00**	**0.00**	**40.00**	**0.00**	**30.00**	**147.70**	**50.00**	**40.00**	**0.00**	**90.00**	**237.70**
TOTAL	**30.00**	**8.25**	**6.75**	**8.25**	**6.75**	**25.20**	**65.30**	**30.00**	**60.00**	**70.00**	**45.00**	**325.50**	**150.00**	**40.00**	**0.00**	**190.00**	**515.50**
Subtotal SREP grants	16.50	55%															
Subtotal SREP loans	13.50	45%															

Table 12: Nicaragua Investment Plan (PINIC)

7. PROGRAMMATIC COHERENCE

SREP's Nicaragua Investment Plan (PINIC) provides opportunities to fight energy poverty, contribute to greater equality, improve social stability, accelerate economic growth, and guarantee job creation through enhancement of the country's competitiveness.

PINIC's two components seek to bridge the Nicaraguan population's energy gap and are in line with the energy strategy launched in 2007 by the government which aims to increase energy generation supply from renewable sources and to change the generation matrix and to develop rural electrification. The following strategies, programs and initiatives adopted by Nicaragua are a proof of this fact.

SICA 2020 STRATEGY

The "Central American sustainable energy strategy 2020" approved by Energy ministers in late 2007 and later by the SICA Presidents (ECLAC, 2007) is a major point of reference in the region. Its purpose is to establish clear guidelines for the sector's sustainable development. For its design, prospective studies were conducted that considered, among other factors, the energy sources available on a global scale, the international commitments of the Johannesburg World Summit on Sustainable Development, the sustainability of the sector, the socio-economic situation, the extant energy system, GHG emissions, and the region's institutional environment.

This strategy provides a common vision on development and energy integration for the countries and sets up goals to:

- (1) Reduce dependence on hydrocarbons;
- (2) Increase the participation of renewable sources;
- (3) Reduce GHG emissions;
- (4) Increase electricity coverage and
- (5) Increase the efficiency of energy's supply and demand.

SE4ALL NATIONAL ACTION PLAN

The Sustainable Energy for All Initiative (SE4All) was launched by the United Nations Secretariat in 2012, which was declared "Year of the Sustainable Energy for All." SE4All aims to improve living conditions based on three pillars:

- (1) Pillar N°1: universal access to modern energy services;
- (2) Pillar N°2: doubling the rate of improvements in energy efficiency in the different sectors of the economy; and
- (3) Pillar N°3: doubling the use of renewable energies in the global matrix.

In order to help drive the SE4All initiative forward in Nicaragua, the same four stages implemented in other countries were proposed:

- Rapid Assessment and Gap Analysis (RAGA), conducted by Nicaragua in June 2013)
- National Action Plan (launched by Nicaragua in November 2013)

- Implementation (ongoing)
- Monitoring and Evaluation.

The Inter-American Development Bank (IDB) and the United Nations Development Program (UNDP) support the implementation of this initiative in Latin America, and in particular in Nicaragua, which joined SE4All in 2013 and is represented by the Ministry of Mines and Energy (MEM). Based on the four sequential stages, MEM, in collaboration with the UNDP and the IADB, conducted a Rapid Assessment and Gap Analysis of Nicaragua's Energy Sector" in 2012-2013. Then, in coordination with IRENA and a "Core Team" that included MEM, ENATREL, and the other SE4All players mentioned above, the SE4LL-Nicaragua National Action Plan was launched on Nov. 25, 2013. In it, the RAGA results and a preliminary roadmap for a National Action Plan were presented. The same team formed the SREP Technical Committee for the elaboration of PINIC.

RRA PROCESS WITH IRENA

In 2013, the Government of Nicaragua requested the International Renewable Energy Agency (IRENA) to support the country's Renewable Readiness Assessment (RRA). This assessment is part of the SE4All initiative. Nicaragua proposed that the RRA process of IRENA –the referral agency on technical matters for Pillar No. 3, (doubling the use of renewable energies in the global energy matrix) of SE4All be considered the main planning mechanism of that Pillar.

Nicaragua's RRA initial planning process recommended a short-term (2020) Action Plan in order to take advantage of the following opportunities:

- (1) Evolution of the public policies framework
- (2) Greater Access to modern energy services (contemplated in PINIC)
- (3) Promotion of small hydro power plants (contemplated in PINIC)
- (4) Stakeholders capacity building (contemplated in PINIC)
- (5) Expansion and reinforcement of the network infrastructure (contemplated in PINIC)
- (6) Promotion of geothermal energy (contemplated in PINIC)
- (7) Promotion of wind energy
- (8) Harnessing biomass potential (contemplated in PINIC)

PNESER PROGRAM

A number of bilateral and multilateral organizations led by the Inter-American Development Bank (IDB) has decided to help the authorities execute the National Sustainable Electrification and Renewable Energy program (PNESER, after its Spanish initials), officially launched in 2011. Below is a list of the program's components and their corresponding investment:

- (1) Component 1 – Rural Electrification through Network Extensions (US$106.0 million).
- (2) Component 2 – Normalization of electricity service to irregular settlements (US$42.3 million).

- (3) Component 3 – Service Expansion in Isolated Areas using Renewable Energy (US$16.5 million).
- (4) Component 4 – Pre-investment and Project Studies for Renewable Generation (US$19.1 million).
- (5) Component 5 – Energy Efficiency Programs (US$20 million).
- (6) Component 6 – Transmission System Reinforcement (US$161.8 million).
- (7) Component 7 – Improvement of the Sustainability of ENEL's Isolated Systems (US$9 million).

GACC

The Global Alliance for Clean Cookstoves (GACC) is a UN Foundation initiative that brings together public and private sectors in order to save lives, improve the quality of life, empower women, and fight climate change through a vibrant global market that will develop clean and efficient solutions for household cooking. The "100 by '20" Alliance calls for 100 million households to adopt clean and efficient cookstoves and fuels by the year 2020. This effort, when launched, will expand the work initiated by PINIC.

CACCI

The goal of the Central America Clean Cooking Initiative (CACCI) is to support clean cookstove solutions in Guatemala, Honduras, Nicaragua and El Salvador. The activities that will be supported by the World Bank's grant include establishing a roadmap for universal access by 2030. This roadmap will be based on the 2020 regional sustainable energy strategy. This effort, when launched, will expand the work initiated by PINIC.

In sum, PINIC will support measures aligned with Nicaragua's high-level human and economic development goals, to ensure greater access to energy at affordable prices, improve the population's wellbeing and a greater deployment of renewable energy technologies, contributing to the country's energy security and independence, and contributing to the global drive to reduce the human impact on climate.

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8. IMPLEMENTATION AND RISK ANALYSIS

SREP IMPLEMENTATION IN NICARAGUA

Based on their experience in the implementation of nationwide programs, the government of Nicaragua believes its institutions have the capacity to design, monitor and execute the projects proposed in the SREP Program.

For the preparation of this PINIC, a SREP Nicaragua Technical Committee was formed, under the leadership of the Ministry of Finance (MHCP) and MEM, and composed of technical experts from MEM, ENATREL and ENEL. The Focal Point for SREP Nicaragua is Engineer Salvador Mansell, Minister of Energy and Mines and ENATREL's Executive President.

MEM and ENATREL have been in charge of recent rural electrification projects, and have also been executing agencies for several programs funded by multilateral donors. Future projects (financed by SREP, GCF and others) could use to a great extent the PNESER structure -see Annex (4)- now slated for closing in 2017. Government institutions also have ample experience with firewood programs.

Nicaragua also has human skills in solar, geothermal and hydroelectric technologies. The older hydroelectric power plants are under the responsibility of ENEL and its officers have worked at every level of management and in all technical and manual tasks, both in project planning and execution.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PRINCIPLES

The PNDH (2012-2016) and the National Environmental and Climate Change Strategy have shaped a new environmental agenda with an enduring commitment to pursue sustainable human development. Nicaragua's environmental policy is based on technical guiding principles taken from the Political Constitution, the General Environmental and Natural Resources Law, and other common laws, rules and national and international agreements. There are also sectorial policies and specific policies that complement the social and environmental policies' general framework. In particular, the following principles apply for energy projects:

Social principles

The main principles being proposed for projects' social management are decentralization, respect for indigenous peoples, citizen participation, gender, social, and territorial equality, and responsibility.

With regard to decentralization, municipalities must give their approval to electricity generation and transmission projects. Additionally, Law No. 28 grants autonomy to Nicaragua's two Caribbean regions to "participate in deciding the ways in which the region's natural resources will be exploited and their benefits reinvested."

Citizen participation is a guiding principle in the environmental management strengthening process: it is contained in Citizens Participation Law No. 475 mandating people's participation in the formulation of local public policies.

Concerning the rights of indigenous peoples, the Political Constitution establishes in its Article 5 as a principle of the Nicaraguan nation: "…the existence of indigenous peoples, who benefit from the rights, duties and guarantees set out in the Constitution, and in particular those of maintaining and developing their identity and culture, having their own social organization arrangements, and handling their local affairs, as well as maintaining the communal forms of land property and their use and enjoyment."

With regard to gender equality, the participation on equal terms of men and women in all areas of society is considered a necessary condition for sustainable development. Therefore, MEM has created a Gender Unit within the Ministry, which is responsible for coordinating, advising and evaluating the application of gender focus in the energy and mining sector. For more details, please see Annex (3).

Environmental principles

The guiding principles regarding environmental matters are those included in Nicaragua's Political Constitution, Treaties, Pacts and agreements both national and international, and in the General Environmental and Natural Resources Law (No. 217).

For more details, please see (MARENA/LUXDEV, 2013)

MAIN IDENTIFIED RISKS AND MITIGATION MEASURES

Concerning potential risks, Nicaragua has a modern regulatory regime, a well-functioning energy market and institutions, and a good track record in implementing renewable energy projects. Therefore, major risks associated with renewable energy projects that would be financed by SREP are believed to be few. Following are the main risks with their respective mitigation measures.

Risk	Description of the identified risks and mitigation measures	Residual Risk
Institutional risk (related to the legal framework)	The energy sector's institutional risk related to geothermal projects is low because: (i) there is a mature legal framework in place that has remained stable over the past decade with a good performance of private generation projects; (ii) the INE has the authority for independent regulation and has adequate technical capacity; (iii) energy purchase agreements and their adjustments are open to public scrutiny. The institutional capacity of executing agencies, including their ability to manage procurement, financial management, and environmental and social safeguards has been demonstrated in the PNESER project. In those cases where strengthening is required, capacity building will be provided.	**Low**
Technological risk (related to technological complexity)	Geothermal technology is well known and mastered by the global actors in the sector. However, significant investments will be needed to reinforce the national technical skills and experience. This risk is partially mitigated by SREP's technical assistance support. Concerning technologies for productive uses in rural areas, the case of SHPs has to be attended to with caution in order to ensure the quality of project designs and of electromechanical equipment. The technologies for hybrid mini-networks, efficient kilns, biodigesters or solar water heating	**Moderate**

	are proven and less complex to manage. As for PV projects for residential energy supply, the technology is proven. The issue of battery recycling has to be included in project design.	
Environmental risk (related to the projects' environmental impact)	The Ministry of Natural Resources (MARENA) is responsible for issuing environmental permits to any new electricity generation or transmission project and manages the National Environmental Information System (SINIA-MARENA) where information on the state of Nicaragua's environment and natural resources can be found. The various renewable energy projects that have been built have helped the country gain experience in environmental monitoring measures that must be taken into account in project construction and operation. The strengthening of SINIA and of the actors involved in the monitoring and follow-up of environmental mitigation measures would be a way of mitigating environmental risks in the development of renewable energy projects. PINIC's greatest environmental risk lies with geothermal projects that can cause vegetation loss during construction, air pollution due to non-condensable gas emissions (mainly H_2S), dispersion of drilling fluids and geothermal brines at surface during drilling, noise and other physical disturbances to fauna and nearby communities. All these risks are easy to prevent and mitigate through proven technologies of the geothermal industry.	**Low**
Social risk (related to social conflicts)	Most of the proposed geothermal projects are located in sparsely populated areas in dry Pacific zones with little flora. PINIC's global impact on other rural areas will be to deliver electricity to more people and improve service quality, provide solutions for access and for greater productivity. In other words, the project will foster economic growth and more equity, which will mitigate possible conflicts that might arise from disinformation, political ideologies, possible gender inequality, or project developers' lack of commitment.	**Low**
Financial risk (related to the viability of projects and/or the executing agencies)	Nicaragua's electricity sector faces the challenge of historical indebtedness of the country's main distribution company (DISNORTE) due to high-energy losses, as well as the fiscal deficit created by the government subsidies for low-income households. Geothermal development will require much transparency and also the guarantees necessary in order to sign long term power purchase agreements (PPAs). With regard to isolated use, it will be necessary to promote new business models to manage SHPs, hybrid mini-networks, and sustainability of residential photovoltaic systems. Other renewable energy technologies will be disseminated under a scheme of soft loans, which may require more market studies that should be included as part of the SREP support.	**Moderate**

Table 13: List of risks related to SREP, and mitigation measures

9. CAPACITY BUILDING, MONITORING AND EVALUATION

KNOWLEDGE MANAGEMENT AND CAPACITY BUILDING

It is proposed that SREP support current knowledge management systems such as the MEM's Office for Public Information Access, MARENA's SINIA and OLADE's SIEE.

The activities of capacity building and reinforcement of technology management will permit: (i) ensuring that knowledge management processes provide learning opportunities for similar programs within the country and in the region, (ii) improving the enabling framework for renewable energy production and use, and (iii) increasing investment (both public and private) in renewable energy development. These activities can be placed within the framework of the Capacity Building Study "CNA[19], 2014" carried out with IRENA's support.

This will be an important part of SREP in linking the proposed investments with the development of local experience in renewable energy and capacities. In general, the technical assistance support will seek to strengthen governance and institutional capacity, which can help in replicating the projects supported by SREP, whereas technical assistance should contribute to minimize barriers to the incorporation of renewable energy.

The identification of lessons learned should be linked to supervision and to the presentation of reports on projects' results.

MONITORING AND EVALUATION

PINIC projects will be implemented under a complete monitoring and evaluation scheme directed at obtaining, analyzing, processing and communicating key information related to PINIC's activities and projects, as well as their results, impacts, and lessons learned. This will be a key tool for planning and supervising PINIC activities.

PINIC's Monitoring and Evaluation (M&E) system will be integrated within the national system for follow-up and evaluation of the energy sector, which is fed mostly by:

- Primary information on supply and consumption of the National Energy Balance produced by MEM.
- Consolidated electricity statistics by INE.
- Dispatch and price reports produced by the System Operator (CNDC), which is part of ENATREL.
- Statistics on households, access to services, energy use, and consumption patterns, produced by INIDE.
- Monitoring of gender issues by MEM's Gender Unit.
- Information provided by Nicaragua's Renewables Association ("Renewables"), which gathers data on private sector companies and NGOs implementing access programs.

[19] Capacity Needs Assessment.

However, there are limitations, particularly regarding disaggregation of information by gender, data on rural vs. urban access, relation between energy and poverty, quantification of investment and job creation, among others. In particular, it is important to develop a system to measure energy-access taking into account its quality. See (ESMAP, 2014).

In this respect, it is important that SREP provide technical assistance for capacity building within the institutions that manage energy sector related information, in an effort to create reliable and organized systems that meet international norms on M&E information for the energy sector, in particular within the framework of Nicaragua's SE4All 2030 goals.

PINIC's M&E follow up will be executed by permanent national entities rather than temporary ones in order to increase capacity in the long-term in a catalytic manner, following the main indicators shown in Table 14.

Transformative impact			
Results	**Indicators**	**Baseline**	**Targets**
Support low carbon development pathways by reducing energy poverty and/or increasing energy security	Percentage of the populations without access to the grid or to reliable electricity service	20% in 2014 - ENATREL	< 10% in 2030
	Net annual electricity generation from RE (GWh)	1,887 GWh in 2013 (49.7%) - INE	4,809 GWh of a total of 5,344 GWh in 2027 (90%)
	Increase in private investment in RE per year (US$)	$129 million in 2013 - Climatescope	$525 million until 2022.
Results			
1.Increased supply of renewable energy	Annual net electricity generation from Geothermal (GWh)	607 GWh in 2013 - INE	>1,080 GWh in 2022
2.Increased access to modern energy services	Number of women and men, businesses and community services benefiting from improved access to electricity and fuels as a result of SREP interventions	0	In 2022: 200,000 men 200,000 women 2,000 SMEs and community services

Table 14: PINIC Results Framework

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10. ANNEXES

ANNEX (1) NICARAGUA'S ABSORPTIVE CAPACITY ASSESSMENT

CONTEXT AND EVOLUTION OF THE ECONOMY IN 2014

In recent years, Nicaragua has made efforts to maintain a stable macroeconomic policy, anchored in an almost balanced fiscal balance of the central government, moderate inflation and a "crawling peg" or "foretold slip" exchange rate regime. From October 2007 until late 2011, the country participated in a program with the International Monetary Fund (IMF) under the Extended Credit Facility figure. After the program ended, the authorities have continued to implement prudent macroeconomic policies that have strengthened the economy. The IMF and the authorities continue to maintain close collaboration.

After the global recession of 2008 and 2009, the country registered a growth of 4.6% per year from 2010-2013 (3.7% in the last 20 years). A recovery in private consumption and fixed investment increased as favorable terms of trade fueled this growth. Meanwhile, FDI has promoted the increase of total investment, rising from 31.1% of GDP in 2006 to 52.2% in 2014 (estimated). The sectors that have focused greater FDI flows are industry, energy, mining and communications.

While the economy slowed in 2014 compared to 2013, economic growth is expected in the range of 4.0% -4.5%. During the second quarter of 2014, the economy slowed due to seismic activity (April), the higher than expected construction sector contraction and drought, which reduced the annual GDP growth of 5.4% in the first quarter 3.2% in the second. However, the strength in foreign demand, particularly from the exporting industrial activity (free zone, food and mining) and improved terms of trade (due to higher export volumes and the recovery of international prices Main products) maintained a positive growth rate for 2014. The Nicaraguan Central Bank (Spanish acronym BCN) estimated potential growth of 5% in the medium term while the IMF estimated 4%.

The government's fiscal policy continues to show a prudent and balanced handling. In 2013 the central government generated a surplus of 0.1% of GDP while for the closing of 2014 a deficit of 0.4% of GDP is expected, and 0.8% in 2015. This is mainly due to government investment program, focused on sectors of energy, water and sanitation.

The public debt of Nicaragua continues a downward trend. Due to structural factors related to reduced fiscal deficits and strong economic growth and the upward revision of nominal GDP and the increase in the discount rate, the ratio of debt to GDP reached 49.7% in 2013. Public debt has decreased from 61.7% of GDP in 2009 to 49% in late 2014 and is expected to reach 48.2% in 2015.

In 2014, it is expected that the deficit of the external current account will decrease to 10.1% of GDP, although still high compared to international standards. In 2013, the deficit stood at 11.3% of GDP. While Nicaragua exhibits a deficit in trade in goods, is offset by the inflow of FDI and donations. In October 2014, the export performance remained robust, driven by increased demand from major trading partners and recovery in prices of export products, which is reflected in the improvement of the trade balance deficit.

The Government continues to implement prudent macroeconomic policies, prioritizing fiscal discipline and stability of the main monetary and financial variables. This has allowed the strengthening of public finances in the fiscal, external, monetary and financial sectors. The economic outlook in 2014 reflects a balance between robust economic growth, foreign direct investment stable, moderate fiscal deficit and continued access to concessional terms by the external financing.

DEBT SUSTAINABILITY ANALYSIS

Because the debt is subject to concessional terms, a Debt Sustainability Analysis (DSA) was performed under the framework of the IMF and the World Bank for low-income countries (DSF).

The results of the DSA (January 2015) show that the debt is sustainable in the long term. Debt has experienced an improvement in their sustainability since 2007, due to: (i) the upward revision of estimated GDP in 2012 (base 2006); (ii) an increase in the discount rate used in the analysis (from 4% to 5%); (iii) the sustained growth of GDP, and (iv) fiscal discipline. Under the baseline scenario, all indicators of external public debt remain below the thresholds. The projection of the external public debt is robust to the six standard shocks. Similarly, this projection is robust to alternative scenario of reduced concessionality of new loans to the public sector.

The alternative scenario of historical variables could cause the present value of the ratio of debt to GDP to violate the threshold (40%) in 2033. This represents an improvement in terms of sustainability of debt compared to the results obtained in August 2014 where the threshold is violated in 2029. This result may be explained by the gradual improvement that has taken the country in terms of growth and debt reduction following the Heavily Indebted Poor Countries (HIPC) initiative. Also influence the positive results obtained during 2014 in terms of low inflation and decreasing current account deficit given the dynamism of the export sector. With respect to total external debt, note that the present value of the ratio of debt to exports and debt and income would be in an upward trend; however, do not exceed their thresholds within the projection period.[20]

[20] The DSA classifies countries as: (i) "low risk" if all debt indicators are below the thresholds. Alternative scenarios and stress tests do not violate that threshold in any way; (ii) "moderate risk" if the baseline scenario does not exhibit a breach of thresholds, but alternative scenarios and stress tests show a significant increase in the rate of debt service during the projection or a violation of the ratio debt / acquisition (iii); "High risk" if the baseline scenario shows a debt default and / or service charges during the projection period. This is compounded by the violation of thresholds in the alternative scenarios / stress testing; and (iv) "on indebtedness".

ANNEX (2) STAKEHOLDER CONSULTATIONS

To prepare the Nicaraguan SREP Investment Plan (PINIC), identify obstacles and propose solutions that can create a transformative effect on the energy sector, the Nicaragua SREP team has conducted a series of activities, including: (a) An exploratory mission involving the multilateral development banks and government institutions; (b) individual meetings with relevant stakeholders including development partners related to renewable energy, civil society, representatives of international cooperation and project developers; (c) a Joint mission with ample teams from the multilateral development banks and the participation of major stakeholders involved in the renewable energy sector; (d) public comments on the PINIC draft, and (e) continuous interactions with stakeholders, and the energy, private sector and gender teams of the GRUN and MDBs throughout the preparation process.

EXPLORATORY MISSION

An exploratory mission involving multilateral development banks (Inter-American Development Bank, the International Finance Corporation -IFC- and the World Bank) visited Managua, Nicaragua, from 6 to 8 November 2014 to discuss the PINIC preparation process with GoN representatives, civil society, private sector and international organizations.

The overall objective of the mission was to establish an initial contact between national authorities (MHCP, MEM, ENATREL, and ENEL) and multilateral development banks (MDBs) and set general guidelines for the development of the PINIC.

INDIVIDUAL MEETINGS

The PINIC development team held several meetings with representatives of national authorities as part of the SREP team from Nicaragua between December 2014 and March 2015 including MHCP, MEM, ENATREL, ENEL and relevant industry representatives.

These meetings helped identify major obstacles and possible synergies with the programs currently running.

JOINT MISSION

The joint mission of the MDBs to support the SREP program in Nicaragua was held in Managua from 12 to 15 February 2015.

The main objective of the mission was to proceed with the completion of PINIC. The mission included the participation of a diverse MDB team with representatives from the IDB, WB and IFC.

This delegation met for working sessions (workshops) with the SREP technical team of the GoN, consisting of: MEM, ENATREL and ENEL.

Open sessions included several international aid organizations including the: International Cooperation Agency (JICA), the German Cooperation Agency (GIZ / EnDev), the Swiss Cooperation, the Canadian International Development Agency (CIDA), the UN Program for Development (UNDP), the European Union (EU), and private sector organizations (Renewable Energy Association of Nicaragua, the Center for Clean Energy Production, and the Association of Micro-Finance).

These sessions presented PINIC and its scope, with the goal of getting early feedback and to engage other development partners in leveraging the program.

The mission contributed a better view of the barriers to the development of Renewable Energy projects and explored ways of involving the private sector, reviewed the benefits of using efficient stoves, and took note of the challenges of bringing renewable energy-based electricity services to rural populations. Participants also discussed how to contribute further ideas and project suggestions if the PINIC were approved.

PUBLIC CONSULTATION

The public consultation was carried out after the joint mission. A revised PINIC draft was released and distributed to all stakeholders who participated in the meetings and joint mission sessions for public comments from 13 to 27 March 2015 with the support from the GoN.

There were so specific comments to the proposed PINIC. The online questionnaire is attached below.

Formulario de encuesta pública SREP Nicaragua

El objetivo del Plan de Inversión SREP para Nicaragua (PINIC), apoyado por el Programa SREP del Fondo Estratégico para el Clima (CIF), es de acompañar y fortalecer al cambio de la matriz energética de Nicaragua y de promover acceso universal a servicios modernos de energía. Más información sobre la Iniciativa: https://www.climateinvestmentfunds.org

*Obligatoire

Nombre *

Cargo *

Institución *

Sector *

País *

Correo electrónico *

(Opcional) Télefono

Del 13 de marzo al 27 de marzo 2015, el equipo SREP Nicaragua compuesto por BID, Grupo Banco Mundial, el MHCP, el MEM, ENATREL, y ENEL solicitan su retro-alimentación a la Propuesta "PINIC"

Por favor hacernos llegar sus comentarios para que se puedan tomar en cuenta en la versión final a ser sometida al Fondo Estratégico para el Clima (CIF, por sus siglas en inglés). Para descargar el documento, favor hacer click en este enlace: https://drive.google.com/folderview?id=0B_6QO1YPjQRacHk5Wm94OU5heDQ&usp=sharing

Comentario #1

Favor escoger la sección.

Su comentario:

Favor limitarse a 300 palabras. Se pueden incluir enlaces o referencia a documentos.

Comentario #2

Favor escoger la sección.

Su comentario:

Favor limitarse a 300 palabras. Se pueden incluir enlaces o referencia a documentos.

ANNEX (3) CO-BENEFITS AND GENDER

TRANSFORMATIVE CHANGE AND EXPECTED CO-BENEFITS

SREP's support to PINIC and its two main components will contribute to achievable, durable, equitable, inclusive, and measurable social benefits for Nicaraguans, as well as reduce poverty and favor the environment. Nicaragua trails behind the Central American countries on the following indicators: electrification rate and energy intensity and relative poverty (Gross National Income per capita), but the GoN considers that a significant and sustainable progress - hand in hand with economic growth - may be achievable through investments in renewable energy. Beyond the production of clean and renewable energy and the improvements in access to energy services, SREP-funded activities will also bring the following co-benefits to local communities:

Improve Nicaragua's energy security: scaling up geothermal energy supply in the national grid will help reduce the country's dependence on imported fossil fuels and prevent dependence on hydroelectric power, which could potentially become an issue like in neighboring Costa Rica under changing weather patterns. It would diversify the energy supply mix prevailing in the country and thus improve the security of energy supply in the country.

Reduced emissions of Greenhouse Gases (GHG): scaling-up geothermal power and promoting small-scale hydroelectric plants will reduce emissions when they're able to replace HFO and diesel-based generation. It is expected that over 450 MW of geothermal capacity could be developed in the next 10-15 years. SREP investments could potentially unlock up to 15 MW of solar PV projects needed for remote areas and up to 40 MW of identified SHP projects for productive uses.

Forest conservation and reforestation: displacement of biomass fuel consumption by using improved cookstoves and efficient kilns will contribute to conserve forests that in many areas are also serving as water basins for small-scale hydroelectric plants.

Reduced indoor pollution: Improved cookstoves will reduce the consumption of firewood consumed by households in rural areas and dramatically improve the air quality in kitchens and living areas, where women and young children spend many hours per day. These will help reduce respiratory diseases in children and women.

Local economic development: Geothermal development will open up of the areas through infrastructure development such as roads and water. The opportunities for utilization of by-product heat and condensate could support industrial and agricultural activities. The introduction of innovative off-grid heat generation technologies will improve productivity and generate significant energy savings in targeted businesses. The co-benefits of rural electrification are massive, and a key contributor to the social and economic development of the country.

Job creation and income generation: new SHP, which will allow productive uses of energy, will generate revenue and support provision of infrastructure services, such as clean water, health care, and information and communication technology. Maintenance of rural PV systems, biodigesters and solar water heating systems will create jobs along the supply chain. Geothermal energy development will foster the creation of jobs during the construction phase. It is estimated that 0.8 jobs / MW are created and 0.2 during the O&M phase. (Geothermal Institute of New Zealand, 2013).

Increased security: rural electrification, and when possible public lighting in rural mini-grids will enhance security in the areas as a result of the economic activities and social amenities.

Reduced electricity tariffs: geothermal power will displace expensive fossil oil thermal power and thereby save foreign exchange and reduce pass through fuel costs. It is estimated that geothermal has a LCoE between 90-100 $/MWh which is lower than current fossil fuel generation costs.

ECONOMIC AND SOCIAL GENDER CONTEXT

Nicaragua ranks sixth in the Global Gender Gap Report 2014 (WEC, 2014) prepared by the World Economic Forum. This position places it as the Latin American country where women enjoy more equitable access to education and health care, and are more likely to participate fully in political and economic life of the country.

Nicaragua has signed international agreements for the elimination of all forms of discrimination and the eradication of violence against women such as the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the Convention of Belem do Pará. Its Constitution provides equal protection before the law for men and women and a recent law was recently passed to promote equal rights for both sexes.

In the productive sector women represent 36.6% of workers. The wage gap is 19.8% in favor of men. Women hold 40.2% of the seats in the National Assembly and 55.6% of ministerial positions.

Social context

Productive sector. Women constitute 50.6%[21] of Nicaragua's population. There are more women in age to work but only amount for 36.6%[22] of the workforce. However, the increase of women in the workforce has reached up to 64.8%[23] in recent years, while men's participation now reaches 87.4%[24]. The wage gap is 19.8%[25] in favor of men.

Two of each three workingwomen work informally, with low productivity. While only one in two men are in this situation[26].

The interaction between ethnicity and gender is of central importance. Despite the increase in income and participation rates of women in the workforce, indigenous women remain at the lower end of the income distribution, showing the highest levels of poverty and exclusion[27].

Household. 3 of every 10 households are managed by a woman[28]. There are a larger number of households with family management in the city than in rural areas. Single households are mostly lead by widows or women separated from their partner, opposite to men who are mostly in a couple or married.

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[21] INIDE. Estimaciones y Proyecciones de Población Nacional, Departamental y Municipal. Revisión 2007

[22] EMNV 2005

[23] ILO 2013

[24] ILO 2013

[25] EMNV 2005

[26] INIDE, Principales Indicadores de Empleo en Nicaragua, marzo 2008.

[27] BID 2008 Equidad de género en el mercado laboral Nicaragua

[28] Encuesta de Hogares sobre Medición del Nivel de Vida 2009 (EMNV 2009), Nicaragua, mayo 2011.

The male household heads mostly settle in the primary sector with 48.5%, while women belong mainly in the tertiary sector (71.0%). On a national scale, the households headed by men are poorer than households led by women.

Violence against women. Almost 30% of Nicaraguan women have suffered physical or sexual violence from their partner[29]. In 2012, 40 women died in Nicaragua from the violence waged by their partner or ex-partner[30].

Education. The number of men in primary education is higher than women. However, more women (83.4%) than men (77,4%)[31] complete primary school and pursue secondary education.

Political representation. Nicaragua is one of the countries with the highest representation of women in senior government positions. Women hold 40.2% of the seats in the National Assembly and 55.6% of ministerial posts[32].

Energy. There is no data available to indicate the status of women in relation to renewable energy in Nicaragua. The number of women working or studying energy related studies is unknown. There is also no data on the impact of these technologies on women or how they may use them.

There is very limited data on the impact of traditional cookstoves on women's health, nor the precise time they may spend collecting firewood to cook.

Gender legislation

Discrimination. Nicaragua ratified in 1981 the CEDAW. This international convention aims to eliminate all forms of discrimination against women, forcing states to reform laws to ensure gender equality and establishing courts and effective public institutions.

With the signing of CEDAW, the Nicaraguan state contracted a series of legal international obligations that are reflected in its Constitution, adopted in 1986. And they have been embodied in its legal body over the years.

In terms of equal rights and gender equity, Nicaragua's Constitution states in its Articles 4, 5, 27 and 48 the obligation for the State to promote and ensure the human development of all Nicaraguans, the prohibition of any discrimination, equal protection before the law for men and women and their effective participation in the country's political, economic and social life.

In 2008, the Law on Equal Rights and Opportunities was approved which aims to promote and ensure equality between men and women in the enjoyment of human rights, civil, political, economic, social and cultural rights and establish the fundamental mechanisms by which all organs of public administration and other branches of government, regional and municipal governments ensure effective equality between women and men.

In April 2015 the Family Code entered into force, establishing the legal status of the family and its members. For the first time Nicaragua recognized the role of women as heads of households and

[29] PAHO, 2013. http://www.paho.org/hq/index.php?option=com_content&view=article&id=8175%3Aviolence-against-women-latin-america-caribbean-comparative-analysis-population-data-from-12-countries&catid=1505%3Aabout-us&Itemid=1519&lang=en

[30] Cepastal. http://estadisticas.cepal.org/cepalstat/WEB_CEPALSTAT/estadisticasIndicadores.asp?idioma=i

[31] Banco Mundial. 2010. Gender Statistics

[32] Naciones Unidas, 2013. Observatorio de Igualdad de Género de América Latina y el Caribe. Informe Anual 2012

gender equality in providing responsible parenthood. In Nicaragua 40% of households are headed by women[33].

Violence against women. As for protection from violence, Nicaragua ratified the 1995 the Convention on the Prevention, Punishment and Eradication of Violence Against Women "Convention of Belem do Pará". This Convention is one of the major human rights instruments of women aimed at implementing concerted action to prevent, punish and eradicate violence against women, based on gender, while condemning all forms of violence against women perpetrated at home, in the workplace or by the State and/or its agents.

Signing this Convention led to the adoption of the Comprehensive Law Against Violence Against Women in 2012. This law creates for the first time in national law the crime of *femicide* and aims to act against violence perpetrated against women for the purpose of protecting the human rights of women and guarantee a life free of violence; establish comprehensive protection measures to prevent, punish and eradicate violence and assist women victims of violence, promoting changes in social, cultural and patriarchal patterns imposing power relations.

SREP executing Institutions in Nicaragua

The institutions in charge of implementing SREP in Nicaragua (MEM, ENATREL and ENEL) have created gender units and have gender specialists working within their institutions.

The Ministry of Energy and Mines has created Gender Unit in early 2013 in charge of the whole process of design, formulation and development of policies, programs, projects, and responsible, among other duties, to ensure that MEM plans incorporate and implement gender equality measures.

ENATREL has had a gender specialist working with the institution for several years funded by the Government of Nicaragua and the Canadian International Development Agency (CIDA) under the PELNICA Program (Electrification Project Nicaragua). It integrates gender in the design and implementation of ENATREL's projects.

Between 2010 and 2014, a gender strategy for the PERZA program (Development of Off-grid Small Scale Hydropower for Productive Uses) was developed with support from the United Nations Development Program (UNDP Nicaragua) and financial resources of the Government of Nicaragua, Swiss Cooperation in Central America and the Royal Norwegian Embassy. The program included training for officials and implementation of workshops on gender equality (adults and children) in the areas of advocacy, this way promoting the participation of women and men in rural electrification projects driven by the Government of Nicaragua. Also, 40-50% of key positions on the boards of local utilities (ELE) were reserved for women. Technical positions (SHP and distribution lines operation and maintenance) were occupied by women.

[33] Encuesta de Hogares sobre Medición del Nivel de Vida 2009 (EMNV 2009), Nicaragua, mayo 2011

Gender activities transversal to all Components of the IP

As indicated earlier, Nicaragua has no data are available to provide a baseline for gender diagnosis or investigation in the field of renewable energy. This deficiency has hindered the integration of gender factors in the Investment Plan, so that the following activities are recommended:

- Strengthening the institutions in charge of SREP coordination in the design, implementation, monitoring and evaluation of strategies, plans, programs and renewable energy projects for the inclusion of a gender perspective. This could be done by strengthening their gender units, creating a Gender Strategy for the Renewable Energy sector and the implementation of a mechanism for monitoring and tracking where possible to assess achievements and compliance with the proposed medium, short or long term targets.
- Support to other national institutions linked to renewable energies that are working on gender issues as the Integrated Information System for Monitoring and Evaluation of Renewable Energy in Nicaragua (SIMERNIC - http://simernic.renovables.org.ni/), for which the Renewable Association is preparing a review to include identification and formulation of gender indicators. This work is linked with the Advocacy Network for Gender and Energy (RIGE in Spanish)

ANNEX (4) EXISTING RENEWABLE ENERGY ACTIVITIES IN NICARAGUA

PNESER

The seven different components of the PNESER program are as follows:

Component #1 – Rural electrification and grid extension (US$106.0 million).

PNESER's first component will provide access to electricity to 117,390 households in 3,666 communities in rural areas, which are part of the 310,000 homes without electricity out of total of 1,100,000 occupied households.

Component #2 – Service regularization in communities (US$42.3 million).

This component will allow the normalization of 164,000 households located in 648 identified settlements, including improved distribution networks, wiring and meters. Of these 164,000 homes, about 124,000 are listed as customers of distributors and 39,000 are illegal users, but generally all receive poor service due to lack of standardized networks that increase the technical and non-technical losses (theft overloading networks), the lack of investment in networks and energy losses.

Component #3 – Off-grid renewable energy for rural areas (US$16.5 million).

This component includes the development of micro projects and/or small hydro, wind power plants or other RE sources such as PV solar energy, aimed at promoting sustainable development, improving the sustainability of the electricity supply to about 10,000 homes, of the estimated total of 310,000 lacking service in Nicaragua.

Component #4 - Pre-investment studies and Renewable Energy Generation projects (US$19.1 million).

Pre-investment studies and demonstration projects will be funded to enable increased use of renewable energy sources, mainly hydropower, geothermal, biomass, wind and solar. Nicaragua has high potential exploitable (1500 MW geothermal, hydroelectric 2000 MW, 800 MW wind and 200 MW biomass), which is under developed partly due to lack of basic studies. The implementation of this component will contribute to creating the conditions to change the energy mix, currently highly dependent on oil. The component includes RE projects focused on

i) studies and optimization of alternatives,

ii) design of structures and equipment of the selected alternatives,

iii) analysis of economic, financial and environmental and social feasibility of hydropower projects,

iv) installing a solar demonstration project generation connected to SIN, and

v) completion of the geological map and the pre-feasibility study of the Cosigüina Volcano geothermal project. It also includes other investments for wind and solar studies.

Component #5 – Energy efficiency (EE) programs (US$20 million).

This component will support the implementation of EE programs aimed at reducing the power demand and the actual energy consumption in Nicaragua, mainly in cooling and lighting in various sectors of consumption. It includes the following measures:

i) substitution of at least 2 million of incandescent light bulbs with compact fluorescent lamps in the residential sector;

ii) substitution of at least 20,000 magnetic 40 W fluorescent lamps with 32 W electronic lamps in the government sector;

iii) replacement of at least 25,000 mercury lamps by sodium vapor lamps or other efficient lighting technology;

iv) the installation least 13 solar water heating systems in five hospitals, three hotels and five industrial facilities;

v) performing engineering and development for the implementation of solar thermal energy in refrigeration and air conditioning; and

vi) installation of more than 750 solar PV systems for productive uses in Nicaragua.

Component #6 – Rural area transmission system reinforcement (US$161.8 million).

This component will finance the substations and transmission lines required to improve the efficiency of the transmission system, providing a reliable supply to new users and to those who are already connected, and incorporate new sources of ER in the Nicaraguan grid. Initially it has been deemed necessary to build, renovate or expand seven substations, including their transmission lines and other related works, which will be designed to supply loads placed in their areas of influence.

Component #7 – Sustainability of ENEL's mini-grids (US$9 million).

The component includes resources for:

i) "Institutional Strengthening of the agencies managing off-grid systems" that seek to strengthen the managerial and operational capacity of agencies managing mini-grids through acquisition of equipment, goods, consultancies and services that increase the skills and operational capabilities ENEL agencies on the Caribbean coast of Nicaragua;

ii) "Pre-investment studies in off-grid systems", which support the development of pre-investment studies in the area where the potential for developing renewable energy projects that can replace the generation medium term there fossil;

iii) "Investment projects with renewable sources" that support renewable and alternative investments to replace fossil generation in the area of influence of mini-grids.

SE4ALL NICARAGUA COUNTRY ACTION PLAN (2030)

Implementing SE4All in Nicaragua, as in other countries, is done through 4 phases, as follows:

- 1) Perform a Rapid Assessment and Gap Analysis - the RAGA was completed by Nicaragua in June 2013.
- 2) Develop a Country Action Plan (CAP Nicaragua launched in November 2013)
- 3) Implementation (ongoing)
- 4) Monitoring and Evaluation.

The Inter-American Development Bank (IDB) and the United Nations Development Program (UNDP) support the implementation of this initiative in Latin America, particularly in Nicaragua, who joined the Initiative in 2012, being represented by the Ministry of Energy and Mines (MEM).

Based on the four (4) sequential stages, the MEM, in coordination with UNDP and IDB, conducted a "Rapid Assessment and Gap Analysis" of its energy sector in 2012-2013.

Then, in coordination with IRENA and a "Core Team" consisting of MEM, ENATREL and other SE4All actors listed above, Nicaragua launched its Country Action Plan (CAP) on November 25, 2013, in an event which presented the results of the Rapid Assessment (RAGA) and a road map for the preliminary development of the CAP.

In this context, the Renewable Energy Readiness Assessment (RRA) process was adopted as the main planning mechanism for SE4All's Pillar No. 3 (Renewable Energy).

In summary, Nicaragua has adopted the following roadmap:

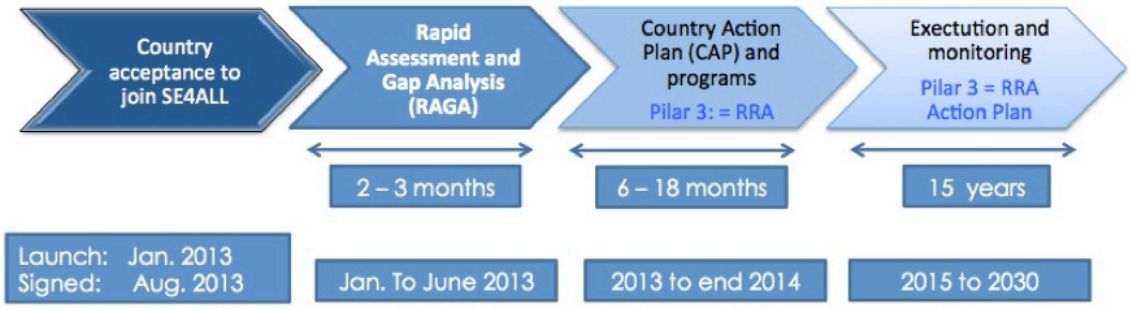


Figure 18: SE4All and RRA roadmap in Nicaragua

RRA (IRENA) PROCESS AND ACTION PLAN (2020)

The government of Nicaragua requested in 2013 the International Renewable Energy Agency (IRENA) to perform a RRA. The RRA process is a comprehensive assessment of the conditions of the situation in the energy sector of a country and identifies the actions needed to overcome the obstacles to the deployment of renewable energy.

The 2020 Action Plan recommends taking advantage of the following opportunities:

- Opportunity 1 / Evolution of the policy framework and reform of the "Promotion of Electricity Generation with Renewable Sources Act" (No. 532)

- Opportunity 2 / Increased access to modern energy services: support the use of solar energy systems for off-grid users
- Opportunity 3 / Promoting SHPs.
- Opportunity 4 / Training and information of actors: to conduct an evaluation of Capacity Needs Assessment (CNA) in coordination with IRENA.
- Opportunity 5 / Expansion and strengthening of the network infrastructure
- Opportunity 6 / Promotion of geothermal energy
- Opportunity 7 / Promotion of wind power
- Opportunity 8 / Tapping the potential of biomass: accelerate modern and sustainable use of biomass sources.

CNA (IRENA)

The CNA process is intended to propose actions to create an enabling environment for the formation of specific technical, legal and financial capacities within the renewable energy industry during 3 phases: 2014-2017, 2018 - 2020 and 2020-2030.

According to a simple methodology developed by IRENA, the study estimated the number of professionals required in the fields of research, engineering and technical careers that would be needed to accompany the change of Nicaragua's energy mix.

ENDEV (GIZ)

The EnDev initiative is supported by GIZ, Dutch NL Agency, Australia. The Energy for Development (EnDev) has the main objective is to provide access to energy for homes, social institutions and small and medium enterprises. Its timeline is open-ended.

4E (GIZ)

The aim of 4E Program is to improve the general conditions, as well as institutional and personal capacities for promoting and implementing renewable energy and energy efficiency projects in Central America, and contribute to mitigate climate change. The focus of the program during the first phase (2010 -2013) was El Salvador, Costa Rica and Honduras. The program launched operations in Nicaragua in 2014.

EEERC / LAIF (KFW)

The Program for Energy Efficiency and Renewable Energy in Central America has been designed to facilitate SME access to funding to carry out investment projects related to the reduction of energy consumption, efficient energy systems and renewable energy technologies.

BID/FOMIN – SNV BIOGAS PROGRAM

The IDB/FOMIN – SNV biogas initiative promotes the emergence of a market for biogas production in Nicaragua, which is recommended to address it in two ways: domestic and productive. It is currently in execution and should end in 2016.

PREPCA (BUN-CA/HIVOS)

The Regional Program on Energy and Poverty in Central America (PREPCA) is part of the Renewable Energy Program for 2011-2015 of HIVOS. It aims at maximizing resources and manage a multi-stakeholder approach and greater integration of energy management in production processes.

ECPA

ECPA began in 2009, and its term is open. In 2012, an initiative led by TWP and PowerMundo was launched to create synergies in learning and combating deforestation, and contributing to the increased use of improved cookstoves in Central America.

ANNEX (5) CONCEPT NOTES BY COMPONENT

COMPONENT #1: DEVELOPMENT OF NICARAGUA'S GEOTHERMAL ENERGY

The objective of this component is to scale-up geothermal power generation development in Nicaragua by addressing key barriers that include the high resource risks, mobilizing qualified developers, and facilitating large scale financing to cover the significant up-front investment costs.

1. Issue description

Nicaragua has experienced steady economic growth of about 4% since 2007, which has resulted in a similar increase in electricity demand. Electricity shortages and blackouts experienced around 2007 have been overcome and are a thing of the past. However, the improved reliability of supply was primarily through the addition of generation capacity operating on imported fuel oil, where the long-term costs are high and unpredictable. While there are indications of an upcoming period of robust economic growth, the country's sub-optimal generation mix could sap this momentum by dragging down productivity and undermining competitiveness. Surveys[34] have identified electricity as the most significant obstacle for conducting business in Nicaragua, as the country has some of the highest electricity costs in the region. Moreover, as the second poorest country in the region with over 42% of the population living below the poverty line[35], the poor in Nicaragua are estimated to spend about 45% of their household income on electricity[36]. Therefore, reliable electricity supply that is also affordable is a development imperative.

The Government of Nicaragua (GoN) is taking significant actions to optimize its power generation mix with the support of development partners and the private sector. Its Indicative Electric Expansion Plan for the country has established a goal of producing 90% of energy from renewable sources, which has been reflected into the National Energy Strategy and Nicaragua's Action Plan SE4All 2030. In order to achieve and maintain the GoN target, Nicaragua has been attempting to mobilize investments into a number of renewable energy technologies. Geothermal stands out among them as the only year-round base-load renewable energy source that can be expanded at scale in Nicaragua[37]. Once developed, geothermal can operate on a non-intermittent, 24/7 basis. This is not only beneficial for providing reliable service, but it is becoming an increasingly essential complement to integrating additional other intermittent renewables, such as wind power, without technically destabilizing the power system. There are indications[38] that up to 80 MW of thermal capacity operating on bunker fuel is presently being used to supply base-load power, which could, to a large extent, be replaced by additional geothermal capacity; with prospects for even more additions

[34] Business Enterprise Survey, World Bank Group 2010.

[35] According to the V Encuesta de Medición de Nivel de Vida (V EMNV) de 2009, the value of monthly consumption of the poor or "poverty line" was C$977.09 or US$47.39 per month.

[36] Centrales Hidroeléctricas de Nicaragua S.A. "Estudio del Mercado Energético de Nicaragua". September, 2012.

[37] While hydropower can be a base-load renewable energy source when developed with storage, most of the hydro development planned in Nicaragua are run-of-the-river making them a source with significant seasonal variability.

[38] Based on discussions with the Nicaraguan Energy Institute (INE) and the Ministry of Energy and Mines (MEM).

including need to meet growing demand. Since geothermal is an indigenous resource, its greater utilization will also enhance the energy security of the country, reducing its dependence on imported fuels lowering the country's balance of payment exposure. It also serves as a natural hedge against the volatility of international commodity prices, such as fuel oil, which will provide greater predictability to businesses and household consumers alike. Geothermal is also a clean energy resource, and its greater utilization will have local and global environmental benefits.

Nicaragua has the largest estimated geothermal potential in Central America, located along a 300 kilometers stretch that make up the Quaternary volcanic range that extends parallel to Nicaragua's Pacific Coast (see Figure 19). While estimates range, the GoN's Geothermal Master Plan has identified twelve geothermal development areas where the potential is initially predicted at 1,519 MW[39], which exceeds the total installed generation capacity in the country. Despite this potential, only two geothermal fields are developed and producing electricity presently, namely San Jacinto-Tizate[40] and Momotombo[41], leaving 80% of the estimated potential in the Geothermal Master Plan open for future development.

Despite the significant benefits of incorporating more geothermal capacity to produce electricity, the expansion of development in Nicaragua has been slow due to a number of major barriers. They include geothermal resource risks, attracting qualified developers, and financing mobilization to cover the high up-front costs. This is particularly the case when developing green field projects that have not been explored previously. In order to scale-up geothermal and meet GoN goals, it will be vital to address these barriers since nearly all of additional geothermal potential are green field developments.

Figure 19: Identified geothermal development areas in Nicaragua

Source: MEM

[39] Bundshuh, T. et al in 2000 estimated the geothermal potential to be as high as 3,300 MW.

[40] San Jacinto-Tizate's estimated potential in the Geothermal Master Plan is 167 MW, although the current installed capacity is 77MW, of which, the available capacity is 58 MW, as per information from INE.

[41] Momotombo's estimated potential in the Geothermal Master Plan is 154 MW, although the current installed capacity is 77.5 MW, of which, the available capacity is 25 MW, as per information from INE.

Geothermal Resource Risks: Geothermal is developed in a multi-stage, modular manner. There are greater resource risks associated especially with early stage development of green field geothermal projects due to the uncertainty regarding the availability of sufficient quantities of commercially exploitable resources. The industry practice is to initially carry out surface level reconnaissance work[42] followed by a program of physically drilling slim-hole and exploration wells. A program of surface reconnaissance and drilling 3-5 exploration wells can typically cost around US$30-US$40 million. It is difficult to mobilize funding at this early stage, especially through private sector, since they stand to lose the risk capital if the development is not bankable.

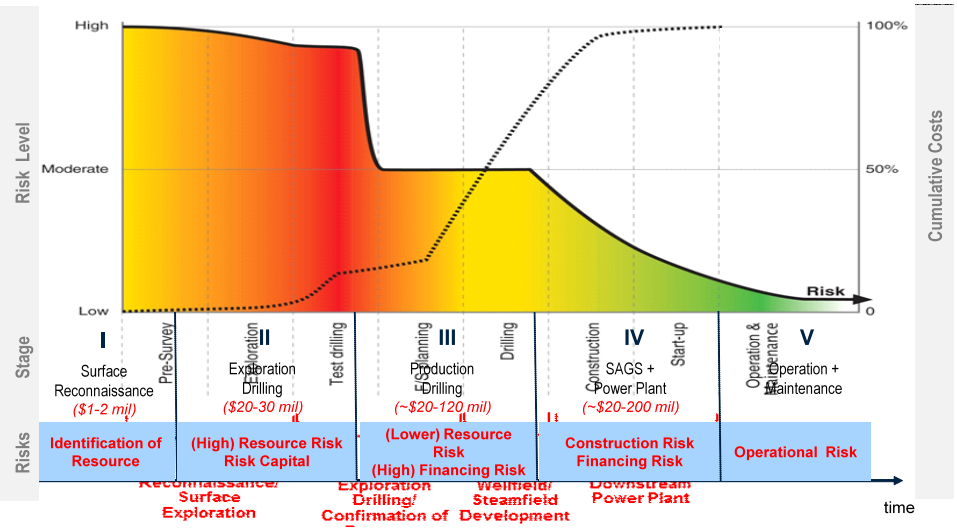


Figure 20: Illustration of relationship between resource risks and cost of development

Source: Adapted from the Geothermal Handbook: Planning and Financing Power Generation, ESMAP, The World Bank, 2012

Attracting Qualified Developers: While Nicaragua is viewed as a country with appealing geothermal prospects, the overall investment climate and the small size of the market can make it a challenge to attract technically and financially capable developers. As a result, developments may not meet industry and international standards that could lead to poor results; and also deter financiers. A market sounding[43] indicates that there are qualified developers who would be interested in entering the Nicaragua geothermal market, under the conditions that industry-standard surface studies have been carried out in advance, some degree of exploration drilling is already conducted to at least identify the availability of a steam resource, and some form of resource risk mitigation to reduce their financial exposure to the high risks is provided.

Mobilizing Large Scale Financing: While mobilizing risk capital for exploration is a particular challenge, securing financing for geothermal remain a barrier even after the bankability of the project is confirmed. One reason for the financing challenge is the likely need to raise more equity (albeit at lower risk) to carry out additional production drilling to develop the steam field. The production drilling costs coupled with the funding needed for the power plant and transmission lines lead to high up-front investments that can raise the amount and cost of financing to levels that can be prohibitive. In addition, the long and unpredictable time that is required before a geothermal power plant is

[42] Geological, geophysical and geochemical surface surveys commonly referred to as the 3Gs.

[43] Carried out by the World Bank Group in 2014/15, upon the request of the GoN.

operational creates uncertainty regarding the timing of revenues placing financiers at greater risk. As a result, reaching financial closure on a geothermal project following resource confirmation can take significant time leading to implementation delays and lost revenues. Therefore, to develop geothermal through the multiple phases of its project cycle until power plant commissioning, it is important to design mechanisms/instruments that can facilitate and speed-up financing of such large investments.

2. Proposed SREP Investment Support

The GoN has requested assistance from a number of development partners[44], including the IDB and the World Bank Group, with the intention of addressing some of these key barriers to exploiting the resources in the country's geothermal green fields. The development partners have agreed with the GoN on a strategy to quickly confirm the resources in fields that are advanced and ready for exploration; and select key fields where surface reconnaissance could better identify field characteristics so that the ones with the best prospects can be subsequently explored.

Investments to Confirm Resources in Fields where Preparation is Advanced:

Table 15 below identifies three geothermal fields that have been studied at depth, and there is considerable preliminary knowledge about its characteristics (completed Stage 1 in Figure 20). Due to this advanced understanding, the fields are well placed for further exploration through a combination of slim-hole and full diameter drilling, with the goal of identifying the availability of a steam resource and confirming its potential power generation capacity (i.e. Stage 2 in Figure 20). Positive results would unlock the potential in these fields as it will considerably de-risk the project and confirm "bankability" providing confidence to developers to proceed with making further investments and helping secure financing for subsequent stages.

Geothermal area	Estimated potential (MW)	Level of study/development	Concession status	Investor interest (w/risk sharing)
Exploration / Drilling stage				
Casita-San Cristobál	225	Surface studies 1 slim-hole. Resource identified	Cerro Colorado Power (with World Bank Group support)	High
El Hoyo-Monte Galán	159	Surface studies 3 slim-holes. 2 production wells Resource not identified	Under evaluation	Medium
Managua-Chiltepe	111	Surface studies 1 slim-hole. Resource not identified	Under evaluation	Low

Table 15: Green Fields that are Advanced and Poised for Exploration

Source: Review by World Bank and MEM, 2015. Estimated potential reported from Geothermal Master Plan of Nicaragua

[44] In addition to IDB and the World Bank Group, other development partners supporting the sector in Nicaragua include JICA, CABEI, and the Government of Iceland.

Casita-San Cristobal Geothermal Development (The World Bank Group): The Casita-San Cristobal geothermal field is the most advanced geothermal green field in terms of preparation for a full exploration campaign. The investor readiness indicator in Table 15 ("High") reflects the fact that following successful surface studies, there is an 840-meter slim-hole that was drilled in Casita-San Cristobal that identified a steam resource. These results provide considerable confidence for moving forward with a full exploration program. The World Bank Group, upon the request of the GoN, has been working with an experienced private developer that has the concession rights to the field, and state-owned power company, ENEL, to develop the field through a public-private partnership (PPP). The private developer has already made investments of about $10 million to progress development, but yet faces considerable challenges in raising the risk capital necessary to undertake the full exploration program. IDA and SREP funds will be mobilized initially to cost-share the risks in a 3 to 5 well exploration program designed to meet good industry practice. A joint World Bank-IFC team will provide technical assistance on the PPP cost sharing arrangements between the developer and ENEL. Once resources are successfully confirmed, feasibility and safeguards work will be carried out in-line with industry practice and international standards. This will form the basis for any additional drilling, and the development of an initial power plant of about 20 MW along with its associated infrastructure, which will demonstrate the capability of the field to successfully produce electricity. Since reaching financial closure can be challenging even at this advanced stage, additional IDA/SREP funds will be allocated to help leverage and facilitate the mobilization of the larger private financing needed at this point, and to expeditiously reach financial closure. IFC is prepared to help lead the syndication of different financing options. By demonstrating the power generation capability of the Casita-San Cristobal field, the proposed IDA/SREP intervention is expected to greatly enhance the confidence for mobilizing additional financing towards subsequent expansion, unlocking the potential to fully exploit the geothermal resources in the field.

Surface Reconnaissance to Advance Geothermal Sites with Limited Information:

Table 16 identifies the remaining undeveloped geothermal fields, where there has been a minimum reconnaissance, and more information is needed before making significant investments in exploration. The GoN, in consultation with the IDB and the World Bank Group (WBG), has selected several for further study so that more information can be obtained about the field characteristics. These studies would advance the GoN knowledge about each field, and help make a determination as to which ones are more suitable for further investments. It will help develop a sustainable pipeline of geothermal investments that will be vital to continue the scale-up during the years to come.

These fields are crucial to unlocking a stream of geothermal prospects in order to sustainably scale-up geothermal in Nicaragua. However, the limited information available regarding field characteristics at these sites is likely to attract limited interest by developers, who, based on the results of the market sounding, are seeking fields were the surface studies are completed and there is some drilling to confirm the availability of a steam resource. In order to make these fields suitable for awarding concessions to developers, it will be important that geological, geophysical and geochemical surveys that are consistent with industry standards are carried out (Stage I in Figure 20).

Geothermal area	Estimated potential (MW)	Level of study/development	Concession status / Development partner	Level of preparation and interest
Pre-feasibility phase / Identification				
Volcán Cosigüina	106	Surface studies	No concession.	Medium
Volcán Mombacho	111	Identification Pre-feasibility	No concession. With JICA support for surface studies.	Low
Caldera de Apoyo	153	Identification Pre-feasibility		Low
Volcán Telica-El Ñajo	78	Identification Pre-feasibility	Needs clarification.	Low
Caldera de Masaya	100	Identification Pre-feasibility	No concession.	Low
Tipitapa	9	Identification	No concession.	Low
Isla de Ometepe	146	Identification	No concession.	Low

Table 16: Green Fields that require additional surface reconnaissance

Source: Review by World Bank and MEM, 2015. Estimated potential reported from Geothermal Master Plan of Nicaragua

Volcán Cosigüina, Volcan Mombacho and Caldera de Apoyo (Inter-American Development Bank and Japan International Cooperation Agency): In the Volcán Cosigüina (VC) geothermal field, the IDB has been working with Nordic Development Fund (NDF) and the GoN in carrying out the surface level reconnaissance, and slim-hole drilling campaign to locate and identify the availability of a steam resource. The initial results of these studies are positive, which is reflected in the readiness indicator in Table 15 ("medium"), where the field is classified as being poised for proceeding with further exploration. The next immediate step is to carry out a slim-hole drilling campaign to locate and identify the availability of a steam resource, after which, IDB and JICA would assist the GoN to mobilize the larger funding necessary to carry out exploration drilling in order to confirm the resource capacity in this field. Meanwhile, in Volcán Mombacho (VM) and Caldera de Apoyo (CA) fields, JICA has been working with GoN in carrying out the surface level reconnaissance. Subsequently, SREP funds are planned to be allocated to carry out slim-hole drilling for VM and/or CA fields, achieving the same level of investigation for all three fields, i.e. VC, VM and CA. Thereafter, a highly concessional loan under possible IDB-JICA co-financing will be mobilized to carry out full size exploration drilling for the field or fields that will demonstrate the best geothermal potential among the three. Industry standard and internationally compliant feasibility assessments and safeguards work would be carried out to determine the commercial viability as well as sustainability of further development. By confirming the resources in the field and ascertaining the commercial viability, the IDB/JICA/SREP intervention would contribute to de-risk the projects to a considerable extent and greatly enhance investor confidence as well as provide GoN wider options for eventual PPP investment stage, whose detailed structure and possible IDB/JICA support are open for further consideration and analysis.

Caldera de Masaya (World Bank Group): The WBG would also consider supporting the development at Caldera de Masaya should it yield positive results. By confirming the resources in the field and ascertaining the commercial viability, the MDB/SREP intervention would contribute to de-risking the project to a considerable extent and greatly enhance investor confidence as well as provide

GoN wider options for eventual PPP investment stage. The strategy would increase the likelihood of attracting a qualified developer capable of mobilizing the financing necessary to carry out the subsequent stages of field development.

3. Proposal to begin with the transformation process

The proposed MDB/SREP intervention is catalytic, as it will re-start investments in a sub-sector that has not provided signs of further development beyond San Jacinto-Tizate in 2012, despite its significant potential, due to the major barriers that were previously highlighted. The existing geothermal operations in Momotombo and San Jacinto-Tizate provide a base reference with significant lessons learned that can be incorporated into the next generation of projects in Nicaragua. While the proposed MDB/SREP intervention is based on extensively analyzed approaches that have been proven elsewhere globally, it is designed to push the envelope specifically in Nicaragua by taking on key risks that are beyond the capacity of many developers, as confirmed by the market sounding and recent developments. The proposed cost-shared approach will better allocate risks leveraging relatively modest public and international funds towards mobilizing significant private capital to invigorate development in the sector. The PPP structures will also demonstrate new modalities through which risks can be shared in the geothermal sector, which will provide input and lessons for future expansion as well. The proposed projects will strengthen capacity within the GoN as well as with developers, in project development, sector oversight, policy formulation, and technical skills development; that will provide a foundation of knowledge and skills to catalyze geothermal immediately as well as into the future. Going forward, the proposed MDB/SREP supported intervention by the GoN will also better place future Nicaraguan geothermal developments to be able to access regional and global opportunities such as the LAC Geothermal Development Facility (GDF) and the Green Climate Fund (GCF), should they become operational and available. The approached developed through the MDB/SREP support will be replicable within Nicaragua as well as regionally.

BOX: Cost-Shared Risk Mitigation for Scaling-Up Geothermal Development

There are several ways in which geothermal resource risks have been mitigated and investments mobilized to develop power generation capacity. These various options were carefully considered by the GoN through participation in the Global Geothermal Development Plan Roundtable and the GeoLAC discussions, through a stakeholder engagement and workshop with support from the World Bank Group, and also based on its long-standing history of developing geothermal. Through these efforts, it was concluded that a cost-shared approach to risk mitigation could be the one of most appropriate measures of intervention for addressing this key barrier given the circumstances in Nicaragua. A cost-shared risk mitigation scheme would enable Nicaragua to utilize its public funding along with international assistance to leverage significant private capital and expertise to help advance the development of its geothermal sector. It also fits with the GoN philosophy of a largely private sector driven power sector where public interventions are strategically applied towards achieving public goals. Cost-shared risk mitigation is a relatively straight forward approach where the public sector takes on some portion of the funding at the high risk exploration stage, and catalyzes additional private capital to take on part of the risks. Once exploration is completed and resources confirmed, it will "unlock" the potential in these fields where the private and public sectors can more confidently invest given that the risks are substantially reduced. Cost-shared risk mitigation is a proven approach that has contributed to catalyzing geothermal capacities in excess of 3,000 MW globally. The GoN hopes to apply these global lessons in designing and implementing its own scheme towards a similarly successful end in Nicaragua.

SOURCE: adapted from World Bank/ESMAP, "A comparative Analysis of Geothermal Resource Risk Mitigation Mechanisms: A Global Survey", forthcoming.

The greater utilization of clean, renewable geothermal energy will transform the generation mix in the power sector, and help realize the green development path for economic growth that has been set by the GoN. The increase in base load power, where the only alternate options are fossil-based, are becoming increasingly necessary for stably integrating more intermittent renewables such as wind and solar. Eventually, the improved generation mix will help lower and stabilize long-term electricity prices and also confer environmental benefits. The development of geothermal will also have other transformational co-benefits since it will improve basic infrastructure in areas where it is lacking, create opportunities for direct use of geothermal and condensed heating in industrial and agricultural activities, and generate direct and indirect employment[45].

4. Readiness for the project implementation

Nicaragua is poised for a geothermal expansion, with a number of projects that are ready for investments in surface reconnaissance and exploration, which will have a transformational impact by confirming and opening up the potential in these fields for significant scale-up. The policy framework has been enhanced accordingly by the GoN and capacities strengthened with the support of development partners. Several important policy and institutional reform actions related to geothermal development are indicated below:

- Nicaragua is one of few countries globally that has a comprehensive Geothermal Master Plan, which identifies and details twelve geothermal development areas, and based on available information, the potential power generation capacity of each. This information provides a basis for prioritization and guidance to developers.
- There is a geothermal law in Nicaragua that provides greater sector specific legal certainty for developers as well as a framework for the GoN to oversee sector development.
- Clear mandate and budget allocation for MEM, ENEL and ENATREL to represent the public sector in working with developers to advance sector development in-line with power needs and national development goals.
- Training and capacity building through the Program for the Creation of Human Resources in the Geothermal Sector with the support of IRENA; and the Government of El Salvador (with LaGeo).
- GoN participation in the Global Geothermal Development Plan (GGDP) where there is coordination of activities and sharing of knowledge amongst geothermal stakeholders around the world.
- Establishment of geothermal laboratory facilities at the MEM, with the support of the Government of Iceland.
- Screening of geothermal fields and the evaluation of geothermal absorptive capacity, risk mitigation approaches based on global experience, and market sounding to ascertain developer interest in investing in the sector; have been carried out through technical assistance from the WBG.
- Capacity building and institutional strengthening program for GoN geothermal sector is being carried out through technical cooperation from JICA starting in 2015.

[45] Based on the world average, geothermal energy development creates 0.5 direct employee/MW and 2 development staff members in a power plant. This means that the geothermal energy development would directly create 2.5 jobs for each new MW installed.

- Strengthening of the electricity transmission infrastructure in the Pacific zone through the PNESER program, which will enable evacuation of electricity from geothermal development areas throughout the region. It expands the electricity market for geothermal and facilitates scale-up by creating export options.
- Sector sustainability through the multi-annual Program to Strengthen the Electricity Sector in Nicaragua funded by the IDB, with major objectives in: (i) financial sustainability, (ii) transparency of results in sector management, (iii) sustainable energy matrix, promotion of renewable energy, private investment and energy efficiency, and (iv) promoting regional integration. Geothermal development will benefit with new generation contracting procedures as a stimulus for private investment, as well as with the implementation of a new tool to assess system operational security and the introduction of new renewable energy projects.

The investments that are proposed for MDB/SREP support have been carefully selected so that limited amount of SREP resource can result in as large scaling-up impact as possible and implementation can begin rapidly and it can lead to results quickly. The Casitas-San Cristobal field is the most advanced geothermal green field in the country in terms of preparation, since a steam resource has been identified and an exploration drilling program prepared, which is under review by the WBG. In addition, much of the land needed for the project has been acquired, environmental impact assessments have been submitted for approval, and some of the major associated infrastructure (such as access roads) are already constructed. Simultaneously, the GoN combining the assistance of IDB/JICA, can expect to have more than one field with slim-hole drilling and at least one field with full size exploration drilling, among Volcán Cosigüina Volcán Mombacho and Caldera de Apoyo fields, which will allow GoN to have wider options for strategic development of their geothermal resources in coming years. The remaining fields within the second group of projects, where further surface reconnaissance is needed as per market indication, were identified based on GoN priorities and plans to offer future concessions to qualified developers. The surface level studies can be initiated with minimal additional advance planning. Once the studies are completed, then further analyses will be required to evaluate results and determine the most promising prospects that should be further advanced with additional investments, and considered for public-private participation.

5. Justification of the SREP investment

The proposed MDB/SREP intervention will have the following benefits, which are consistent with the overall program goals:

- It will kick-start a geothermal development program, which has seen limited expansion in recent time, and enable a progressive scale-up in the sector. In its absence, it is unlikely that many of the green field sites will advance further; while the two existing brownfield sites are not likely to see significant additional expansion as they are exploited close to the limits of resource availability. As illustrated in Figure 21, the proposed program would contribute towards an initial expansion of about 60 MW (Phase I); that will unlock potential in these fields where there could be a rapid second phase expansion of perhaps another 150 MW due to the greater certainty of developing brownfield resulting in an "unlocking" effect (Phase II); and then progressively scale-up with subsequent modules (Phase III). While the extended

outcomes are difficult to predict at this stage, the successive expansion of geothermal with a similar trajectory in Nicaragua to meet growing economic needs could lead to the development of over 450 MW of capacity over the next 10-15 years (base case in Figure 21). Figure 21 also illustrates potential outcomes should the results of the exploration turn out to be more modest, as a low case scenario. On the other hand, should the results of the exploration and field development turn out to be robust, Nicaragua could be in a position to develop a substantial proportion of the potential in its Geothermal Master Plan (high case scenario in Figure 21).

- It will demonstrate innovative approaches to designing and structuring PPP arrangements for implementing a mechanism for cost-shared resource risk mitigation in the geothermal sector. Its successful implementation could serve as an example for replication in the region in other countries that are also facing similar challenges with slow exploitation of geothermal resources.

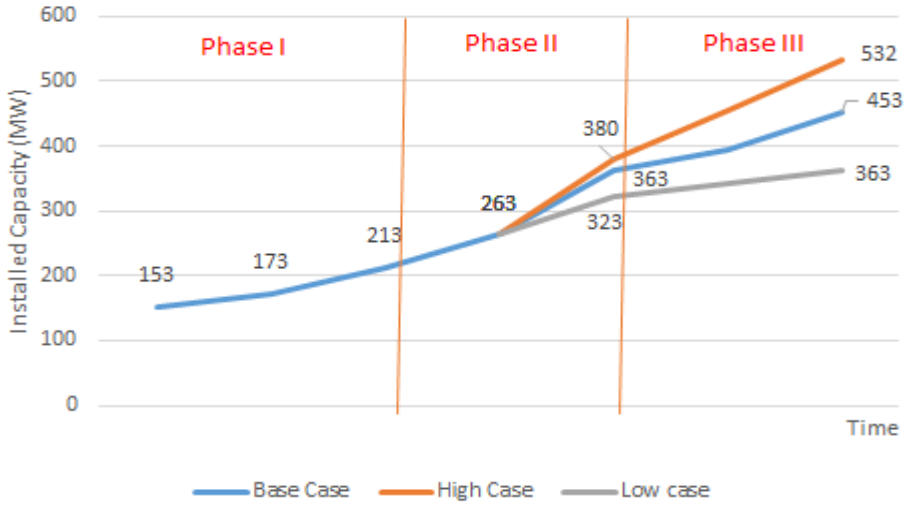


Figure 21: Illustration of potential for geothermal scale-up

Note: illustrative example based on present estimate from available information, these estimates will be progressively revised based on more accurate information that will be obtained through the proposed MDB/SREP interventions.

- It will help build a strong pipeline of projects that are in-line with industry practices and meet international standards. Although resource risks are inherent to geothermal development, significant investment exposure can be reduced through prudent and proven geothermal development practices that are not always adhered to. The participation of the MDBs can ensure that global knowledge is transferred and systems are in place to ensure sound technical, environmental and social practices, which will enhance the likelihood of successful and sustainable outcomes.

- It will help attract qualified developers with the technical and financial capacity to mobilize the large-scale investments that are needed to fully develop the geothermal potential in the country. The MDB/SREP intervention will ensure that investment-ready developments are offered in an efficient and transparent manner; and the participation of the MDBs will

provide a wider range of qualified developers with the confidence to enter the sector in Nicaragua.

- It will support Nicaragua's continued effort towards a clean energy development path by shifting away from the utilization of fossil fuels. Greater utilization of geothermal will directly mitigate greenhouse gas emissions and also provide local environmental benefits. As importantly, it will provide the base-load capacity necessary in order to integrate more intermittent renewable energy sources without destabilizing the grid and undermining the reliability of electricity supply.
- It will help diversify the power generation mix in the country that will lead to long-term reduction and stabilization of costs. This will improve the investment climate and enhance business competitiveness; and also improve the quality of life of household consumers. The addition of reliable base-load capacity will also facilitate the expansion of the grid so that access to modern electricity can be provided to an increasingly larger population in the country, improving their lives and reducing extreme poverty.

6. Gender

Although the geothermal works and surface studies proposed by PINIC will have a very limited impact on communities in this early stage, the following gender aspects in the design and implementation of projects will be considered:

- Consultations. Promote equal participation of women and men in consultations. Encourage participation by both groups to incorporate their views and interests.
- Loss of livelihood. Analyze the potential impacts on existing livelihoods in exploring geothermal area. Some of these projects are carried out in nature reserves and/or protected areas, which may impact tourism, agriculture, livestock, crafts, etc. If so, the SREP Nicaragua team will implement the necessary mitigation measures to address potential impacts on the livelihoods of men and women.
- Employment. The team will promote the hiring of women in both highly skilled professionals positions and in those where no prior qualification is required, it will also favor the hiring of workforce from the communities near the projects. In the latter case, women will be part of the training processes that are carried out. Also, a suitable working environment for women will be ensured. Measures will be taken to guarantee an environment free of harassment, such as construction of adequate facilities if necessary.

The following activities are recommended for this Component:

- Creating scholarships for women's access to technical careers or technical studies with career opportunities in the geothermal field and/or
- Creating partnerships with schools and technical colleges to promote placements for female students.

7. Outcome indicators

The following outcome indicators are proposed to monitor achievement:

- a) Total confirmed geothermal resources indicating power generation capacity that can be installed
- b) Diversification based on total additional geothermal energy generated (GWh/y)
- c) Reduction in greenhouse gas emissions by displacing (bunker) fuel oil
- d) Potential new and existing connections to be served by the new geothermal generation
- e) Replication of development approach/model

8. Financing plan

Components / Subcomponents	SREP	SREP-IDB		SREP-WBG	
		Grant	Loan	Grant	Loan
Superficial studies and slim-holes (Resource identification)	4.00	0.75	3.25		
Production wells (Resource confirmation)	17.25		3.50	7.00	6.75
Feasibility studies	0.50			0.50	
Investment	0.00				
Technical assistance	0.75	0.00		0.75	
Subtotal Component #1	**22.50**	**0.75**	**6.75**	**8.25**	**6.75**

Table 17: Component #1 - Indicative funding proposal (million of US$)

9. Preparation schedule

Milestone	Date
PINIC S/C approval (CIF)	May 2015
Detailed design of projects no later than (GoN/MDB):	October 2015
S/C approval (SREP) of projects (CIF)	November 2015
S/C approval (SREP) of projects (MDB)	January 2016
SREP funds available for disbursement (MDB)	April 2016
IDB internal approval of leveraged funds	August 2016
WBG internal approval of leveraged funds	August 2016
MDB funds disbursement	December 2016

Table 18: Component #1 – Project preparation schedule

COMPONENT #2: INTEGRAL DEVELOPMENT OF RURAL AREAS

1. Issue description

Access to modern energy services is a global challenge, particularly affecting Nicaragua, the country with the lowest rate of electricity coverage in the western hemisphere and highest dependence on firewood for cooking. The National Human Development Plan (PNDH) and the Law No. 272 "Law of the Electrical Industry" (LIE), establish the universal right of people to electricity. In late 2014, 80% of Nicaraguans had access to the grid (ENATREL, 2014), which means that an estimated 1.2 million people (approximately 200,000 households) do not have access to modern electricity: this represents a significant barrier for socioeconomic development and a gap to reach the target agreed by Central American countries to achieve 90% coverage in all countries by 2020, according to the Sustainable Energy Strategy 2020 of the Central American Integration System SICA.

Note that the overall coverage rate hides large variations between rural and urban areas, and on-grid and off-grid users. Generally, coverage is almost 100% in cities, 40-60% in most rural areas, and 0-20% in parts of the autonomous regions of the Nicaraguan Caribbean and in the department of Jinotega. In summary, a majority of the 1.2 million people without access to electricity live in rural areas and several options are being reviewed to serve them. In a majority of cases, solar or hydroelectric grid systems have lower costs than electrification with Diesel-based generation. In others, combined (hybrid) mini-grids are needed to provide more power and continuous supply. Access to modern electricity remains a major challenge in rural areas where the extension of distribution networks is not economically viable.

On the other hand, Nicaragua suffers from low yields of firewood energy caused by inefficient stoves: this results in a high demand for firewood at the national level and a waste of time for women and children involved in collecting and cooking food and preoccupying air pollution inside the home and its associated effects harmful to human health. Finally, it has caused a negative impact on the environment through deforestation and degradation of Nicaraguans forests. An estimated 1.8 million Nicaraguans (between rural and urban households, as MEM, 2007 and MEM, 2011) using firewood as unique, primary and secondary fuel, and do so inefficiently.

According to the National Energy Balance (BEN, 2012) prepared by the MEM, the primary energy production in Nicaragua was 1547.3 thousand tons of oil equivalent (ktoe) and is mostly composed of firewood 64.9%, while the final energy consumption reached 2180.5 ktoe of which 44.4% was firewood alone. Wood is the primary energy consumed in the residential sector, with low efficiency, where cooking food is the main energy use. Users of this fuel are concentrated in the rural sector and semi-urban areas of cities and in most cases, these users are unaware of the health, environmental and economic problems associated with the consumption of firewood and charcoal. Given this context, one of the central themes promoted by the GoN is the sensitization and training of families, because if they are unaware of the damage and disruption caused by wood smoke, are not able to understand the need to change traditional stoves for a more efficient and cleaner technology. The information should also help users select the technology that best suits their needs and meets certain characteristics of quality, efficiency, durability and affordability. Similarly, families should be aware of the health, economic and environmental benefits generated by efficient and clean stove technologies.

Businesses in rural areas of Nicaragua are unproductive and highly inefficient. Moreover, the depletion of natural resources and their degradation is resulting in unsustainable business practices. The adoption of new technologies is essential to ensure that natural resources of the country, agricultural growth and increases in the welfare of the population are sustainable in the medium and long term. The government recognizes the great potential for rural development (especially in the poorest regions) in the implementation of RE systems to small-scale decentralized production sectors. The MEM has been actively working to develop mechanisms to facilitate the integration of small-scale RE in several value chains in the rural sector. However, the deployment of RE technology - such as small hydro, PV systems, efficient digesters or ovens - requires investment in a context where funding is scarce. This shortage is acute in rural areas where productivity is low, limiting the ability to accumulate resources and increasing the perceived risks when trying to access to investment financing.

This component 2 focuses in particular in eight departments of Nicaragua (Matagalpa, Jinotega, Chontales, Boaco, Nueva Segovia, Madriz, RAAS[46], Río San Juan) in which the following deficiencies were identified:

First, many communities lack access to electricity, because they are too distant from distribution networks. However, in the mountainous areas of Matagalpa, Jinotega, Chontales, Boaco, Nueva Segovia, Madriz, RAAN[47], RAAS and Río San Juan, there are many sites with small-scale hydropower potential.

Second, artisanal industries that produce bricks, tiles or lime, work with archaic furnaces and kilns, which leads to increased consumer demand for firewood, while smoke and soot emissions damage the quality of life of populations near the production centers. Of course, they are environmental damages too. This sector is characterized by little industrial and economic development, yet generates products for construction (homes, schools, health centers), sanitation projects (septic tanks) and more, for the less privileged sectors.

Third, over 50% of farmers do not have irrigation systems, and those who possess one incur high costs of fossil fuel and labor. According to the agricultural census (CENAGRO IV) of 262,546 surveyed producers only 4.42% (equivalent to 11,599 producers) had an irrigation system.

Finally, according to the same census, 29,504 producers are involved in milk sales nationwide, of which 19.513 producers (over 60%) are located in the 8 departments targeted for SREP intervention. These producers, mainly because they are located in remote areas and in many cases do not have access to electric services, lack a suitable refrigeration system that can be used to store your milk or derivatives, resulting in economic losses and poor product quality. The implementation of RE systems will avoid losses and enable improvements in product quality, and help the production processes, thus improving the entire value chain.

[46] Southern Autonomous Atlantic Region (Spanish acronym RAAS)

[47] Northern Autonomous Atlantic Region (Spanish acronym RAAN)

2. Subcomponents

Subcomponent #2A : Financing photovoltaic (PV) solar systems for rural electrification

The first subcomponent of this integral rural development program aims to provide off-grid solutions for residential electricity generation in remote areas. It follows the recommendations of the National Electrification Plan (PLANER), which has studied the types of technologies to be evaluated in remote communities and rural areas of Nicaragua, with special emphasis on the Atlantic region, which includes RAAN, RAAS and Río San Juan.

Geographically, the Department of Managua represents more than half (53%) of domestic demand (with the capital accounting for 31%), followed by Chinandega (8%), Masaya (6%), León (5%) and Granada (4%), as shown in Figure 22.

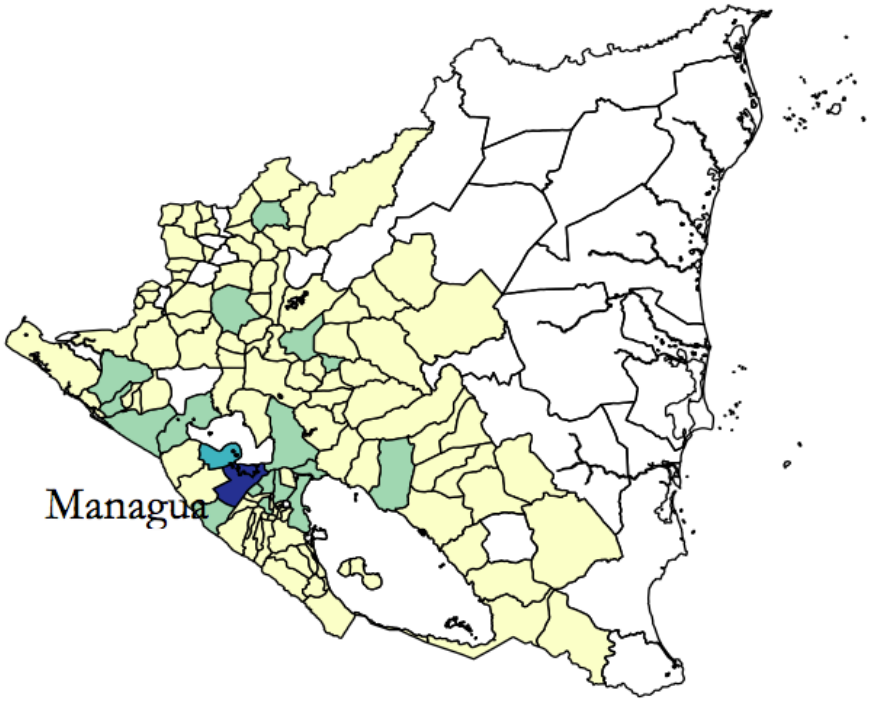


Figure 22: Mapping of the national electrical demand- 2013
Source: (CNDC, MEM, 2013), (Ponce de León, 2014)

The development of electricity infrastructure is still insufficient and has Nicaragua's electricity coverage rate at about 80% in 2014 (ENATREL, 2014). This overall rate of electricity coverage conceals large variations in coverage between urban and rural areas, as evidenced by Figure 23.

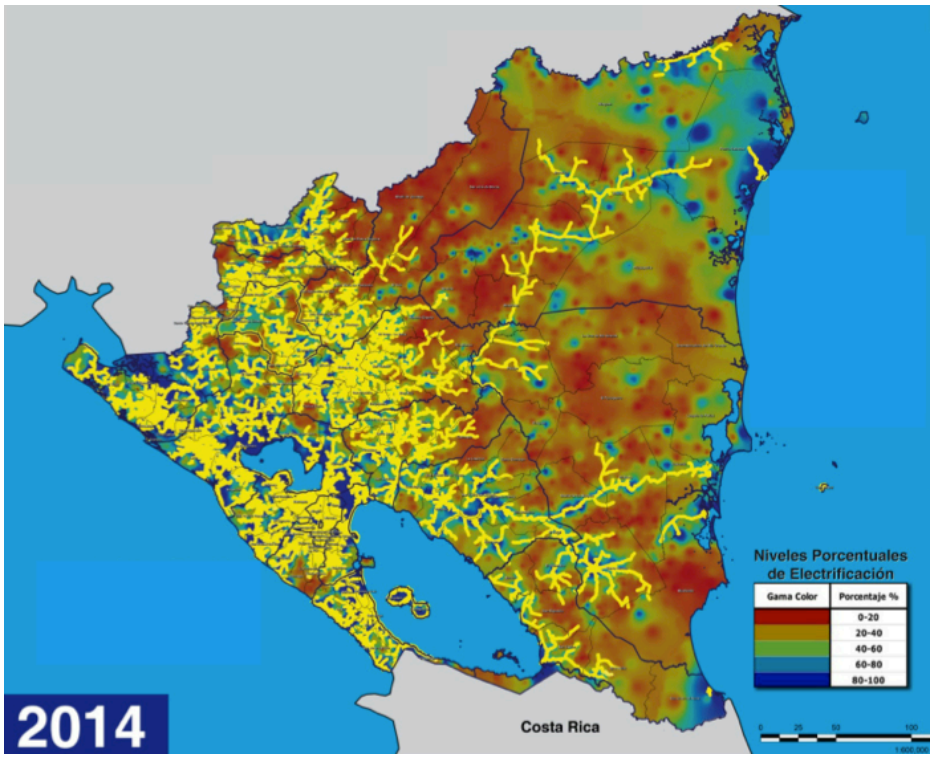


Figure 23: National electrical coverage and main distribution grids, 2014
Source: ENATREL

Centralized solutions including hydropower and mini-grids, require more planning and detailed design, so they are alternatives that could be implemented in the medium to long term (and potentially apply to GCF financing).

Rural electrification with distributed off-grid renewable energy systems has higher entry costs, caused by the lack of basic infrastructure, difficult access to remote areas and high transaction costs per user, which discourages projects where they are most needed.

To address this barrier, PINIC proposes a short-term solution with RE-based off-grid systems, and governmental support. The proposed technologies are relatively easy to acquire, install and operate.

This subcomponent aims to support an electrification program that will aim to serve 25,000 homes, with solar home systems ranging from 50 W to 200 W, starting with:

- Solar home systems in 18 communities located in the municipality of Waspam, specifically in the areas near the banks of the Coco River upstream of the town of Waspam. Because of the accessibility, distance to the grid and other socio-economic conditions, the GoN recommends the implementation of home PV electrification.
- A community pilot project, with a proposed community solar plant in Cabo Gracias a Dios on the Caribbean coast, close to the border with Honduras, which could be replicated in other communities if deemed successful

The intervention model will take into account the sustainability of the systems, particularly regarding (i) the evaluation and selection of new technologies including remote monitoring, (ii) operation and

maintenance of the systems, and (iii) deep-cycle battery recycling. It will explore the options of a rural rate subsidized by on-grid users and / or "Pay as you go" systems.

Subcomponent #2B: Adoption and transfer of improved cookstoves for use by households

The second subcomponent of this integrated rural development program aims to provide access to modern fuels and better use of biomass in remote areas.

Regarding cooking food, currently two models of improved stoves have been used in Central America. It is necessary to increase the offer allowing the families to choose the stove that meets their needs, preferences and tastes. Experience in wood stoves programs in Central America is limited to local initiatives, funded by local governments, international institutions or regional bodies and have been carried out by Non-Governmental Organizations, individuals and even religious groups. Most of these projects have been undertaken without sufficient baseline studies, technology knowledge, control and monitoring of the technology's usage and adoption.

This subcomponent will support the study phase for the wider adoption and transfer of 400,000 improved cookstoves nationally. SREP will enable diagnostics and baseline studies for the following activities:

1. Structuring of a Program for the adoption and transfer of 400,000 improved stoves until 2030. This will include the revision of the environmental, economic, social, financial, legal and technical feasibility of such program. At least two different models will be explored: a socially inclusive model and a 100% private sector business model (taking into account the possible business models and value chains, considering the choice of technology, production, marketing, distribution, training and maintenance). However, the specific intervention model will be defined in project design. An environmental impact study will be included in the national program to assess the degradation and deforestation of forests, emissions of greenhouse gases and emissions from the use of traditional stoves and projection of the potential impact of this program. Finally a health study will be carried out to estimate the contaminating impact of traditional stoves inside the households, and projection of the potential impact on health of the program. Climate financing schemes and payment by results models will be explored in order to ensure maximum scale up of the program at a national level.

2. Pilot phase or seed funding for the national program: the aim will be to distribute at least 5,000 to 8,000 improved stoves based on the results of the feasibility studies. This funding will serve to catalyze the distribution of at least 40,000 additional improved stoves: the financing of these could be proposed in a second phase, and potentially apply to GCF and other climate related funding (such as the voluntary carbon markets).

Subcomponent #2C: Renewable Energy for productive uses

1. Development of a baseline and market potential of RE technologies for productive uses in rural areas of Nicaragua: (i) first, the baseline will be collected with a gender perspective to know the current use of renewable energy in rural areas of the country, especially in relation to productive uses, establishing the characterization of the producer as a beneficiary of the program; and (ii) second, diagnostics at the municipal level will be conducted in order to identify potential beneficiaries and

projects (and their needs for the implementation thereof), and the areas with the greatest potential for growth in this market.

The following technologies will be surveyed specifically: small hydropower, biodigesters, efficient furnaces and kilns, and thermal and electrical applications of solar energy.

2. Implementation of productive uses pilot projects in rural areas: PINIC will identity pilot projects, which will need to comply with specific requirements in terms of commitment, responsibilities and actions by the different actors of the program, according to the areas of expertise each agency involved. These could be technology demonstrations of solar irrigation systems, cooling solar-based systems, efficient kilns and biogas digesters for thermal uses, including in this first phase the installations in productive units in the targeted departments. In order to strengthen the skills and knowledge of the beneficiaries and collaborating institutions, this will also include training on the use of technologies, use and maintenance of systems, recommendations for improvements in the production processes, allowing greater profitability of the beneficiaries.

3.-Creation of a financing window dedicated to organizations and producers, which may include a portion of grants for pilot projects. Also within this component, evaluations will be made to share lessons learned and project results.

Subcomponent #2D: Transmission infrastructure reinforcement

The plan to strengthen power transmission infrastructure in the northeastern and eastern regions of the country contemplates building 102 km of transmission lines and 4 substations by 2020:

- Construction of a substation in Waslala (El Cuá), 48.3 km of single-circuit HV line, and other works
- Construction of a substation in Santa Clara and 47.3 km of HV line (Ocotal-Santa Clara 138 kV).
- Construction of a substation in Jinotega and 6 km of double-circuit line, segment Jinotega-Planta Centroamérica-Sébaco at 138 kV.
- Construction of a substation in Corinto and 0.5 km of double-circuit line.

This subcomponent is complementary to the 3 others, and prepares future phases of electrification in remote areas. No SREP funds are required for this subcomponent.

3. Proposal to begin with the transformation process

The regions with lower electricity coverage are municipalities characterized by extreme poverty, low Human Development Index and the lowest per capita income of the country. In these municipalities there are small urban population centers where electricity supply is provided through small distribution networks, however, most of the inhabitants live in small rural communities composed of tens or a few hundreds of dispersed households. This context leads to the following options to promote the use of renewable sources:

1) Phase 1: Rural electrification projects through home PV systems to supply electricity to households in remote and dispersed communities.

2) Phase 2: Rural electrification projects with mini-distribution networks and PV-diesel (or diesel-wind) hybrid systems for small and medium population centers. (SREP funds would only support the PV part)

Nicaragua has some history of implementing rural electrification through PV systems. The first attempts were done through a community model (this is the case of Waspam Solar and EUROSOLAR programs) where the O&M was done by the beneficiaries with insufficient resources to guarantee their sustainability. The PERZA project executed by the MEM with IBRD resources also distributed a significant amount of PV systems and established a framework for intervention with different management models depending on the level of income of the communities. PNESER is also contemplating to intervene in some communities with PV systems using a technical and economic sustainability scheme. However, there is still much work to be done in this area particularly with the people at the base of the pyramid, which need a more robust government intervention. PPP schemes have worked well in the past for grid extension programs such as PNESER where the government executed the project works and then transferred the infrastructure to a local company to take over the O&M. PNESER also developed an economic and financial model to determine the level of subsidy per community intervened which could also work for rural electrification with PV.

The business model of SREP projects, whether home or community systems, has to be designed taking these experiences into account. The feasibility of issuing contracts at least for O&M, with a local energy service company or ESCO will be explored. Tentative rates were calculated for each individual system, based on ability to pay (obtained by surveys) of the population. The basic idea is that a portion or the totality of the initial investments will be subsidized by the GoN whereas all or most of the maintenance, operation and business expenses will be covered by a tariff, collected by the ESCO responsible for O&M. The methodology to determine this will be determined in the project design and will build from existing models such as PNESER. This approach would be complemented by new regulations adapted to the special characteristics of this public service.

This component also proposes to implement studies, pilot projects and a financing line to promote productive renewable energy investments, including biogas and other off-grid RE in rural areas. Based on priority and high potential sub-sectors identified (i.e. cocoa, coffee, dairy, animal husbandry), the MDB can use SREP resources to leverage additional resources from the IDB and other partners. If successful, the scheme can then be replicated in other productive subsectors. The involvement of both public and private financial institutions in the deployment of the financial mechanism, as well as the strengthening of demand driving factors should produce a demonstration effect and ensure the sustainability of such investments.

To accompany the credit line, PINIC also intends to conduct studies and make arrangements with other institutions to establish a renewable energy base line in the rural sector, and will perform diagnostics to identify and select potential beneficiaries of pilot projects, considering the current situation and conditions for equipment installation.

4. Readiness for the project implementation

The following actions are being proposed to work towards universal access to modern energy services:

- ENATREL, through the National Plan for Rural Electrification (PLANER), is planning to reach a target population of more than 100,000 households (15% of the total population) in the next 10 years.
- In particular, several PV solar projects were designed for the RAAN; because of the difficulty to access, the remoteness of the grid and other socio-economic conditions, off-grid solar PV was judged more suitable for these communities to gain access to an electricity public service.
- The GoN also promotes sustainable energy use of firewood through the National Strategy Firewood and Charcoal (ENLCV) of Nicaragua. According to MEM, approximately 60% of the total population cooks food with firewood in traditional stoves, which have a negative impact on human health and the environment. Aware of the challenge, MEM is currently in the process of promoting a National Wood and Charcoal Action Plan (2015-2022), which has the strategic vision "To improve the quality of life of the actors of the firewood and charcoal value-chain."
- A Technical Standard Certification and the establishment of a Testing Laboratory for improved cookstoves in Nicaragua are being promoted to have a regulatory tool to standardize the compliance conditions a wood stove must follow as to energy consumption, emissions' reductions and safety. The draft technical regulation is currently under review and fundraising has begun to establish the laboratory.

The following actions are being proposed to increase the deployment of RE technologies in rural areas for productive uses:

- A list of 69 identified small hydro projects (less than 1 MW), with resource potential, is available. For these projects, and any other project that could join the list, it is necessary to perform feasibility studies and assess market potential.
- A MAGFOR study[48] indicated that Nicaragua has great potential to produce food, counting about five million hectares for permanent crops, pastures and various crops.
- A market study for the brick fabrication sector was conducted and funded by the Swiss Agency for Development
- The IDB has launched the program "Access to Credit in Rural Productive Chains" (NI-L1080), currently underway, which provides an existing scheme to channel funds to the final beneficiaries. This offers the opportunity to build on a structure already in operation, with distribution networks and associated economies of scale.

[48] Plan Sectorial Prorural Incluyente 2010-2014. Ministerio Agropecuario y Forestal (MAGFOR)

5. Gender

Subcomponent #2A: Rural electrification through off-grid solar PV

The use of off-grid PV systems can have short-term and very positive impacts on the socio-economic situation of women by reducing the time spent on housework, health and safety improvements, and increase chances of generating an income. We list below some of gender aspects that should be included during the design and implementation of projects:

- Gender Evaluation. Conduct a gender assessment of the populations, where the projects will be implemented.
- Consultations. Ensure the presence of women and men in public consultations and encourage the participation of both groups to incorporate their different views and interests.
- Decision-making bodies. Encourage the presence of women in the decision-making or management bodies for the projects.
- Employment. Encourage the training and recruitment of women for the operation and maintenance of installed PV systems.
- Self-employment. Facilitate the creation of small businesses led by women, taking advantage of the arrival of electricity.
- Rates. Create subsidies, special rates or payment plans with long-term and low interest rates for poor households to facilitate the interconnection of women to the grid.
- Improved health. Encourage the purchase of refrigerators and better preservation of foods to reduce food-related diseases in poor households.

Some of the recommended activities within this subcomponent, amongst others, are:

- Hold leadership and self-esteem workshops that encourage women to take advantage of new opportunities provided by the newly acquired access to electricity, with jobs in the operation and maintenance of the PV systems, productive uses of electricity, decision making in the management of SFV, participation in payment collection, access to credit, etc.
- Offer help to women to prepare business plans for new companies.
- Incorporate a gender perspective in the feasibility studies.

Subcomponent #2B: Adoption and transfer of improved cookstoves for use by households

The distribution and use of improved cookstoves will not only help to reduce GHG emissions and deforestation Nicaragua, but also reduce disease occurrences and more than 2,300 annual deaths mainly among women and children associated with household pollution caused by the use of traditional wood stoves. Also, women and men can improve their economic situation by reducing their spending on firewood, medical expenses and be able to access the new jobs that will be created with the construction, distribution and maintenance of new stoves. We list below some of gender aspects that should included during the design and implementation of projects:

- Consultations. Ensure the presence of women and men in consultations to incorporate their different views and interests in the project design and the design or selection of the most appropriate stove. If this is essential in any project, it is vital in such projects where the use of improved stoves by women determine the success or failure of the project.

- Employment. Encourage the training and recruitment of women for the construction, distribution and maintenance of the kitchens.
- Awareness. To succeed, public awareness campaigns that explain the benefits for home and community use of new stoves are needed. The messaging for men and women will need to be adapted.
- Prices. Innovative financing solutions must be explored, taking into account the specific needs of women in the communities in which to install the stoves. Women may require training in basic financial and forms of savings.
- Masculinity. Develop a strategy to involve men in the project. In many cases it is men who make the larger purchase decisions at home so it is necessary for men to see the benefits a new stove will have in their homes.

Some of the recommended activities within this subcomponent, amongst others, are:

- Workshops on basic skills for entrepreneurs targeting women or with a minimum quota for women's participation in order for women to create new businesses or become a part of the businesses that are created for the construction, distribution and maintenance of the stoves.
- Ensure that studies on diagnosis, baseline and contamination impact incorporate a gender perspective.

Subcomponent #2C: Renewable energy for productive uses

During the implementation phase of the pilot projects for productive uses in rural areas, the following items will be considered:

- Consultations. Ensure the presence of women and men in consultations and encourage the participation of both groups to incorporate their different views and interests.
- Employment. Encourage the training and recruitment of women for the operation and maintenance of SHP plants, PV systems, biogas digesters and efficient kilns.
- Self-employment. Facilitate women's entrepreneurship through access to credit and training.
- Access to credit. Ensure that existing businesses led by women also have access to credit

Some of the recommended activities within this subcomponent, amongst others, are:

- Encourage financing for companies led by women, through products specifically designed.
- Encourage the recruitment of women in the construction and maintenance of SHP plants, PV systems, biogas digesters and efficient kilns.
- Include a gender perspective in the baseline and diagnostics studies for this subcomponent.

6. Justification of the SREP investment

Access to modern electricity remains a major challenge in rural areas where the extension of distribution networks is not economically viable. In several departments of Nicaragua, MEM and ENATREL have identified the need to promote the installation of off-grid distributed generation from renewable sources, with the possibility to combine them later on into mini-grids, where applicable. In all these cases, the regulatory framework and tariff structure must be defined in order to ensure equitable access to electricity, and could possibly include cross-subsidies between on-grid and off-grid users.

The current model ("Business as usual"), where the responsibility to close the electricity coverage in rural isolated populations falls on the GoN alone, there will still be 10% of the population without access. SREP can support the efforts of selection of viable business models and conducting pilot projects to recommend a reliable solution, adapted to the reality of each region in order to achieve true universal access.

In terms of access to modern energy services it is known that nearly 60% of the rural and 20% of the urban population cooks food with firewood in traditional stoves that cause negative impacts on human health and the environment. The MEM is in the process of promoting a National Firewood and Charcoal Action Plan (2015-2022). This concurs with the objective of the Sustainable Energy Strategy for 2020 of the Central American Integration System (SICA) to spread 1 million improved stoves by 2020 in the region. Improved stoves run on 20-40% less wood and help reduce consumption firewood in the region by 10% (MEM, 2011). Through more efficient use of nonrenewable biomass, stoves can reduce 1.5 to 2.5 tons of CO_2-equivalent emissions annually per stove[49], improve indoor air quality, and reduce household fuel wood expenditures. SREP's support will facilitate the adoption and transfer of 400,000 improved stoves and promote renewable technologies in SMEs that use firewood in production processes through the structuring of a national program.

By incorporating renewable energy based technologies in SMEs, PINIC will offer options to increase the productivity and better integrate the SMEs in the value chains, by improving financing conditions for these profitable and sustainable investments. As stated above artisanal and agro industries (farmers and milk producers for example) are in desperate need of these technologies to improve their productivity. Moreover, these investments can also help producers who face the need to convert crops and adapt to climate change (higher temperatures and lower precipitation levels are affecting traditional crops). It is envisioned that SREP funds will catalyze further interventions in this area both by IDB and local development banks, which target the same beneficiaries.

PINIC will increase thus the penetration of adequate renewable energy technologies (electrification and thermal applications) in rural areas of Nicaragua, and open the possibility to replicate and scale-up the model with future support of GCF to reach 100% of the population of Nicaragua.

[49] See Gold Standard Verification report, GS690. Proyecto Mirador, 2011 - 2012. Det Norske Veritas.

7. Outcome Indicators

For the universal access subcomponent, we propose to measure the following indicators:

a) Number of beneficiary households with solar PV systems operating under a sustainable model, disaggregated by male and female heads of household
b) Increase in time spent by women in productive activities
c) Number of people with access using a service quality indicator (such as ESMAP 5-tier system), disaggregated by sex
d) Number of improved cookstoves adopted and running.
e) Number of men and women trained in the use and management of improved stoves
f) Quantity of wood used per household for cooking (kg/day, week or month)
g) Reduction of respiratory disease in men, women and children.
h) Reduction of the number of hours used for cooking.

It is expected that, in addition to reducing CO_2 emissions, relative to a "Business as usual" scenario, the program will contribute to:

- Improved electrical service to SMEs
- An increase in the productivity of rural production units;
- Reduction of energy subsidies; and
- An improved resilience to climate change.

Specifically, the following could be measured:

- Number of SHP potential developed and installed
- Number of solar irrigation systems installed in SMEs
- Number of solar powered cooling systems installed in SMEs
- Number efficient kilns substituted in SMEs
- Number of biodigesters installed in SMEs
- Number of small and medium producers trained in the use and maintenance of technologies, disaggregated by sex
- Number of loans, disaggregated by sex

8. Financing plan

Components / Subcomponents	SREP	SREP-IDB		SREP-WBG	
		Grant	Loan	Grant	Loan
2A Financing photovoltaic (PV) solar systems for rural electrification	**2.80**	**2.50**	**0.00**	**0.00**	**0.00**
Feasibility studies for solar PV and hybrid plants	0.5	0.15			
Solar home systems for 18 communities of the Waspam municipality (Río Coco)	1.50	2.00			
Off-grid solar plant for the Cabo Gracias a Dios community (160 households)	0.30	0.30			
Technical assistance	0.5	0.35			
2B Adoption and transfer of improved cookstoves for use by households	**1.20**	**1.20**	**0.00**	**0.00**	**0.00**
Viability studies and diagnosis for sizing and selection of improved cookstove models	0.20	0.20			
Total or partial financing of improved cookstoves (5,000 to 8,000)	1.00	1.00			
2C Renewable energy for productive uses	**3.50**	**3.50**	**0.00**	**0.00**	**0.00**
Feasibility studies and final design of the Auas Tigni and El Tortuguero MHPs	1.00	1.00			
Viability studies and diagnosis for sizing and selection of efficient stove models	0.20	0.20			
Total or partial financing of efficient stoves for SMEs (≈250 SMEs)	0.80	0.80			
Financing of other efficient technologies for SMEs (biodigesters, productive uses of PV, and irrigation systems)	0.00	0.00			
Partial financing for the construction of SHP Salto Labú and Salto Putunka (RAAN)	1.00	1.00			
Financing for the construction of SHPs	0.50	0.50			

Table 19: Component #2 - Indicative funding proposal (million of US$)

9. Preparation schedule

Milestone	Date
PINIC S/C approval (CIF)	May 2015
Detailed design of projects no later than (GoN/MDB):	October 2015
S/C approval (SREP) of projects (CIF)	November 2015
S/C approval (SREP) of projects (MDB)	January 2016
SREP funds available for disbursement (MDB)	April 2016
IDB internal approval of leveraged funds	August 2016
IDB funds disbursement	December 2016

Table 20: Component #2 - Project preparation schedule

ANNEX (6) ROLE OF THE MDB

The two Components of this Investment Plan will be executed in a collaborative manner by the Inter-American Development Bank (IDB) and by WBG through the International Bank for Reconstruction and Development (IBRD). Table 21 shows the proposed participation of the two institutions, based on their respective expertise. Each institution will develop one Program under the SREP umbrella.

Component	Subcomponent	IDB (Program A)	IBRD (Program B)
Component 1. Geothermal development			
Component 2. Integral development of rural areas	2A Rural electrification with PV		
	2B Improved cookstoves		
	2C RE productive uses		
	2D Transmission infrastructure for RE		

Table 21: MDB Roles for the Implementation of the Nicaragua SREP IP

Note: Shaded areas indicate components or subcomponents included in each MDB Program.

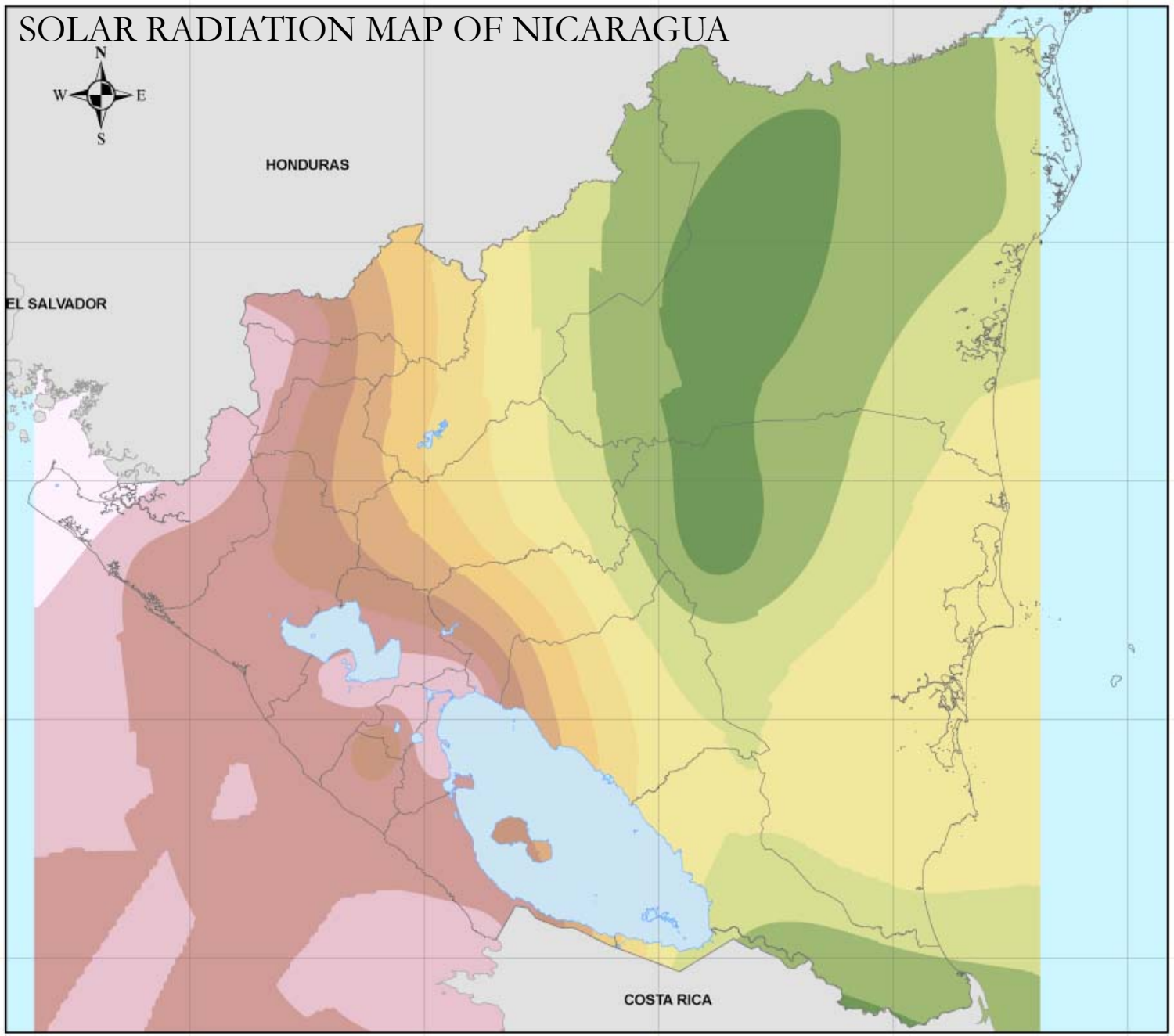
Table 22 shows the expected periods of time required for the preparation of the two programs (time between IP approval and program approval by the SREP Trust Fund Subcommittee).

IDB (Program A)	IBRD (Program B)
6 months	6 months

Table 22: Expected Preparation Times for MDB Programs

As shown on Table 21, one of the components (geothermal) will be executed jointly by two MDBs. In this case, the MDBs will seek to achieve the best coordination possible in terms of building on each institution's strengths, learning from each other, minimizing transaction costs, and maximizing cost effectiveness.

MAPA DE RADIACION SOLAR



MINISTERIO DE ENERGIA Y MINAS

RADIACION GLOBAL
(Wh/m2 día))
Año de Referencia

Radiación Global

- 4,098.382813 - 4,278.580519
- 4,278.58052 - 4,396.641085
- 4,396.641086 - 4,527.129079
- 4,527.12908 - 4,663.830787
- 4,663.830788 - 4,819.173637
- 4,819.173638 - 4,980.730201
- 4,980.730202 - 5,129.859337
- 5,129.859338 - 5,254.133617
- 5,254.133618 - 5,347.339327
- 5,347.339328 - 5,490.254749
- 5,490.25475 - 5,682.879883

UBICACION DE ESTACIONES ACTINOMETRICAS DE MEDICION

50 25 0 50 Kilometro

Fuente: Mapas Solares de Nicaragua
Estación Actinometrica: Vadstena
Universidad Centroamericana (U.C.A)
Julio López de La Fuente SJ

PROYECTOS HIDROELECTRICOS EN OPERACIÓN

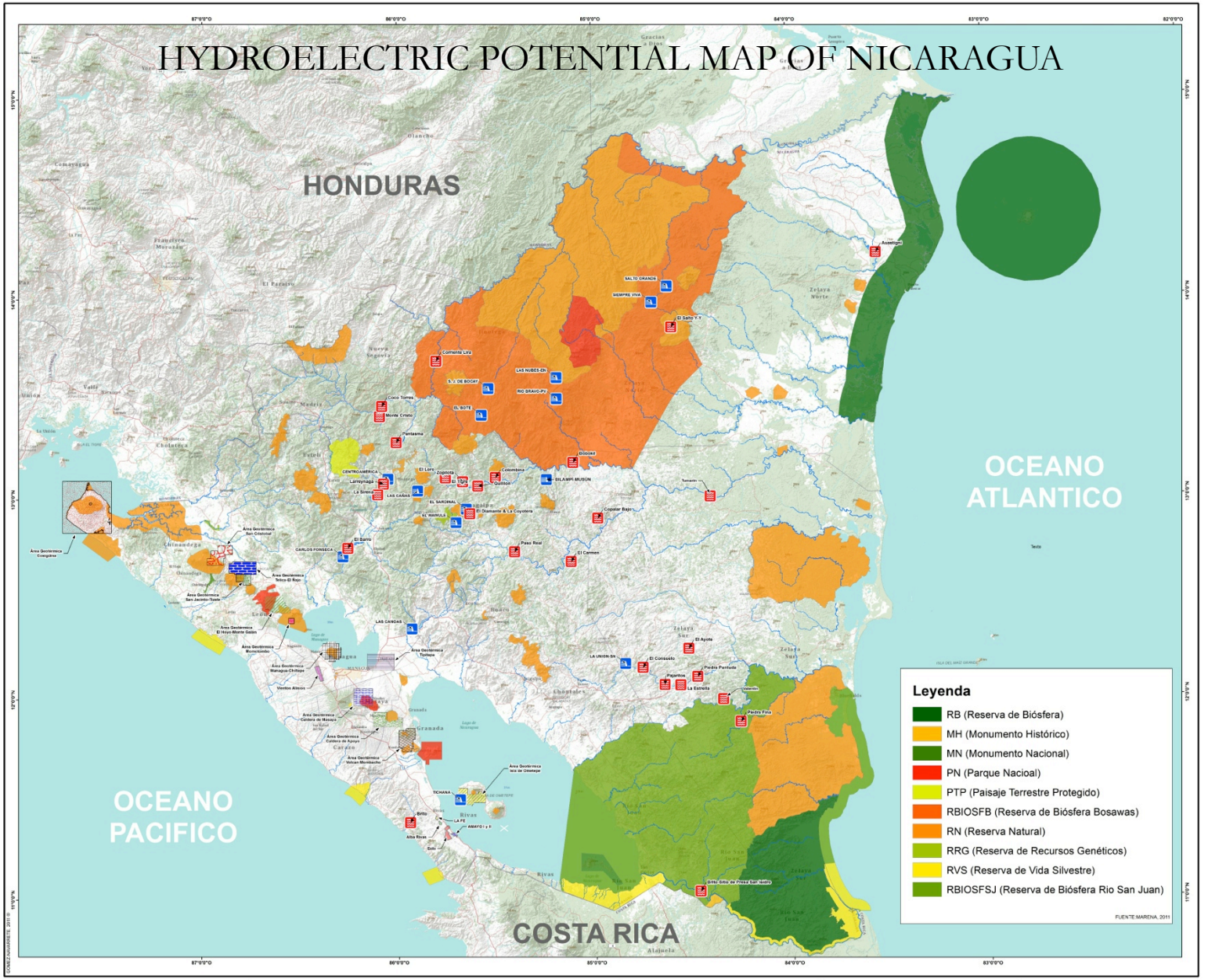
DEPARTAMENTO	PROYECTO	POTENCIA
Rivas	Tichana	0.5 MW
RAAN	Siempre Viva	2.5 MW
RAAN	Salto Grande	1.8 MW
JINOTEGA	S. J. De Bocay	0.2 MW
RAAN	Rio Bravo-PV	0.3 MW
RAAN	Las Nubes-EN	0.2 MW
MATAGALPA	Las Cañas	3.7 MW
BOACO	Las Canoas	1.8 MW
CHONTALES	La Union-SN	0.2 MW
MATAGALPA	El Wawule	1.7 MW
MATAGALPA	El Sardinal	1.8 MW
JINOTEGA	El Bote	0.9 MW
JINOTEGA	Centroamérica	50 MW
LEON	Carlos Fonseca	54 MW
RAAS	Bilampí-Musún	0.3 MW

POTENCIALES SITIOS HIDROELECTRICOS

(* en construcción)

DEPARTAMENTO	PROYECTO	POTENCIA
RAAS	Tumarín*	253 MW
JINOTEGA	Pantasma*	12.5 MW
MATAGALPA	La Mora*	1.8 MW
BOACO	Paso Real	16 MW
BOACO	El Carmen	100 MW
JINOTEGA	Monte Cristo	4 MW
JINOTEGA	Larreynaga	17 MW
MADRIZ	Coco Torres	6.3 MW
MATAGALPA	El Diamante	1.8 MW
MATAGALPA	El Loro	2.5 MW
MATAGALPA	Colombina	2.7 MW
MATAGALPA	El Tigre	5 MW
MATAGALPA	Zopilota	5.1 MW
MATAGALPA	Quililon	6 MW
MATAGALPA	Esquirín	10.5 MW
MATAGALPA	La Sirena	27 MW
MATAGALPA	El Barro	35.5 MW
MATAGALPA	Boboké	68 MW
Nva. SEGOVIA	Corriente Lira	40 MW
RAAN	Siempre Viva	1 MW
RAAN	Salto Grande	1.8 MW
RAAN	El Salto Y-Y	25 MW
RAAN	Auastigni	8 MW
RAAS	El Ayote	5 MW
RAAS	El Tortuguero	5.5 MW
RAAS	Piedra Puntuda	11 MW
RAAS	El Consuelo	13.3 MW
RAAS	La Estrella	17.4 MW
RAAS	Valentín	24.5 MW
RAAS	Pajaritos	30.5 MW
RAAS	Piedra Fina	44 MW
RAAS	Copalar Bajo	150 MW
RIO SAN JUAN	San Isidro	10 MW
RIVAS	Brito	250 MW

HYDROELECTRIC POTENTIAL MAP OF NICARAGUA



MINISTERIO DE ENERGÍA Y MINAS
DIRECCIÓN DE ELECTRICIDAD Y RECURSOS RENOVABLES
DIRECCIÓN DE LICENCIAS Y NORMACIÓN
MANAGUA, NICARAGUA

PROYECTOS HIDROELÉCTRICOS, EÓLICOS Y GEOTÉRMICOS vrs ÁREAS PROTEGIDAS EN NICARAGUA

AGOSTO DE 2011

ELABORA:	REVISA:	AUTORIZA:
GOMEZ NAVARRETE, J.	BERVIS, E.A	CORTES SANCHEZ, I.

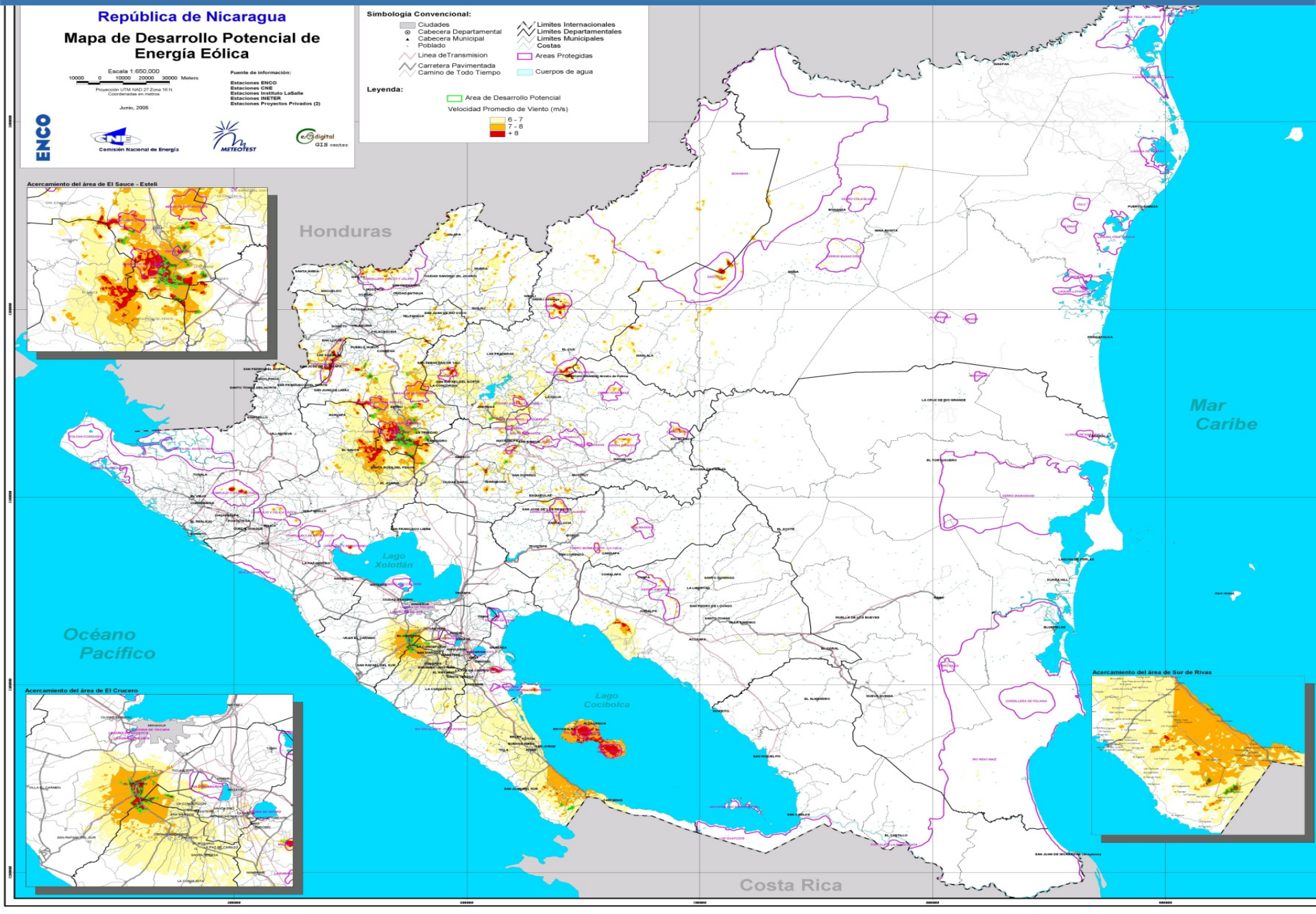
MAPA BASE SOLO REFERENCIAL. NO SE PROYECTA. NI GEORREFERENCIA. LOS DATOS CONTENIDOS FUERON SUMINISTRADOS POR LA DIRECCIÓN DE GEOTERMIA Y LADIRECCIÓN DE LICENCIAS Y NORMACIÓN DEL MEM. INFORMACIÓN DE ÁREAS SUMINISTRADA POR MARENA.

LEYENDA
CAPITAL
Sitios con Potencial Hidroeléctrico
Proyectos Hidroeléctricos en Operación

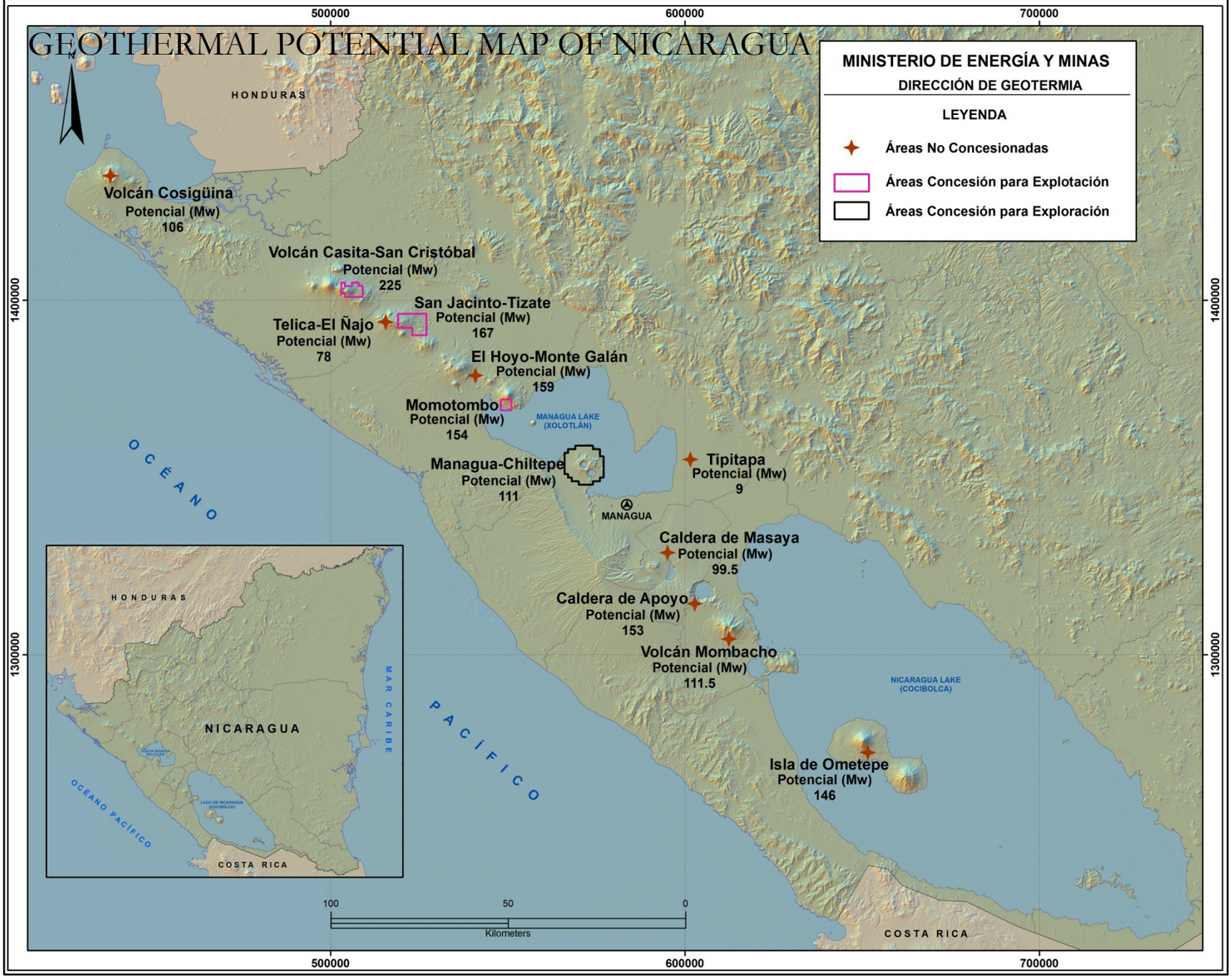
Gobierno de Reconciliación y Unidad Nacional
El Pueblo, Presidente!

MAPA DE POTENCIAL EOLICO

WIND POWER MAP OF NICARAGUA

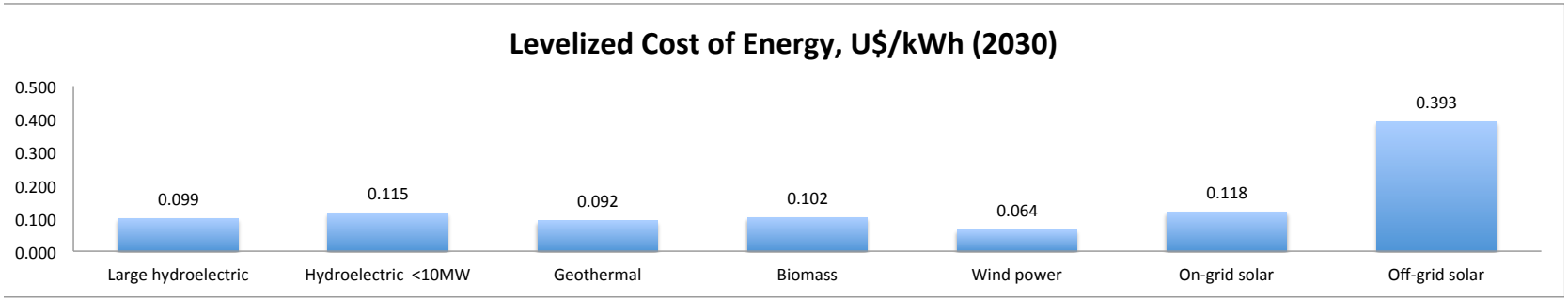


MAPA POTENCIAL GEOTÉRMICO SEGÚN PLAN MAESTRO DE NICARAGUA, 2001.



LCoE calculations for SREP	Large hydroelectric	Hydroelectric <10MW	Geothermal	Biomass	Wind power	On-grid solar	Off-grid solar
Project							
Size (kW)	100,000	5,000	35,000	30,000	40,000	15,000	1
Capacity Factor	56.00%	45.00%	95.00%	60.00%	42.00%	23.00%	19.00%
1st year production (kWh)	490,560,000	19,710,000	291,270,000	157,680,000	147,168,000	30,222,000	1,664
Annual degradation	0.00%	0.00%	0.10%	0.00%	0.00%	0.30%	0.50%
CAPEX / OPEX							
CAPEX ($/W)	$ 4.20	$ 3.50	$ 6.11	$ 3.50	$ 1.60	$ 1.90	$ 5.00
Variable costs	$ -	$ -	$ 0.002	$ 0.02	$ -	$ -	$ -
Escalaction of variable costs (%)	0.00%	0.00%	2.00%	5.00%	0.00%	0.00%	0.00%
O&M ($/kW)	$ 40.00	$ 30.00	$ 75.00	$ 15.00	$ 37.50	$ 16.50	$ 80.00
Escalation of O&M (%)	3%	3%	3%	3%	3%	3%	3%
Project PPA							
PPA global ($/kWh)	$ 0.118	$ 0.110	$ 0.090	$ 0.118	$ 0.110	$ 0.130	$ -
PPA escalation (%)	3.00%	1.50%	1.50%	1.50%	1.50%	1.50%	0.00%
Financing and discounting							
Discount rate (%)	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	8.0%
Debt ratio	70%	70%	70%	70%	70%	70%	0%
Debt amount	$294,000,000	$12,250,000	$149,756,250	$73,500,000	$44,800,000	$19,950,000	$0
Debt rate	7.0%	8.0%	7.5%	8.0%	8.0%	7.0%	0.0%
Debt tenure	20	10	20	12	10	15	0
LCoE results							
Discounted - Levered 15 years	0.099	0.115	0.092	0.102	0.064	0.118	0.393
Discounted - Levered 20 years	0.096	0.106	0.089	0.096	0.060	0.109	0.355
Discounted - Levered 30 years	**0.090**	**0.099**	**0.084**	**0.093**	**0.057**	**0.103**	**0.326**

	Ex: : El Carmen	Ex: : El Diamante	Ex: : Chile	Ex: : NSL	Ex: : EOLO	Ex: : NSP	Ex: : bE (RAAS)
Total CAPEX	$420,000,000	$17,500,000	$213,937,500	$105,000,000	$64,000,000	$28,500,000	$5,000
OPEX (Year 1)	$4,000,000	$150,000	$3,207,540	$2,815,200	$1,500,000	$247,500	$80



ANNEX (9) LIST OF POWER GENERATION PLANTS (SIN)

	Effective capacity 2014 (MW)	Nominal capacity en 2014 (MW)
Fossil fuel-based plants	**570.16**	**652.5**
Nicaragua (GEOSA)	100	106
Managua (GECSA)	11	57.4
Censa - Amfels	60.9	65.3
Empresa Energética de Corinto, Ltda.	70.5	74
Tipitapa Power Company	50.9	52.2
Generadora San Rafael, S.A. (Gesarsa - ENEL)	0	6.4
Hugo Chávez (ALBANISA)	60	60
Che Guevara I (Tipitapa) (ALBANISA)	19.2	20.4
Che Guevara II (Masaya) (ALBANISA)	19.2	20.4
Che Guevara III (Managua) (ALBANISA)	19.2	20.4
Che Guevara IV (Masaya) (ALBANISA)	19.2	20.4
Che Guevara V (Masaya) (ALBANISA)	18.6	20.4
Che Guevara VI (Nagarote) (ALBANISA)	12.87	13.6
Che Guevara VII (Nagarote) (ALBANISA)	38	40.8
Che Guevara VIII (León) (ALBANISA)	25.27	27.2
Che Guevara IX (ALBANISA)	45.32	47.6
Biomass-based plants	**124.8**	**253.5**
Nicaragua Sugar Estate Ltd(NSEL)	77.3	79.3
Monte Rosa	47.5	54.5
Agroindustrial Azucarera S.A(Timal)	0	119.7
Hydroelectric power plants	**111.9**	**134.7**
Centroamérica (HIDROGESA)	48	54.4
Santa Bárbara (HIDROGESA)	50	0.9
ATDER-BL El Bote	0.9	14.4
Hidro Pantasma (HPA)	13	65
Gas turbine plants	**0**	**65**
Las Brisas (ENEL)	0	65
Geothermal plants	**69.34**	**154.5**
Momotombo Power Company (MPC)	23	77.5
Polaris Energy Nicaragua, S.A (PENSA)	46.34	77

Wind power plants	**179.56**	**186.6**
Consorcio Eólico, S.A (AMAYO I)	39.9	39.9
Consorcio Eólico, S.A (AMAYO II)	23.1	23.1
Blue Power & Energy, S.A	39.6	39.6
Eolo de Nicaragua, S.A	36.96	44
Blue Power & Energy, S.A (PBP)	40	40
Total on-grid power (SIN)	**1,055.76**	**1,381.8**

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