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Energía y Recursos Naturales

**ENERGY EFFICIENCY IN CENTRAL AMERICA:  
PROGRESS AND ACTION TOWARDS THE  
FULFILLMENT OF THE GOALS OF THE  
CENTRAL AMERICAN SUSTAINABLE  
ENERGY STRATEGY**

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This document was prepared under the supervision of Victor Hugo Ventura, Chief of the Energy and Natural Resources Unit of the ECLAC Subregional Headquarters. Victor Hugo Ventura and Ryan Carvalho produced substantive content with the collaboration of Eugenio Torijano and Manuel Eugenio Rojas, Research Assistants.

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## EXECUTIVE SUMMARY

Energy Efficiency (EE) activities began in the Central American countries during the seventies as a result of the first oil shocks. However, various factors, including socioeconomic and political problems during the eighties and low crude oil prices, resulted in EE activities being given lesser importance. Nevertheless, the need for energy efficiency and conservation became a priority once again at the beginning of this millennium and especially after 2003 when international crude oil prices began to rise, showing no sign of returning to previous levels.

During the period from 2003-2007, the Central American countries put in place an Energy Emergency Plan that was prepared for the Central American Integration System (SICA) with the support of the Economic Commission for Latin America and the Caribbean (ECLAC), implementing this plan with the cooperation of international agencies, donors and multilateral banks. The Plan prioritized EE initiatives and promoted increased use of Renewable Energy Sources (RES).

The discussion of strategies to address the oil crisis resulted in the countries developing a regional energy agenda. With the support of ECLAC, the institution responsible for the base studies, the Central American Sustainable Energy Strategy 2020 (Energy Strategy 2020) was approved in November 2007. The strategy is focused on promoting sustainable development of the regional energy sector. The Energy Strategy 2020 contains four goals linked to EE (energy efficiency in lighting, refrigerators and industrial electric motors; reduction of electricity losses in transmission and distribution; reduction of consumption of oil derivatives in public and private transport sectors; and promotion of sustainable, efficient and clean firewood stoves in rural areas).

Six years after approval of the Energy Strategy 2020, the status of Energy Efficiency (EE) programs and initiatives in Central American countries varies greatly. The process of restructuring and transformation of the energy sectors, which commenced in the nineties, has yielded varying results. In some countries, the creation or strengthening of a government institution (ministry or department) responsible for energy policymaking and governance has only been achieved in the last few years. This has been a positive factor for the organization and promotion of EE initiatives and projects.

The conditions of net oil importing countries and the negative impacts of high oil prices have raised awareness among governments, institutions and society in general of the importance of EE. However, the supply of electricity and other highly sensitivity issues (especially those related to reviews and price adjustments, tariffs and subsidies, and social opposition to new hydroelectric and easements for expansion of transmission and distribution systems) continue to dominate the energy agenda of these countries, resulting in the postponing of decisions related to the creation and/or strengthening of institutions devoted to EE.

The regulatory and institutional contexts of energy services in the region have many similarities, and it is possible to identify two main models: one with high government involvement in the provision of energy services, and the other fully or partially liberalized, with predominant involvement of private entities engaged in providing energy services. In this context, there are two countries that have adopted a legal framework to promote EE, each representing one of these two models: Costa Rica, which passed its EE law nearly two decades ago and is now discussing changes to update this legal framework, and Panama, which recently passed a law on this matter and is working on the rules and regulations that comprise the legal framework for EE. Both countries can be considered as leaders in EE in the sub-region, although both are tackling a broad agenda and have much work left to do.

In the case of Costa Rica, the allocation of resources to promote and coordinate EE activities EEC is still pending; however institutions like the Costarican Electricity Institute (ICE) and international cooperation have played an important role. In the case of Panama, its EE law is very recent (2012), although there is significant progress towards sustainability in EE activities.

Important progress has been achieved in EE activities and programs, especially in countries where the private sector and universities have begun to take a leadership role within their respective areas. However, the region continues to be overly dependent on international cooperation to promote EE programs, despite signs that energy prices reflect conditions of scarcity, which in turn would imply higher returns for investments in EE. This indicates that there are still barriers relating to a lack of knowledge on the part of end users as to how to achieve greater energy efficiency.

There are still risks and threats to the strengthening and sustainability of EE, particularly in the four Central American countries that have not yet institutionalized this activity. These risks and threats include: difficulty in monitoring the results of energy efficiency programs; a lack of continuity in the implementation of energy efficiency policies, especially after changes or relay in the administration of the institutions; failure to incorporate EE within state policies; and the still emerging and scarce domestic sources of funding, specifically for energy efficiency programs.

Even though the EE goals established in the Energy Strategy 2020 are considered conservative, it would appear that their fulfillment is not easy, especially in certain areas and countries (e.g. transportation in all countries and reduction of electricity losses in Honduras and Nicaragua). In the case of efficient lighting, the goals seem achievable, although the most significant obstacles could result from a failure to reach agreements on harmonization of regional standards and to create a regional market for efficient lamps that would lower the prices of energy-efficient light bulbs. In this regard, it should be emphasized that a successful regional program for efficient lighting could pave the way for other programs like the initiative to replace inefficient refrigerators in the residential sector. For programs aimed at deploying efficient industrial motors, the respective chambers, unions or industry associations should be included in these initiatives.

In the case of traditional energy, the entry of the region into the Global Alliance for Clean Cook stoves (GACC) and the commitment of funds and support from donor countries and multilateral development banks are steps in the right direction. The main challenge continues to be the establishing of multi-sector country level units to coordinate and execute programs and projects for sustainable use of firewood in the region.

In El Salvador it is important to highlight the achievements of the central government and the National Energy Council (CNE). This experience could be used as an example for countries that do not have EE laws or institutions dedicated to EE. To this end, it is recommended that these countries incorporate activities and programs in the short to medium term (1 to 4 years) with achievable goals and verifiable results.

Given prevailing conditions and current political situation (2013-2014), it would seem highly unlikely that three countries, (Guatemala, Honduras and Nicaragua) will pass EE legislation over the short and medium term. It is therefore advisable to find mechanisms which facilitate the continuity of existing and planned EE initiatives and programs, especially after changes in administration.

It is important to note that energy efficiency is one of the pillars of the United Nations "Sustainable Energy for All (SE4ALL)" initiative. Central American countries have joined this initiative and commitments made as a result of this initiative could act a bridge for the continuity of EE programs.

## FOREWORD

This document has been prepared by the Mexico City Subregional Headquarters of the Economic Commission for Latin America and the Caribbean (ECLAC), with the purpose of assessing the progress towards fulfillment of the energy efficiency goals of the Central American Sustainable Energy Strategy 2020 (Energy Strategy, 2020). A preliminary version of this assessment was presented at a meeting of experts held in Panama from September 4 to 6, 2013. During these meetings, high level representatives of the Energy and Hydrocarbon Directorates of Central American countries as well as representatives from the Central American Integration System, cooperation agencies, multilateral organizations and regional initiatives provided important feedback and comments, mainly with regards to recent projects and action in the field of energy efficiency.

The document was prepared under the supervision of Victor Hugo Ventura, Chief of the Energy and Natural Resources Unit of the ECLAC Subregional Headquarters, with the participation of the staff from the Unit. Ryan Carvalho produced substantive content with the collaboration of Eugenio Torijano and Manuel Eugenio Rojas, Research Assistants.



## I. THE MOTIVATIONS FOR AND ROLE OF ENERGY EFFICIENCY PROGRAMS IN CENTRAL AMERICA

### A. INTRODUCTION AND BACKGROUND

#### 1. Introduction

Energy is a crucial element for economic development and quality of life in any economy. The supply of reliable and quality energy services at a reasonable cost is essential for economic growth. In Central America, energy security is a major concern due to the fact that these countries are net oil and fossil fuel importers. With the exception of two countries, which have small amounts of crude oil reserves, there are no proven hydrocarbon reserves in the rest of the region. The economies of Central America have been heavily impacted by rising oil prices during the period from 2003 to 2008 and the fivefold increase in prices over those from the final decades of the last century. Since 2009, average oil prices have stayed high, very close to the levels recorded in 2008, showing high volatility.

In response to high oil prices, Central American countries have taken a series of actions to promote energy efficiency and to facilitate the development of renewable energy sources. Both measures have also been promoted for their role in mitigating greenhouse gas emissions, though it is important to note that Central American countries are very low emitters of greenhouse gasses. This paper is dedicated to the former topic and aims to determine the actual progress made in energy efficiency (EE) in the six Central American countries (Belize is not included in this evaluation).

This document offers recommendations to overcome the barriers and obstacles that EE initiatives and activities are facing, aiming to influence and contribute to the attainment of the objectives set out in the Central American Sustainable Energy Strategy 2020 (Energy Strategy 2020). The objectives of Energy Strategy 2020 are presented in box 1 along with the established Energy Efficiency goals.

#### 2. Background

Central America is made up of a long tapering isthmus that connects North and South America. Central America has an area of about 500,000 square kilometers (CEPAL, 2013d) and includes (from north to south) the countries of Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. As of 2011, the region had a population of approximately 45 million (CEPAL, 2013d), which translates into approximately 90 people per square kilometer. The region is highly vulnerable to natural disasters, especially hurricanes and tropical storms. Geologically there is a high risk of earthquakes, mainly in four countries (Costa Rica, Guatemala, El Salvador and Honduras).

Economically these countries are very diverse. While average GDP growth for the region as a whole was approximately 5% in 2012, there were large variations within the region, with Panama growing at a rate of 10.7% and El Salvador growing at a much slower pace of 1.6%. Following a slowdown due to the global financial crisis of 2008, which had a significant effect on the economies of the region, these countries have returned to pre-crisis rates of growth (CEPAL, 2013a).

On examining the gross domestic product figures for 2012 for the region we see discernible differences between the countries, with Costa Rica and Panama registering higher levels of GDP per capita as compared to the rest of the group, at approximately \$6,000 and \$7,500 USD. Guatemala and

El Salvador have a per capita GDP of between \$2,300 and \$3,000 USD, while Nicaragua and Honduras have a per capita GDP close to \$1,500 dollars (figures are in constant 2005 dollars, CEPAL 2013d). With regards to exports the region has predominantly been an exporter of agriculture products like coffee and bananas; however exports of clothing, electronics, manufactured goods and services have been on the rise in recent years.

**BOX 1**  
**ENERGY STRATEGY 2020**

The objective of the Central American Energy Strategy 2020 is to secure the supply of energy in Central America, guaranteeing adequate quality, quantity and diversity of supply while ensuring the sustainable development of the region. The strategy takes into account the needs of the region in terms of social equality, economic growth, protection of the environment and compatibility with international environmental commitments.

The strategy has 7 major objectives:

- 1) To reduce the demand for petroleum products.
- 2) To reduce dependence on imported energy sources by promoting renewable energy.
- 3) To improve Energy Efficiency and promote the rational use of energy.
- 4) To promote the use of technologies and energy sources that are less harmful to the environment.
- 5) To improve access to energy, especially for low income groups and isolated populations.
- 6) To mitigate the environmental effect of energy production and use.
- 7) To develop energy projects with natural resources which are compatible with the environment.

The strategy also defines several goals to be attained for each objective by the year 2020, which have been endorsed by regional authorities. Below are the goals that have been defined for Energy Efficiency:

- 1) Reduce the use of firewood for cooking through deployment of efficient firewood stoves in one million rural homes in Central America.
- 2) Reduce by 12% the use of electricity in the residential, commercial, industrial and public lighting sectors through deployment of efficient lighting systems.
- 3) Reduce by 35% the use of electricity for refrigeration in the residential sector through the substitution of older inefficient refrigerators by efficient refrigerators.
- 4) Reduce by 10% the use of electricity in the industrial sector through deployment of efficient motors.
- 5) Ensure transmission losses in electricity networks do not exceed more than 12% for the region.
- 6) Reduce by 10% the consumption of petroleum derivatives used for public and private transport through measures such as efficient driving and introduction of standards for import of efficient vehicles and promotion of public transport.

Source: CEPAL 2007.

Energy Efficiency (EE) policies first appeared in Central America in the seventies as a result of the first oil shocks. However, several factors, including socioeconomic and political problems in the eighties and lower oil prices, resulted in a reduced focus on EE activities in most of these countries. It was only at the beginning of the new millennium, especially since 2003, when the countries of the subregion

began to suffer from the effects of sustained increases in oil prices that EE programs came back into focus.<sup>1</sup>

As a primary energy product, oil and its derivatives are used directly and/or indirectly in various economic activities. A rise in production costs, tighter margins at companies, and inflationary pressures, have all affected private and public transport, electricity production, energy-intensive industries, and family household budgets. The impacts are greater in the case of net importers of oil products, as is the case of Central American countries (ECLAC, 2009).

As an immediate response aimed at mitigating the impact of high oil prices, the countries in this region have implemented EE measures and initiatives. Additionally, these countries have encouraged increased use of renewable energy sources (RES). These measures improve energy security, reduce oil dependence and also offer an effective means of reducing the production of greenhouse gases (GHG). EE and RES are both key components of the Energy Strategy 2020 adopted by these countries in late 2007.

## B. ENERGY IN CENTRAL AMERICA

The energy market in Central America is characterized by elevated use of traditional energy sources (wood and biomass), especially in less developed countries, and an almost total dependence on imported hydrocarbons and fossil fuels for modern energy uses.

### 1. Primary energy mix

A breakdown of the primary energy sources for the Central American region can be seen in graph 1. The region as a whole is very dependent on firewood as a source of primary energy. This is mainly due to consumption of wood for cooking in rural areas, particularly in Guatemala, Honduras and Nicaragua, and to a lesser extent in other Central American countries. Hydropower, geothermal energy and biomass products like sugarcane are also an important part of the primary energy mix in Central America. Volcanic activity throughout the Circum Pacific Ring along the southern coast of Central America offers the region excellent opportunities to exploit geothermal energy. As of 2011, total primary energy consumption in Central America was 131,150<sup>2</sup> kilo barrels of oil equivalent (OLADE, 2013a).

### 2. Secondary energy mix

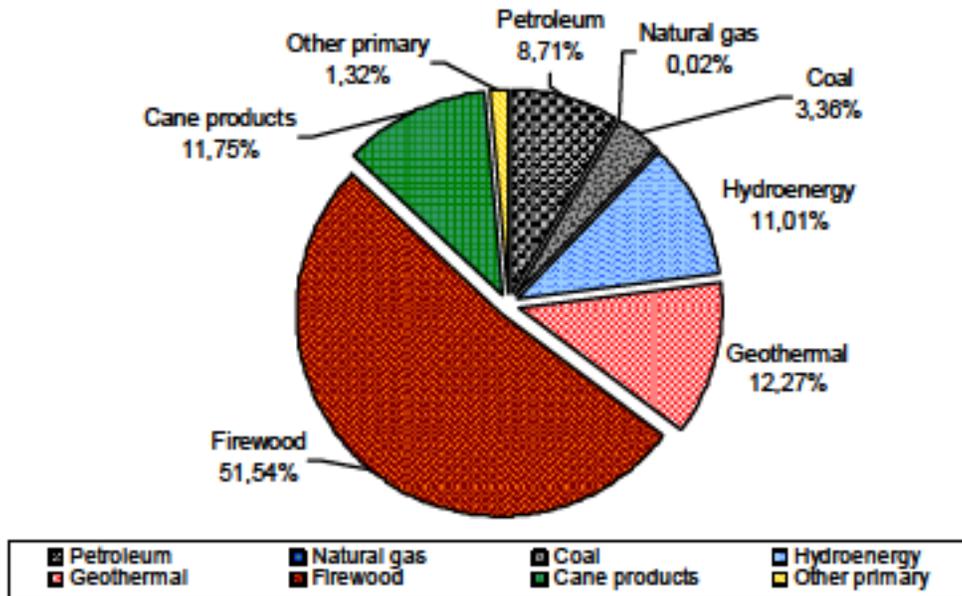
The secondary energy mix (referred to as commercial or modern energy, i.e., that which results from transforming primary energy resources) is characterized by a high degree of dependence on petroleum derivatives. Around 76.5% of secondary energy corresponds to oil and 19.4% to electrical energy. Considering that at least 33% of electricity was produced from petroleum products (mainly fuel oil), we can conclude that modern fuel dependency on oil in Central America is 83% (2011, see graph 2).

<sup>1</sup> During the nineties, the average price of a barrel of oil was below \$20, while from the year 2000, there were significant increases in average prices of 31, 71 and 89 dollars per barrel during the five-year periods 2000-2004 and 2005-2009 and the period from 2010-2012, respectively; this upward trend remains evident in the beginning months of 2013. Figures refer to the benchmark crude West Texas Intermediate (WTI). During the first half of 2013, WTI crude had an average price of \$94.5/barrel (EIA, 2013).

<sup>2</sup> OLADE, SIEE.

**GRAPH 1**  
**CENTRAL AMERICAN PRIMARY ENERGY SUPPLY**

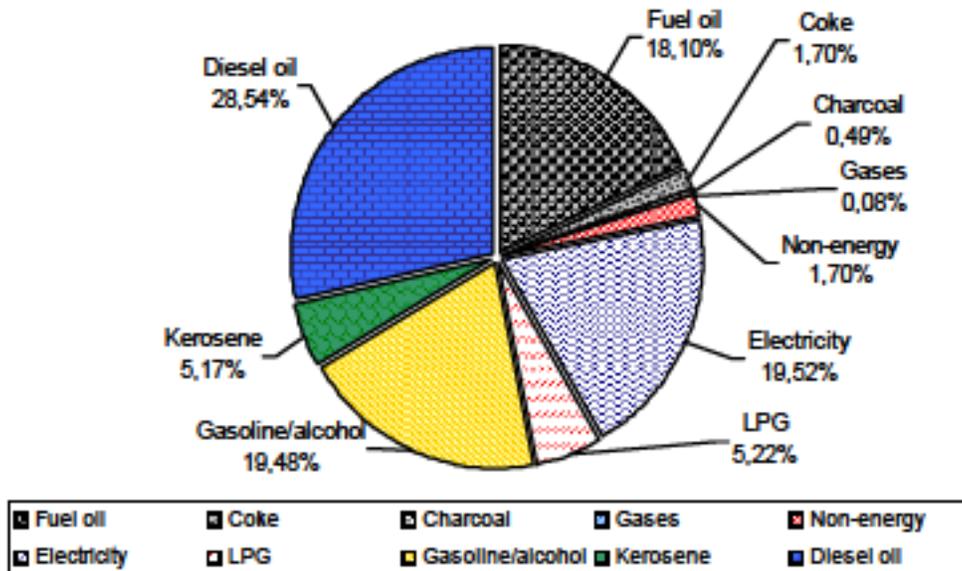
*(In percentages)*



Source: Latin American Energy Organization (OLADE).

**GRAPH 2**  
**CENTRAL AMERICAN SECONDARY ENERGY MIX, 2011**

*(In percentages)*



Source: Latin American Energy Organization (OLADE).

a) **Hydrocarbons**

More than half of the secondary energy sources are consumed by the transportation sector, in the form of gasoline and diesel fuel. Moreover, many of these products are imported. Only a small portion of oil derivatives was obtained from local refinery production. Crude oil imports have also seen a steady decline in recent years due to the closure of certain refineries,<sup>3</sup> which has made the region into a net importer of refined oil products. That being said, there are initiatives in place aimed at building new refineries, which, if realized, would come into operation by the end of this decade.<sup>4</sup> Crude oil imports in the region are sent largely to refineries in El Salvador and Nicaragua, and in smaller volumes to other sub-regions (See table 1).<sup>5</sup>

**TABLE 1**  
**CENTRAL AMERICAN CRUDE OIL PRODUCTION AND IMPORTS, 2007-2011**  
*(In thousands of barrels)*

	2007	2008	2009	2010	2011
Production	6 598.11	6 371.83	6 536.89	5 876.58	5 699.24
Imports	18 097.84	16 779.28	14 663.84	14 419.50	11 086.14

Source: ECLAC, 2011, based on official figures.

A breakdown of the consumption of refined petroleum products by type (graph 3) shows high consumption of Diesel and Gasoline, which represent 64% of consumption of refined petroleum. Diesel and Gasoline are used mainly in transportation sectors. Fuel oil, which represents 20% of consumption of refined petroleum, is used primarily for electricity generation and other industrial uses. Consumption of liquefied petroleum gas (LPG) which is used mainly in domestic settings, such as for cooking in homes, represents a small part of the refined petroleum consumption mix. Total consumption of refined petroleum products in Central America in 2011 was approximately 110 million barrels of oil equivalent (CEPAL, 2012b).

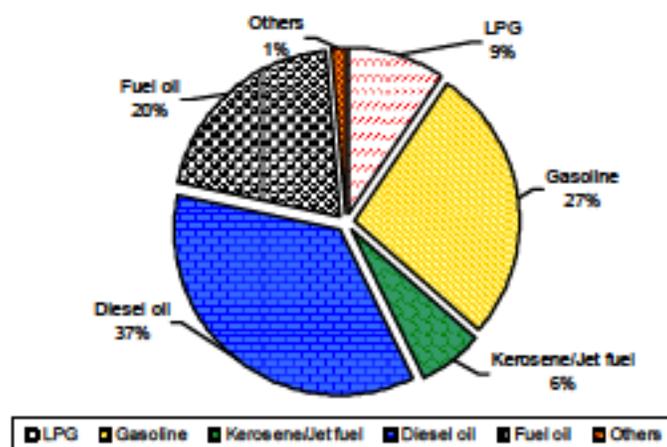
The supply of oil and oil derivatives is managed individually in each country. Nevertheless, some progress has been made in integrating the regional hydrocarbon market. In recent years, these countries have adopted common specifications for petroleum derivatives in the region. A total of seventeen technical regulations have been approved by the Central American Customs Union for petroleum products like diesel and gasoline, in order to facilitate the free movement of petroleum derivatives within the region and to permit better utilization of regional port facilities and storage capacity. However, to date, and with the exception of liquefied petroleum gas, transport of oil derivatives within the region has remained at a small scale.

<sup>3</sup> The Honduran refinery closed in 1991, the Guatemalan and Panamanian refineries in 2002, and the Costa Rican refinery in 2011.

<sup>4</sup> Total crude oil production in Guatemala and Belize is not large enough to justify investment in refineries for processing of crude oil. Costa Rica and Nicaragua have gone ahead with projects to construct refineries which will commence operation by the end of the decade.

<sup>5</sup> As of 2010, Latin America's crude oil demand was approximately 7% of world demand, while that of Central America was less than 1% (OLADE, 2013).

**GRAPH 3**  
**CENTRAL AMERICA: CONSUMPTION OF PETROLEUM DERIVATIVES, 2011**



Source: ECLAC, based on official figures.

#### b) Electricity

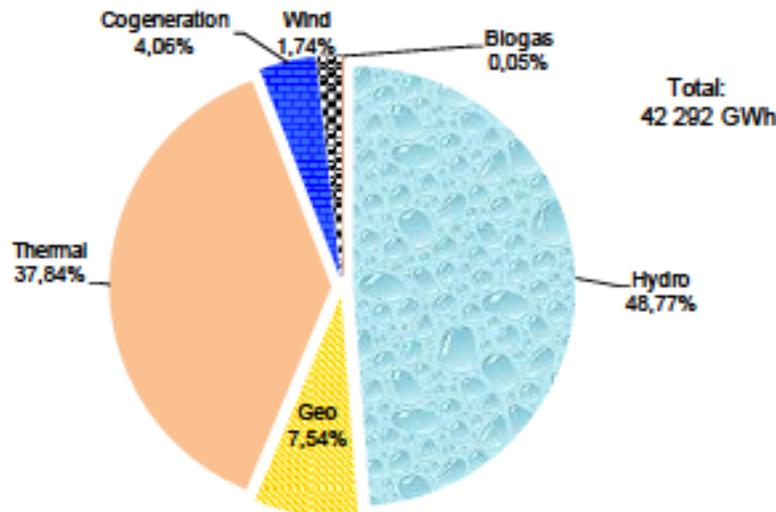
In 2011, the electricity market of Central America had a total installed capacity of around 11,920 MW (table 2) with approximately 42,000 GWh of electricity produced (graph 4) (CEPAL, 2012a). It is interesting to note that total installed capacity in Central America in 1990 corresponded predominantly to hydroelectricity, while in the period from 1990 to 2005, the share of renewable sources in electricity generation, such as geothermal and hydroelectric power plants, declined as countries invested more in thermal power plants, in response to the low oil prices of the nineties and the early years of the new millennium. With the emergence of high oil prices, these countries took a series of measures to facilitate the development of renewable energy sources (RES), which since 2006 has resulted in a reversal in downward trend of these sources' share in electricity production. In 2011, 62.2% of electricity was produced using RES (48.8% hydro, geothermal 7.5%, bagasse in sugar mills 4.1% and wind 1.7%), and 37.8% from thermal sources. There are marked differences in the share of RES between countries: Costa Rica (91%), Guatemala (64%), El Salvador (63%), Panama (53%), Honduras (44%) and Nicaragua (33%).

**TABLE 2**  
**CENTRAL AMERICA: TOTAL INSTALLED ELECTRICITY GENERATION**  
**CAPACITY BY TYPE, 2011**  
*(In megawatts)*

	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Total
Total	2 650.3	1 503.5	2 588.5	1 788.9	1 093.7	2 295.6	11 920.6
Hydroelectricity	1 643.7	486.5	902.3	529.1	105.3	1 293.4	4 960.5
Geothermal	217.5	204.4	49.2	-	87.5	-	558.6
Thermal	612.6	691.2	1 253.6	1 021.4	716.1	1 002.1	5 297.0
Cogeneration	40.0	115.0	383.5	136.4	121.8	-	796.7
Wind	132.8	-	-	102.0	63.0	-	297.8
Biogas	3.7	6.4	-	-	-	-	10.1

Source: ECLAC, based on official figures.

**GRAPH 4**  
**CENTRAL AMERICA: ELECTRICITY GENERATION BY SOURCE, 2011**



Source: ECLAC, based on official figures.

Despite the efforts made in the Central American countries, the region's electricity industry remains highly sensitive to the prices of petroleum products. Much of Central America's hydro and geothermal energy sources remain unexploited. According to available data, it is estimated that less than 20% of Central American hydro energy potential is currently being exploited. In the case of geothermal energy, wind and solar, the use of these energy sources is even lower. An increased use of RES would reduce Central America's dependency on imported fuel for electricity generation and would have the added environmental benefit inherent to renewable energy sources. However, RES, mainly hydroelectricity, is not free of environmental and social challenges.

The first proposal to interconnect the region's electric grids was in the sixties, while studies for integration of regional petroleum markets were developed in the seventies and eighties. The interconnection of the electricity networks of Honduras and Nicaragua in 1975 paved the way for the development of other bi-national interconnections. In December 1996, the Presidents of Central America approved the Framework Agreement for the Central American Electricity Market. This agreement, which was ratified later by the Assemblies of the countries, establishes the basis for the formation of a competitive Regional Electricity Market, aiming to contribute to the sustainable development of the region. The principles of this market are competition, gradualness and reciprocity. The construction of a primary regional network, known as the Electrical Interconnection System for the Countries of Central America (SIEPAC, in Spanish), is nearing completion, though there are still many challenges facing the regional electricity market (CEPAL, 2013c).

In order to understand the evolution of the region's energy sector it is necessary to review some of the key energy indicators of the region.

## C. CENTRAL AMERICAN ENERGY INDICATORS

### 1. Per capita firewood consumption

Firewood is a key component of the primary energy mix in Central America and is used primarily for cooking in rural households. Guatemala, Honduras and Nicaragua have the highest per capita consumption of firewood in the region, while Costa Rica, El Salvador and Panama have lower levels of firewood consumption (see table 3). Energy policies have focused on sustainable consumption of firewood through the promotion of clean and efficient firewood stoves and education of the population on sustainable consumption of firewood. However, over the period 2007 to 2011 per capita firewood consumption in the region has remained steady and no real reduction can be observed. The reduction in firewood consumption through deployment of efficient firewood stoves is one of the goals of the Energy Strategy 2020. Additional efforts are needed to ensure that the strategy goals can be fulfilled in this area.

### 2. Per capita energy consumption

Per capita energy consumption in the region has been increasing steadily (table 4), which suggests that demand for energy has not been influenced by high crude oil prices. However, this could in part be explained by energy subsidies, which have the effect of shielding the populations from the rise in international oil prices.

### 3. Energy intensity

In terms of overall energy intensity, Panama has the lowest energy intensity at 0.97 barrel of oil equivalent (boe) per US dollar, while Nicaragua has the highest energy intensity at 2.71 boe per US dollar. Costa Rica and El Salvador, along with Panama, appear to be relatively more efficient at using energy per unit of economic output, while Guatemala, Honduras and Nicaragua use more energy per unit of economic output (table 5).

**TABLE 3**  
**CENTRAL AMERICA: FIREWOOD CONSUMPTION PER CAPITA, 2007-2011**  
*(In barrel of oil equivalent (boe)/inhabitant)*

Country	2007	2008	2009	2010	2011
Costa Rica	0.76	0.96	0.60	0.66	0.62
El Salvador	0.89	0.90	0.59	0.59	0.59
Guatemala	1.97	1.95	2.02	2.65	2.64
Honduras	1.53	1.57	1.57	1.58	1.58
Nicaragua	1.26	1.25	1.23	1.21	1.23
Panama	1.01	0.93	0.86	0.78	0.71
Central America	0.97	0.97	0.96	0.97	0.97

Source: SIEE, OLADE.

**TABLE 4**  
**CENTRAL AMERICA: PER CAPITA ENERGY CONSUMPTION, 2007-2011**  
*(In barrel of oil equivalent (boe)/inhabitant)*

Country	2007	2008	2009	2010	2011
Costa Rica	5.89	6.06	5.58	5.63	5.52
El Salvador	3.58	3.43	3.24	3.23	3.22
Guatemala	3.89	3.70	4.08	4.66	4.41
Honduras	3.75	3.69	3.63	3.59	3.53
Nicaragua	2.58	2.55	2.49	2.52	2.57
Panama	6.19	6.08	6.56	6.73	7.04
Central America	4.06	3.96	4.04	4.25	4.18

Source: SIEE, OLADE.

**TABLE 5**  
**CENTRAL AMERICA: ENERGY INTENSITY, 2007-2011**  
*(In boe/thousand dollars)*

Country	2007	2008	2009	2010	2011
Costa Rica	1.14	1.16	1.11	1.07	1.07
El Salvador	1.20	1.14	1.12	1.10	1.09
Guatemala	1.71	1.61	1.82	2.06	1.92
Honduras	2.44	2.35	2.41	2.36	2.28
Nicaragua	2.79	2.71	2.73	2.67	2.71
Panama	1.14	0.99	1.04	1.01	0.97
Central America	1.50	1.42	1.48	1.52	1.45

Source: SIEE OLADE.

#### 4. Oil intensity

In examining the oil intensity for the region, excluding consumption of hydrocarbons used for electricity generation, we can see a steady trend for the region as a whole. Oil intensity for the region has decreased over the 5 year period from 2007 to 2011. Costa Rica has the lowest oil intensity, while Nicaragua has the highest intensity, followed by Honduras and El Salvador (table 6).

**TABLE 6**  
**CENTRAL AMERICA: OIL FINAL CONSUMPTION INTENSITY, 2007-2011**  
*(In barrel of oil equivalent (boe)/thousand dollars)*

Country	2007	2008	2009	2010	2011
Costa Rica	0.730	0.673	0.670	0.564	0.523
El Salvador	0.843	0.749	0.827	0.824	0.802
Guatemala	0.790	0.691	0.757	0.691	0.644
Honduras	1.208	1.116	1.063	1.070	0.983
Nicaragua	1.334	1.143	1.195	1.193	1.147
Panama	0.769	0.773	0.817	0.797	0.766
Central America	0.852	0.776	0.813	0.760	0.716

Source: ECLAC, based on official figures.

### 5. Per capita electricity consumption

Per capita electricity consumption in Central America has remained relatively stable over the period from 2007 to 2011. Costa Rica and Panama have high levels of per capita electricity consumption at over 1800 kWh, followed by El Salvador at approximately 800 kWh. Electricity consumption in Guatemala, Honduras and Nicaragua ranges from 400 to 650 kWh (table 7). Higher consumption of electricity in Costa Rica and Panama can be attributed to these countries' higher levels of economic activity and to the warm and humid weather, which requires the use of air conditioning.

**TABLE 7**  
**CENTRAL AMERICA: ELECTRICITY CONSUMPTION PER CAPITA, 2007-2011**  
(In kWh/inhabitant)

Country	2007	2008	2009	2010	2011
Costa Rica	1 862.3	1 878.0	1 829.2	1 862.2	1 846.9
El Salvador	801.6	827.2	820.4	831.0	847.4
Guatemala	489.6	479.1	493.0	497.2	502.4
Honduras	660.7	678.2	645.2	636.6	637.1
Nicaragua	374.6	393.2	400.1	421.7	445.1
Panama	1 586.7	1 605.1	1 663.4	1 778.1	1 856.0
Central America	793.2	801.6	798.2	814.2	824.9

Source: ECLAC, based on official figures.

### 6. Electricity intensity

Electric Energy Intensity for the Central American region has steadily declined over the five year period from 2007 to 2011 (table 8). Costa Rica, Panama, El Salvador and Guatemala had the lowest levels of electric energy intensity in the region, while Honduras and Nicaragua registered higher levels.

**TABLE 8**  
**CENTRAL AMERICA: ELECTRICITY INTENSITY, 2007-2011**  
(Megawatt hour (MWh)/thousand dollars, constant 2000)

Country	2007	2008	2009	2010	2011
Costa Rica	373.9	350.2	349.8	297.1	271.5
El Salvador	292.8	295.5	304.4	303.7	298.5
Guatemala	230.6	209.3	228.2	218.7	205.9
Honduras	485.0	470.7	446.7	421.2	403.0
Nicaragua	445.8	437.3	460.7	471.3	469.2
Panama	322.4	296.2	296.0	296.8	277.6
Central America	325.3	307.6	313.8	296.8	280.0

Source: ECLAC, based on official figures.

### 7. Electricity losses

Electricity losses in the region are high, with a regional average of around 14.9% in 2010 and 16% in 2011. Honduras and Nicaragua have transmission and distribution losses of over 20%, which are significantly

higher when compared with the rest of the countries in the region (table 9). El Salvador, Guatemala, Costa Rica and Panama, while registering losses lower than the regional average, have the potential to achieve further reductions. It is important to note that while Costa Rica has managed to maintain electricity losses at approximately 10% over the period from 2007 to 2010, 2011 saw an increase in electricity losses, rising to around 12%. Electricity losses are primarily the result of theft and illegal connections and to a lesser extent from transmission and distribution of electricity.

**TABLE 9**  
**CENTRAL AMERICA: ELECTRICITY ENERGY LOSSES, 2007-2011**  
*(In percentages)*

Country	2007	2008	2009	2010	2011
Costa Rica	10.6	10.6	10.8	10.8	12.3
El Salvador	12.9	12.8	11.5	12.3	12.1
Guatemala	16.4	16.3	12.8	12.3	12.8
Honduras	21.2	20.6	22.4	23.9	27.0
Nicaragua	28.4	27.3	26.1	25.4	24.1
Panama	11.6	11.8	14.0	12.3	13.0
Central America	15.5	15.3	15.0	14.9	16.0

Source: CEPAL, based on official figures.

### 8. Rate of access to electricity

The rate of access to electricity in the region also displays significant variations. Costa Rica has almost full access; El Salvador has a 93% rate of access, followed by Panama, Guatemala and Honduras at over 80%, and Nicaragua at over 70%. Nicaragua has the lowest rate of access to electricity in the region, but has made significant progress since 2007 (table 10). Although a lot of progress has been made in Central America in improving access to electricity, several regions, particularly rural areas and sparsely populated regions are not covered by the electricity grids. In such cases a connection to the grid requires expensive infrastructure investments, which in many cases cannot be justified economically. There is a need to promote off-grid solutions using renewable energy like solar or mini hydropower stations with the participation of communities, local governments, nongovernmental organizations (NGO's) and international cooperation.

**TABLE 10**  
**CENTRAL AMERICA: ELECTRIFICATION RATE, 2007-2011**  
*(In percentages)*

Country	2007	2008	2009	2010	2011
Costa Rica	98.5	98.7	98.8	98.9	99.0
El Salvador	91.1	91.0	91.1	91.7	92.6
Guatemala	83.7	83.8	84.0	84.4	84.7
Honduras	72.8	76.5	79.4	81.3	83.2
Nicaragua	60.8	63.8	65.3	70.3	73.0
Panama	85.5	86.2	86.9	87.1	88.4

Source: ECLAC, based on official figures.

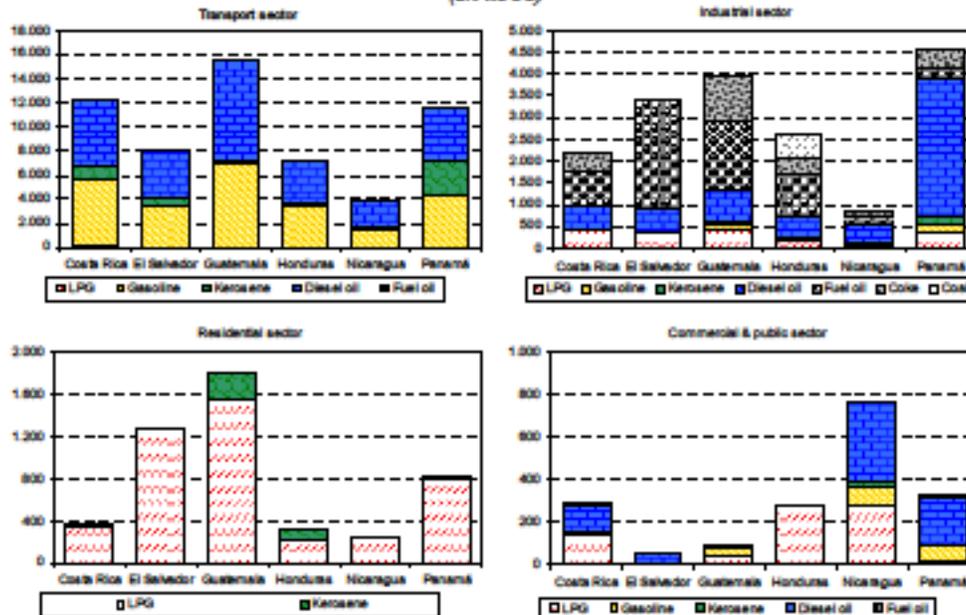
## D. IMPORTANT ASPECTS OF ENERGY CONSUMPTION IN CENTRAL AMERICA

The Central American region is comprised of countries which are at different stages of economic development. In countries with higher levels of per capita GDP and human development index, we see greater reliance on modern energy sources, while in countries with low per capita GDP, we observe greater dependence on traditional or indigenous energy, such as firewood and biomass.

### 1. Fossil fuel consumption

On examining the data for end use consumption of fossil fuels in the region, it is not surprising that the bulk of fossil fuels are used in the Transportation Sector. Graph 5 provides a breakdown by sector of fossil fuel consumption in the region.

**GRAPH 5**  
**CENTRAL AMERICA: FOSSIL FUEL CONSUMPTION BY SECTOR, 2011**  
*(In kboe)*



Source: SIEE, OLADE.

The transport sector in Guatemala is the largest consumer of fossil fuel in the region, with diesel as a key component in the consumption mix. Total consumption in Guatemala was approximately 16,000 kboe in 2011. The transport sectors of Costa Rica and Panama are the next big consumers of fossil fuels, while Nicaragua, Honduras and El Salvador consume relatively less fossil fuels within the region. The main components of the energy mix in the transport sector are Diesel and Gasoline.

The industrial sector is the second largest consumer of fossil fuels in the region, and here again the industrial sector of Guatemala is the largest consumer of fossil fuel energy, at approximately 7,000 kboe. Guatemala is followed by El Salvador and Panama, while Costa Rica, Honduras and Nicaragua register lower end use of fossil fuel in the industrial sector. The key components of the energy mix vary across the region, with Guatemala consuming high levels of coke, and fuel oil as the key component of the energy mix in El Salvador, while Panama consumes more diesel.

The consumption of fossil fuels in the residential sector is relatively low when compared to the industrial and transport sectors. Moreover, the key component of the fossil fuel energy mix for the residential sector is LPG, which is largely destined for cooking. Here again, Guatemala registers the highest consumption of fossil fuels for the residential sector, followed by El Salvador and Panama. Costa Rica, Honduras and Nicaragua use relatively lower quantities of fossil fuel in the residential sector.

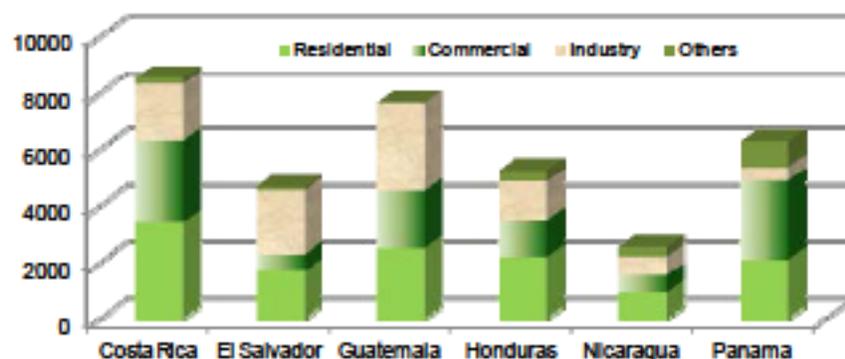
## 2. Biomass consumption in Central America

Consumption in the form of firewood for cooking in rural households and sugarcane products for processing by industry are key components of the biomass energy mix. Considering per capita consumption, it can be concluded that firewood plays an important role in meeting the energy needs of the population in five countries, and to the greatest extent in Guatemala, Honduras and Nicaragua. Biomass byproducts are very important for the energy needs of agribusinesses, especially in the case of sugar cane. For its size, the Guatemalan sugar industry is a major co-generator of electricity, a situation also observed on a smaller scale in Nicaragua and Honduras.

## 3. Electricity consumption in Central America by sector

Electricity consumption in the region when analyzed by sector for each country shows different consumption patterns (graph 6).

**GRAPH 6**  
**CENTRAL AMERICA: ELECTRICITY CONSUMPTION BY SECTOR, 2011**  
(In GWh)



Source: ECLAC and OLADE (for El Salvador and Guatemala).

As of 2011, Costa Rica registered the highest consumption of electricity in the region, with the residential sector being the main consumer, followed by the commercial and public services sector. Guatemala is the second highest consumer of electricity in the region, with much of the energy used in the industrial sector, which is also the case in El Salvador. In Panama, the largest consumer of electricity is the commercial and public services sector, followed by the residential sector.

## 4. Environmental emissions

The economic growth in Latin America and the Caribbean has resulted in an increase in energy production and consumption, which in turn has resulted in a 6% rise in emissions of greenhouse gasses between 2009

and 2010 (OLADE, 2011). Latin American and Caribbean countries were responsible for the production of 1,620,896 gigagrams of carbon dioxide emissions in 2010, 3% of which was emitted in Central American countries (OLADE, 2011).

## E. GENERAL MOTIVATIONS FOR THE PROMOTION OF ENERGY EFFICIENCY (EE)

Energy Efficiency (EE) is defined as the act of attaining the same results with the use of less energy. It can be considered as the lowest-cost source of energy. In his book "The Quest", author Daniel Yergin calls EE "the fifth fuel" and the energy source with the greatest potential to make an impact on our energy use in the years to come, though it is also the measure that is most difficult to understand and put into practice. EE has also been described as a "low hanging fruit" and as a low-cost option to tackle issues of climate change, sustainable energy consumption, and to guarantee security of energy supply.

Efficiency improvements can be gains that result from deploying new technologies such as efficient vehicles or appliances or machinery that consume less energy while delivering the same output, or efficiency gains that result from behavioral changes like using public transport or bicycles instead of motor vehicles. Behavioral changes can be induced through publicity campaigns that encourage people to save fuel and use less energy or through policy measures like restricting vehicle use which induce people to use alternative forms of transport (WEC, 2010).

EE has gained importance over the last few years as governments face the challenges of highly volatile oil prices, issues of energy supply security and climate change resulting from greenhouse gas emissions from the consumption of fossil fuels. Governments across the globe are concerned about the efficiency with which energy is used. The United Nations Sustainable Energy for All (SE4ALL) initiative recognizes improvements in energy efficiency as one of the three objectives essential for achieving sustainable energy for all (see box 2).

### BOX 2 SUSTAINABLE ENERGY FOR ALL

In 2010 the United Nations General Assembly passed resolution 65/151 declaring 2012 the International Year of Sustainable Energy for All. Following the general assembly resolution, the United Nations Secretary General launched the Sustainable Energy for All initiative to promote global action. A high level group was established to develop this initiative which included global leaders from business, finance, government and civil society. The Sustainable Energy for All initiative has three interlinked objectives which are complimentary in nature. The objectives for achieving sustainable energy for all by 2030 are:

- Ensuring universal access to modern energy services.
- Doubling the rate of improvement in energy efficiency.
- Doubling the share of renewable energy in the global energy mix.

In line with the three objectives of this initiative, a global action agenda was defined that identified eleven areas of action for achieving the three objectives.

Source: United Nations 2012.

#### 1. Energy security

Energy is essential for: transporting of people and goods, producing electricity that powers our homes, and that keeps our industries and businesses running. A disruption in energy supplies could cripple our economies and disrupt our day to day lives. The oil embargoes of the 1970s, the volatile situation in the Middle East (where much of the world's oil is produced), and more recently the rise in crude oil prices over the last decade have required countries around the globe to diversify their energy supplies and reduce their

dependence on imported energy sources. China, one of the largest consumers of fossil fuels has made energy efficiency a top priority in its energy strategy, with a goal of doubling energy efficiency. Central America is particularly vulnerable to volatile and rising oil prices. In the period 2007 to 2008 while consumption of oil and oil derivatives in the region remained stable the oil import bill for the region rose by 31% in response to rise in international oil prices. Diversifying energy supply sources and moving to renewable energy can mitigate some energy security risks and lower the oil import bill. However, renewable energy deployment requires infrastructure investments and time to implement. Energy efficiency is seen as a cost-effective and quick solution to reducing dependence on imported energy.

## 2. Energy efficiency and climate change

Energy Efficiency can play an important role in the effort to reduce greenhouse gas emissions and to mitigate climate change. Despite the fact that Central American countries contribute less than 3% of greenhouse gas (GHG) emissions in Latin America and the Caribbean and a very small portion of global emissions, the region is vulnerable to the effects of climate change. The higher probability of natural disasters due to climate change could strain Central American government resources and their ability to react to future extreme events. Governments in the region are aware of the need to mitigate GHG. Through the Energy Strategy 2020 governments have committed to reducing GHG by 20% in the year 2020 based on the 2020 strategy scenario. In addition to mitigating dangerous climate change a reduction in GHG would also promote the health and wellbeing of populations as a result of improved air quality.

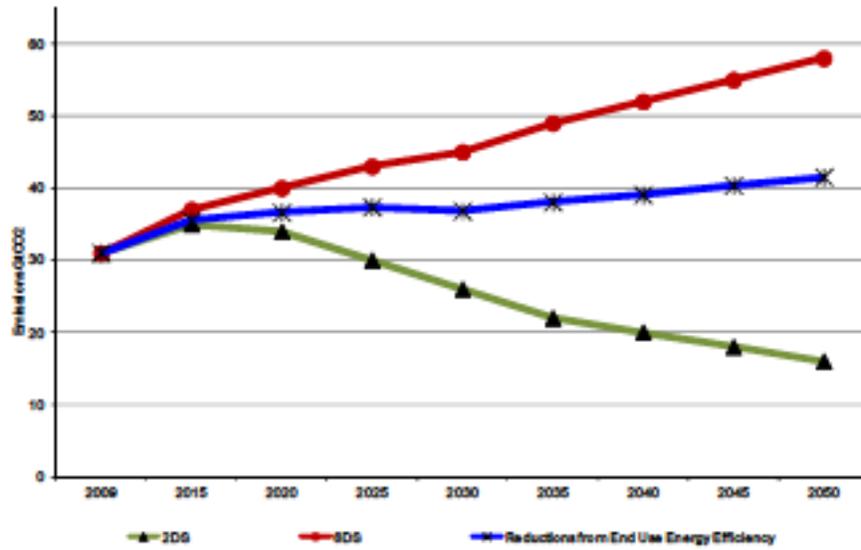
The International Energy Agency (IEA) sees Energy Efficiency playing a major role in global efforts to limit GHG emissions in its scenarios, published in its 2012 Energy Technology Perspectives (ETP). The IEA simulates the 6°C Scenario (6DS) and the 2°C Scenario (2DS).

The IEA 6°C Scenario (6DS) provides a simulation of current global trends. In the (6DS), world energy use will almost double by the year 2050 (compared to 2009), resulting in a significant rise in total GHG. In the absence of mitigating measures, average global temperatures could rise by 6°C over the long term which could bring about radical changes on earth.

The IEA 2°C Scenario (2DS) simulates a global energy system with reduced GHG emission levels, which current climate change research indicates would have an 80% chance of limiting global average temperature rise to 2°C. In this scenario CO<sub>2</sub> emissions would reduce by over half in the year 2050 when compared with 2009 levels and would have to continue to decline beyond 2050.

In the IEA (6DS), global GHG emissions will rise to 58 GtCO<sub>2</sub> resulting in a 6-degree rise in temperatures. On the other hand, the (2DS) scenario would result in GHG emissions of around 16 GtCO<sub>2</sub> and the IEA assumes that 39% of this reduction could come from end use energy efficiency (graph 7).

**GRAPH 7**  
**WORLD: EMISSIONS REDUCTIONS 6DS & 2DS SCENARIO, 2009-2050**  
*(GtCO<sub>2</sub>)*



Source: International Energy Agency, Energy Technology Perspectives 2012 ([www.iea.org/etp](http://www.iea.org/etp)).

## II. SITUATIONAL ANALYSIS

The adoption of the Energy Strategy 2020 by Central American Countries in 2007 demonstrates the region's commitment to the sustainable growth of the energy sector. Energy Efficiency (EE) is one of the key pillars of the strategy and is viewed as the cheapest and fastest way to lower energy consumption in the region when compared with other measures. However, there is a lack of progress in the implementation of energy efficiency initiatives in the region.

In this section, the current status of EE initiatives in Central America and the steps the countries have taken towards meeting the requirements of the *Energy Strategy 2020* are examined. This situational analysis will look at: a) energy sector profiles which provide a summary of the energy situation in each country, identifying key issues in the hydrocarbons and electricity subsectors; b) institutional and legal frameworks for EE (tasks, responsible institutions, policies, strategies, laws and regulations on EE, including the creation of specialized bodies); and c) EE programs and initiatives implemented to date.

Table 11 shows a summary of the current organization of the energy sector in each of the Central American countries. Annex I contains a summary of the relevant data on the electricity and hydrocarbons subsectors in each country. The following analysis is presented for two groups of countries, the first corresponding to those which have enacted an EE law (Costa Rica and Panama) and the second to countries which are considering adopting such laws.

**TABLE 11**  
**CENTRAL AMERICA: MAIN ENERGY ORGANIZATIONS, INSTITUTIONS AND ACTORS**

Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama
<b>Energy sector: Governance and policy</b>					
Ministry of Environment and Energy (MINAE)	National Energy Council (CNE)	Ministry of Energy and Mines (MEM)	Secretariat of Natural Resources and Environment (SERNA), and Petroleum Administrative Commission (CAP) *	Ministry of Energy and Mines (MEM)	National Energy Secretariat (SNE)
<b>Oil regulation: Institutions responsible for petroleum regulation (downstream)</b>					
Regulatory Authority for Public Services (ARESEP) <sup>b</sup> and MINAE	Regulatory Directorate of Hydrocarbons and Mines (DRHM), Ministry of Economy (MINEC)	General Directorate of Hydrocarbons (DGH), MEM	Petroleum Administrative Commission (CAP)	General Directorate of Hydrocarbons (DGH), Nicaraguan Energy Institute (INE)	Directorate of Hydrocarbon, SNE
<b>Electricity regulation: Institutions responsible for regulation of electricity services</b>					
ARESEP	General Superintendence for Electricity and Telecommunications (SIGET)	National Commission of Electric Energy (CNEE)	National Commission of Energy (CNE)	INE	National Authority of Public Services (ASEP)

(continued)

TABLE II (Conclusion)

Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama
<b>Oil subsector: Import, export, refining, transportation, distribution and marketing (downstream) <sup>c</sup></b>					
Costa Rican Oil Refinery (Recope), many companies dedicated to the retail sale <sup>d</sup>	Open market, one private refinery (RASA), many companies (wholesale and retail)	Open market, private companies (wholesale and retail)	Private companies (wholesale and retail)	Open market, Manref (private refinery), Petronic (state company), private agents (wholesale and retail)	Open market, private companies (wholesale and retail) <sup>d</sup>
<b>Electricity sector: Electricity markets and companies providing electricity services (generation, transmission and distribution)</b>					
Costa Rican Institute of Electricity (ICE, state-owned and vertically integrated), six distributors (one state, two municipal and four rural electric cooperatives), many small and medium-sized independent private generators	Unit of Transactions (UT, system operator and market administrator), one generating state company (CEL), one state transmission company (ETESAL) and many private generators, traders and large users	Wholesale Market Administrator (AMM, system operator and market administrator), one generating state company (INDE), many transmission companies (including the state owned ETCBE), and many private generators, traders and large users	National Electricity Company (ENEE, state-owned and vertically integrated), many small and medium independent private generators and a few large users	National Electricity Transmission Company (ENATREL, state-owned, also responsible for the operation and administration of the system and the market), one state hydroelectric generating company (ENEL), many private generators, two distributors and a few large users	also responsible for the operation and administration of the system and the market), one state generating company (EGESA), many private generators and a few large users

## Notes:

<sup>a</sup> The Petroleum Administrative Commission (CAP) is part of the Secretariat of Industry and Trade (SIC).

<sup>b</sup> The Intendancy of Energy is the specialized division of ARESEP responsible for regulation of energy services (electricity and oil).

<sup>c</sup> Two countries have regulated oil markets (Costa Rica and Honduras); the other countries have liberalized markets, with benchmarked prices (El Salvador) and price caps (Panama). There are three relevant products (gasoline, diesel and liquefied petroleum gas [LPG]).

<sup>d</sup> Costa Rica has an emerging market for biofuels (ethanol). Panama is launched its biofuels market in 2013.

## A. COUNTRIES WITH ENERGY EFFICIENCY LEGISLATION

### 1. Costa Rica

The Ministry of Environment and Energy (MINA E) is the country's leading institution in the energy sector. The country's energy policy is based on the principles of conservation, sustainable development, universality, solidarity, efficiency, competitiveness, innovation, environmental sustainability, social and economic development, and public and private participation, principles that are meant to guide the actions and decisions of the country's energy sector.

The ARESEP (Regulatory Authority of Public Services), an autonomous multi-sector entity, is responsible for regulation of the energy sector (oil and electricity), tasks which have been entrusted to its Intendancy of Energy.

#### a) Electricity and hydrocarbon market profile

i) Electricity. The electricity industry is dominated by a national semiautonomous organization with a high degree of vertical integration in the activities of generation, transmission and distribution (the Costa Rican Institute of Electricity, ICE). In the electricity distribution and generation segments, the ICE group has a majority stake. In the former, activities are complemented by two municipal companies and four rural electrification cooperatives. Around 30% of electricity generation has been privatized since the passing of the law on private autonomous generation in the nineties, which resulted in the unbundling of electricity production.

The regulator, ARESEP is tasked with a regulatory role in the electricity sector. It is responsible for approving and authorizing end use consumer tariffs that take into account social equity, environmental sustainability, economic efficiency and conservation. It also approves ICE tariffs for purchasing energy from private electricity companies.

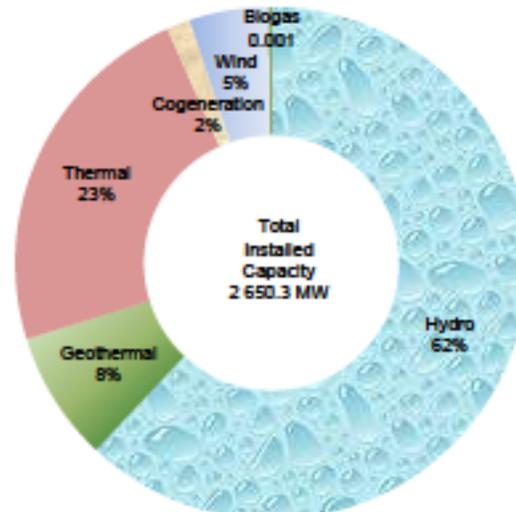
The universal availability of electricity (with rate of access to electricity of over 99.3%, one of the highest in Central and Latin America), the generation of electricity largely from renewable sources, and low or very reasonable levels of electricity losses are some of the outstanding features of the country's electricity sector.

1) Generation. Costa Rica is the only country in the sub-region with a long history of policies that promote the use of renewable and domestic resources for electricity production. Laws that approved independent and parallel private generation in the nineties stipulated that producers must use hydropower, geothermal, wind and other unconventional sources as a primary source. All wholesale energy produced by third parties (private generators, municipal distributors and rural electrification cooperatives) must be sold to the ICE. Graph 8 provides a breakdown of total installed electric capacity. As of 2011 Costa Rica had a total installed capacity of 2650.4 MW, of which hydroelectric installed capacity was 1643.9 MW. Total electricity generated in 2011 was 9759.6 GWh, of which 7134.6 GWh was from hydro-energy (CEPAL, 2012a).

2) Transmission. The electricity transmission system is controlled by the ICE which has developed, maintained and operated the National Electricity System (SEN). It also operates the National Center for Energy Control, which optimizes system operation. The transmission sector operates as a natural monopoly.

3) Distribution. As already mentioned, the ICE and its subsidiary CNFL (Power and Light National Company) are the main electricity distributors. In addition, there are two municipal corporations and four rural electric cooperatives.

**GRAPH 8**  
**COSTA RICA: TOTAL INSTALLED ELECTRICITY**  
**GENERATION CAPACITY, 2011**



Source: CEPAL, based on officially reported figures.

ii) Hydrocarbons. The hydrocarbon sector of Costa Rica follows a monopoly model for import, refining and distribution of crude oil and crude oil derivatives. RECOPE, a state owned enterprise, has the monopoly for the import and processing of hydrocarbons as well as transport of the same by pipelines and wholesale marketing. Transport and retail distribution activities are undertaken by private agents.

The sale and pricing of oil derivatives is regulated by ARESEP, which is responsible for overall regulation of the hydrocarbons sector and for defining the technical and legal framework of the sector to ensure that oil markets have adequate supply and to guarantee the quality and distribution of oil derivatives.

Costa Rica's energy sector can be characterized as having a high dependence on fossil fuels that are used primarily by the transport sector (cargo and passengers). Table 12 shows the total consumption of oil derivatives by type, demonstrating that the bulk of oil derivatives consumed are in the form of gasoline and diesel, which are used primarily in the transport sector.

The monopoly framework has enabled Costa Rica to obtain better pricing for crude oil and oil derivative imports, but the current capacity and technology prevent the refinery from meeting the market

needs. The introduction of laws requiring the sale of cleaner fuels has meant that Costa Rica has had to rely on imports of fuels.<sup>6</sup>

**TABLE 12**  
**COSTA RICA: CONSUMPTION OF OIL DERIVATIVES, 1990-2011**

Year	Total consumption	Final consumption							Electricity production		
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil
1990	6 815	6 703	293	1 933	364	2 923	1 077	113	112	102	10
2000	12 950	12 804	852	4 737	780	4 605	1 377	452	146	131	15
2005	15 151	14 639	1 113	5 265	1 468	5 581	1 002	211	511	481	31
2008	17 673	16 390	1 219	5 667	1 460	6 689	1 038	317	1 283	1 257	26
2009	17 060	16 206	1 230	5 884	1 287	6 571	815	419	854	742	111
2010	17 785	16 339	1 331	6 095	1 327	6 555	814	218	1 446	1 075	372
2011	18 323	16 666	1 365	6 234	1 387	6 646	772	262	1 657	662	995

Source: CEPAL, based on officially reported figures.

#### b) Legal framework for energy efficiency (EE)

i) Energy efficiency law. Costa Rica became the first country in Central America to enact a law for Energy Efficiency in 1994. Law No. 7447 (Rational Use of Energy Law) was enacted with the objective of consolidating state participation in the promotion of rational energy use. Law 7447 attempts to establish mechanisms to promote energy efficiency taking environmental protection into account. The procedures for application of Law 7447 were published in 1996 through Decree No. 25584/24.10.96. Following are some of the key aspects of the Energy Efficiency Law:

ii) Efficiency in energy-intensive enterprises. Private entities that consume in excess of established limits of electricity and hydrocarbons are required to implement energy saving measures within stipulated timeframes to achieve a reduction in total energy consumption. Reduction in energy consumption is to be achieved through a combination of energy audits and technical assessments and investments.

iii) Import of electrical equipment and vehicles. Imports of electrical equipment and vehicles are to comply with energy efficiency guidelines established by MINAE. Importers must submit information on the energy consumption of imported equipment and vehicles.

iv) Energy Efficiency labeling and campaigns. Electrical equipment must bear labels which detail the energy consumption characteristics of the product. The labels must be in compliance with guidelines established by MINAE. Informational campaigns aimed at educating the public on energy efficiency through publicity campaigns and electronic and print media are also mentioned in the law. Additionally, the Ministry for Education is tasked with introducing the subject of energy efficiency in primary and secondary schools.

<sup>6</sup> The refinery closed operations in 2011. Following the resumption of diplomatic relations between Costa Rica and the People's Republic of China in 2007, the state-owned Chinese National Petroleum Company (CNPC) is assessing the possibility of investing in the refining sector in Costa Rica. The project is in the feasibility study stage.

v) Incentives. Financial incentives in the form of tax exemptions are given to electrical equipment that is considered important in promoting rational energy use. Article 38 of Law 7447 created a list of energy efficient electrical equipment that would be exempted from import duties. However, Article 17 of Decree Law 8114 of 2001 partially revoked Article 38 of Law 7447, which resulted in the elimination of tax exemptions on energy efficient equipment. In 2010, Law 8829 was published, which amended Article 38 of Law 7447, reestablishing the exemption of duties for energy efficient electrical equipment. Law 8829 also published a new list of electrical equipment that would be exempt from duties and taxes. A revision of Law 8829 is currently in the public discussion stage, and a revised law is expected to be published in the near future.

Although Law 7447 was passed as early as 1994, some parts of the law have not been implemented as originally intended. Although the law mandates that electrical equipment sold in the country should bear energy labels that indicate the electricity consumption of the equipment so as to educate consumers, the verification and monitoring processes required for these activities have not been implemented due to a lack of resources. A 2011 report by MINAE's Energy Sector Directorate (DSE) states that they (MINAE) do not have adequate resources to undertake the administrative tasks required to implement the monitoring and verification activities stipulated in Law 7447. The report also suggests a revision of Law 7447 to better reflect the operational reality (MINAE 2011b).

c) **Financing of energy efficiency projects and programs**

MINAE finances activities related to energy efficiency from its regular budget, and there are no funds allocated exclusively for energy efficiency activities. Law 7447 promotes tax exemptions for energy efficient equipment and the list of equipment eligible for such exemptions is currently being revised. The ICE has played a key role in financing EEC projects, from its own budget and through third-party funds (loans and grants). In terms of commercial financing, banks in Costa Rica have developed financial products for energy efficiency and renewable energy financing. A 2012 document prepared by the Costa Rican Chamber of Industry (CICR 2012b) lists the different credit facilities that have been developed for industry. Financial institutions offering such financing include banks like BAC San José, LAFISE, and the Popular and Community Development Bank. The document also provides information on financing available from entities such as The National Council for Scientific and Technological Investigations (CONICT), the Central American Bank for Economic Integration (BCIE) and the Foundation for Cooperation and Sustainable Development (*Fundescooperación para el Desarrollo Sostenible*).

d) **Institutions active in the area of energy efficiency**

i) Energy Sector Directorate (DSE). The DSE is tasked with the overall supervision of the energy sector within MINAE. Some of the staff of the DSE office are recruited from within the energy sector and belong to RECOPE and ICE. The salaries of these staff members are paid by their parent organization and not by MINAE. Moreover, DSE does not have a dedicated unit focused on EE issues, and staff at the office work on EE matters as and when assigned.

The main tasks of the DSE are:

- To develop energy pricing policies.
- To conduct and coordinate energy research and assessments in the energy sector.
- To prepare the National Energy Plan
- To promote rational and efficient use of energy.

- To promote research and development of different energy sources and related technologies.
- To evaluate and enforce the policies and goals of the National Energy Plan.

ii) Costa Rican Institute of Technical Standards (INTECO). INTECO is a private non-profit organization that was created in 1987, and was later officially recognized as the nation's standards agency. In the area of EE, INTECO has published 15 standards covering Compact Fluorescent Lighting, Commercial Refrigeration, Residential Refrigeration, and Air Conditioners. The standards define the requirements, testing methods and labeling requirements. Standards developed by INTECO are voluntary in nature and non-binding. This poses a problem, as there is no incentive for importers and distributors to comply with these standards. The *energICE* label for fluorescent lamps developed by INTECO and the ICE certifies that fluorescent lamps that are sold bearing this label comply with the standards developed by INTECO and have been tested by certified laboratories to verify compliance with said standards. As of June 2013, the extension of the *energICE* label for refrigerators was under development by INTECO and ICE.

iii) Costa Rican Electricity Institute (ICE). The ICE is the largest state-owned electric utility. The ICE group also controls the National Power and Light Company (CNFL) and has interests in the telecommunication sector. The ICE has been very active in the energy efficiency area and has launched several energy efficiency initiatives over the years. The topic of EE is covered on its website with sections dedicated to promoting energy efficiency for the residential, industrial, commercial and service sectors.

The ICE is also the promoter of Costa Rica's Energy Efficiency Laboratory which is funded and maintained by the ICE. This lab was designed to provide the country with the capability to measure energy efficiency of electrical equipment and to implement a labeling system for equipment sold in the country. The labeling requirement was part of the EE Law and ICE was tasked with promoting and assisting in the installation of the energy efficiency laboratory to support the labeling program. The laboratory was opened in March 1998 and was accredited by the Costa Rican Accreditation Agency (ECA). It is the only laboratory of its kind in Central America, and to date it has provided its services to Costa Rican entities and to entities from other countries in Central and Latin America. In 2012, the laboratory extended the scope of its activities to measuring the energy efficiency of household refrigerators, commercial refrigerators, solar panels, air conditioners and electric motors. Costa Rica has developed an energy label for compact fluorescent lamps called *energICE*, and the Energy Efficiency Laboratory conducts the tests required to certify a product for the seal. Since 2008, compact fluorescent lamps bearing the *energICE* label have gone on sale, resulting in over two million units being sold. The "en-lighten Initiative" launched by the Mesoamerican Project (PM, see box 3) has selected the laboratory as one of the entities to test commercially available compact fluorescent lamps being imported into the Mesoamerican countries.

iv) Costa Rica's Chamber of Industry (CICR). The CICR has been representing local industry since 1943. Its mission is to promote the sustainable development of the industrial sector of the country. The CICR is active in the areas of energy efficiency, as its members see energy efficiency as a tool to combat the rising costs of electricity in Costa Rica, in order to maintain their competitiveness.

In order to equip professionals from the Costa Rican industry with knowledge of the latest advances in Energy Efficiency, CICR created the "Energy Administrator" training program in cooperation with the German Cooperation Agency (GIZ). Through the program training is provided in technologies and methodologies that can be used to execute energy efficiency programs in industry. The course consists of modules that are delivered by local and international experts covering topics on fuels, refrigeration, air conditioning, motors, boilers, etc. The program is divided into 3 modules, followed by a final project and an exam (CICR 2012a).

**BOX 3**  
**THE MESOAMERICAN PROJECT (*PROYECTO MESOAMÉRICA*, PM)**

The PM is the mechanism established by the Mesoamerican countries to facilitate the design, financing and implementation of regional integration projects in infrastructure, connectivity and social development.

The PM was formally launched in 2008 with the aim of promoting regional integration and development for the eight countries that are part of the Central America System of Integration (SICA). With the help of Colombia and Mexico, this initiative also included the southern states of Mexico as part of the sub-region. It is the successor of two initiatives: the Plan Puebla Panama (PPP), which was conceived in 2001 by Mexico and approved by the governments of the participating nations from the Central American region, and the Mesoamerican Program of Energy Integration (PIEM), an initiative promoted between 2005 and 2008 that emphasized the promotion of regional refineries and introduction of natural gas in the sub-region. On energy issues the PM currently supports the following initiatives:

**a) Mesoamerican project on rational and efficient use of energy**

In June 2011, the PM presented its members with a proposal for rational and efficient use of energy. The PM Memorandum of Understanding for Energy Efficiency has been distributed to member countries and is currently awaiting approval. The Memorandum, if and when adopted, aims to formulate plans and programs in energy efficiency for the region. The programs will aim to promote training and capacity-building for its members in the area of rational and efficient use of energy.

**b) The enlighten initiative**

The enlighten initiative by the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) was established to accelerate global market transformation to environmentally sustainable lighting technologies by developing a coordinated global strategy and providing technical support for the phasing out of inefficient lighting.

UNEP has partnered with the Proyecto Mesoamerica to roll out the Enlighten initiative in the countries that are part of the Mesoamerican Project.

Source: UNEP, 2012 & <[www.proyectomesoamerica.org](http://www.proyectomesoamerica.org)>.

Meetings conducted with the representative of the chamber of industry revealed that Costa Rica could benefit significantly from mandatory standards for electrical equipment. The CICR believes that inefficient air conditioners entering Costa Rica could be prevented from entering the market by implementing mandatory energy efficiency standards for imported air conditioners. The CICR representative also suggested that the current Costa Rican energy efficiency standards should be revised to the levels of developed countries.

v) Others. The distributors of electricity, especially CNFL, also take part actively in EE programs. RECOPE and other hydrocarbon distributors also have education programs for efficient use of fossil fuels.

**e) Energy efficiency programs, projects and initiatives in Costa Rica**

i) Regional Program for Energy Efficiency (PEER). The PEER program was financed by the Global Environment Facility (GEF) and implemented by UNDP in Central America. Costa Rica is one of the participants in this program which was designed to remove the barriers that prevent implementation of EE measures and to promote a market transformation toward efficient use of electricity in the industrial and commercial service sectors. BUN-CA, an NGO with its headquarters in Costa Rica, was responsible for implementing the PEER program in Central American countries. BUN-CA provided support and technical expertise to the country in the development of energy efficiency standards for electrical equipment. Capacity Building activities and workshops were also conducted in the area of energy efficiency.

ii) Energy efficient lighting program. Since the nineties, the electric utilities in Costa Rica have introduced programs to promote the use of compact fluorescent lamps (CFLs) in Costa Rica. In 1996, both the electric utilities introduced CFLs into the market in the residential sector by distributing lamps to customers with the cost of the lamps being collected via the electricity bill. This program saw the distribution of over 300,000 CFLs in the market (MINAET, 2012b). In 2008, the Costa Rican Electricity Institute (ICE) launched the “three for the price of two” compact fluorescent lamp campaign. Drawing on a strategic partnership with importers and distributors, it implemented a “pay for 2, get 3” promotional campaign. The objective was to achieve a 30MW demand reduction in the National Electrical System (SEN) and to avoid investment of approximately \$30 million USD in new power plants over the useful life of the compact fluorescent lamp (CEPAL 2009).

According to available data, over 2 million CFLs were supplied to the residential sector during this campaign (MINAET, 2012b). This program was one of the most successful CFL distribution projects in Costa Rica to date. The ICE followed a strategy whereby CFL distributors were required to supply CFLs that were tested in the ICE’s laboratory to ensure compliance with Costa Rican CFL standards before they were distributed to the public. CFL distributors were exempted from paying for the laboratory tests, thus motivating them to submit to the testing process, and the Costa Rican public was provided with a certified product at a discount, thus contributing to the overall success of the program. The project included a publicity campaign on the subject of lighting, as well as on saving energy.

In 2010, CNFL launched a campaign to provide free compact fluorescent lamps to the residential sector. Over 700,000 lamps were distributed to consumers through this program (MINAET, 2012b).

iii) Efficient lighting in the public sector. To promote efficient lighting in public sector buildings, the Costa Rican Electric Utility CNFL has been conducting onsite assessments of lighting in public sector buildings/offices and estimating the potential savings to the public sector organization from deployment of efficient lighting. Following these assessments formal agreements are signed between CNFL and the corresponding public sector organizations on the amount of investment required to deploy efficient lighting. An external entity contracted by CNFL replaces the inefficient lighting systems and the costs are recovered over time by CNFL through the monthly electricity invoices. (CEPAL, 2009) (MINAET, 2012b).

iv) Efficient public lighting program. As part of its energy efficiency focus, the Ministry of Environment and Energy launched a program to replace mercury lamps used for public lighting, with high-pressure sodium vapor lamps. Over 20,000 replacements have been made within the capital region and surrounding areas. A pilot program for introduction of LED lamps is currently underway (MINAET, 2012b).

v) The energy efficiency center. In 2010 a memorandum of understanding was signed between the US Department of Energy (DOE) and the Costa Rican Ministry of Energy, along with other Costa Rican entities, for the creation of an Energy Efficiency Center. The Center will train professionals in energy efficient technologies and energy audits and expand the technical knowledge base in the country.

vi) Urban train service. Since 2009, Costa Rica has restarted urban train service between San Pedro and Pavas, San Jose and Heredia, and Cartago and San Jose. The train services are offered at competitive prices and at greater frequencies during mornings and evenings. It is estimated that over 1 million passengers were transported by train in 2010 (MINAE, 2013). The resumption of this urban transportation service is a good step towards encouraging people to use mass transit services and decongesting roads while promoting energy efficiency.

vii) Energy efficiency campaigns. Costa Rica has launched energy efficiency campaigns through print and electronic media to promote energy efficiency among its citizens. These campaigns have focused on promoting efficient use of electricity and fuels (MINAE, 2008b and MINAE, 2013).

viii) Restricted vehicle use. The restricted vehicle use program was put in place in response to the rapid increase in oil prices in 2005. Initially, vehicle restrictions were put in place for the capital city (San Jose), and were later extended to the entire Metropolitan area. According to CEPAL (2009) following the extension of the restricted zone from 2.5 km to 25 km, the following results were observed:

- A reduction in travel time on these routes by an average of 11%, with a reduction of 30% on the Central Street route.
- The travel time saved on these routes was estimated to be the equivalent of around US\$3 million.
- Improved Traffic flow was observed on all the routes.
- Total traffic declined by 12%.

ix) National energy prize. This program was established through Decree 26542 of 1997 to promote the rational use of energy in Costa Rica and to recognize the efforts of individuals and organizations that have played an important role in promoting the efficient use of energy within their organizations. The prize has been awarded annually since 1998 to companies ranging from supermarkets, hotels and other commercial entities (MINAE, 2008b).

## 2. Panama

The National Energy Secretariat (SNE) is the main institution in the energy sector. The National Authority of Public Services (ASEP), an autonomous multi-sector entity, is responsible for regulating the electricity subsector. A specialized SNE entity is responsible for the regulation of downstream oil activities. With the exception of specific activities (such as electricity transmission, system operation and management of the market) electricity services, downstream oil activities and marketing of hydrocarbons are provided by private companies.

### a) Electricity and hydrocarbon profile

i) Electricity. Until 1998 the Panamanian electricity sector was in the hands of the government and dominated by a vertically integrated electric utility, IRHE. Electricity reforms in Panama commenced in 1995, following the creation of Law No 6, which permitted privatization of electricity generation. Law 26 of 1996 created the regulator of public services for water, electricity and telecommunications, which today is known as the National Authority of Public Services (ASEP), while in 1997, Law 6 established the regulatory and institutional framework for the electricity sector. The electric utility was restructured into 8 companies: four companies in the area of generation, three distribution companies and one transmission company.

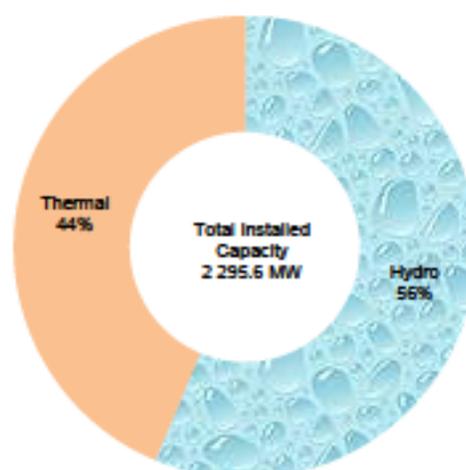
With the passing of Law No 6 of 1997 the Energy Policy Commission (COPE) was created which was responsible for formulating energy policies. However following a steep rise in energy prices in 2007 and thereafter, the government of Panama decided to create the National Energy Secretariat of Panama (SNE) that would be responsible for energy policy. SNE was created by Law 52 of 2008 as a government entity attached to the Ministry of the Office of the President. The National Energy Secretariat inherited functions from the former Energy Policy Commission, the Directorate General of Hydrocarbons and Alternative Energies and the Energy Saving Commission.

1) **Generation.** Panama had a total installed capacity of 2295 MW (graph 9) as of 2011, with 1293 MW of hydroelectric capacity. The major players in the generation sector include: AES Panama (482 MW), EGE-Fortuna (300MW) and BLM Corp (280MW) (CEPAL, 2012a). In 2011, total electricity generated in Panama was around 7702 GWh, the bulk this electricity was generated from hydro power plants (CEPAL, 2012a) which make up approximately 56% of installed capacity and 53% of electric energy consumption, with the rest derived from thermal energy sources.

2) **Transmission.** Transmission of electricity is entrusted to the Electric Transmission Company of Panama (ETESA, which is 100% owned by the state). The electricity dispatch network also operates under the control of ETESA, which is also responsible for planning the expansion of the transmission network.

3) **Distribution.** Distribution of electricity to end users is carried out by three companies; Empresa de Distribución Eléctrica Metro Oeste S.A. (EDEMET), Elektra Noreste S.A. (ENSA) and Empresa de Distribución Eléctrica Chiriquí S.A. (EDECHI).

**GRAPH 9**  
**PANAMA: TOTAL INSTALLED ELECTRICITY GENERATION CAPACITY, 2011**



Source: ECLAC.

ii) **Hydrocarbons.** Panama does not possess any crude oil reserves and depends on imports for its crude oil needs.<sup>7</sup> Crude oil derivatives are imported and stored at different locations across the country. As of 2008 the country had the capacity to store approximately 17 million barrels of oil equivalent products (SNE, 2009).

Refined crude products are imported by around 30 companies to meet the needs of the country. Collectively these companies supply the local transport market, the requirements of the international ships that use the Panama Canal, the electricity producers and consumers of Liquefied Petroleum Gas. As of 2012 the domestic transport market was serviced by 404 gas stations, while there are around 25 companies that service the ships that use the Panama Canal. In 2011 58% of Panama's petroleum derivatives were destined for the transport sector while 15% was used for electricity generation. The transport sector contributes significantly to the oil import bill and could be an excellent starting point for

<sup>7</sup> Texaco refinery, cited in Colon, was in operation from 1954 to 2002.

energy efficiency measures aimed at transport. Panama has been subsidizing Liquefied Petroleum Gas for domestic consumption for several decades, while subsidies on diesel used for public transport have been introduced since 2005 to avoid increases in public transport fares (SNE). A detailed breakdown of oil derivative consumption is provided in table 13.

The National Energy Secretariat (SNE) is responsible for the administration of the hydrocarbon sector and for defining the technical and legal framework to ensure that oil markets have adequate supply and to guarantee the quality and distribution of oil and derivative products. The secretariat regulates import, transport, distribution and marketing activities for oil and oil derivatives.

**TABLE 13**  
**PANAMA: OIL DERIVATIVES CONSUMPTION, 1990-2011**

Year	Total consumption	Final consumption							Electricity production		
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil
1990	6 398	5 503	737	1 788	609	1 973	353	43	895	222	673
2000	11 036	10 061	1 152	3 326	1 450	3 589	331	214	974	513	462
2005	14 279	11 580	1 339	3 489	1 472	4 729	336	216	2 699	205	2 494
2008	17 554	14 547	1 569	4 062	2 368	5 884	348	315	3 007	904	2 103
2009	18 092	16 163	1 609	4 711	2 611	6 524	381	328	1 929	281	1 649
2010	20 203	17 006	1 675	5 048	2 865	6 865	289	264	3 197	993	2 204
2011	22 496	18 712	1 744	5 257	3 250	7 742	229	490	3 784	1 277	2 508

Source: ECLAC, based on officially reported figures.

#### b) Legal framework for energy efficiency

In October 2012 Panama passed the Rational and Efficient Use of Energy Law (*Uso Racional y Eficiente de la Energía UREE*) to guide the plans, programs and activities for efficient use of energy. The law, developed by the National Energy Secretariat (SNE), aims to promote rational and efficient use of energy, while increasing competitiveness within the commercial, industrial and service sectors of the economy. Executive Decree 398 of 2013 regulates the law on rational and efficient energy use.

The Rational and Efficient Use of Energy Law (UREE) of October 2012 mandates the creation of energy committees within every public institution. These committees will be constituted by staff from the technical, administrative and finance functions within each institution and will be responsible for executing energy efficiency initiatives. The committees will be required to develop within a year from their creation a five-year energy efficiency plan for their respective organizations. While the functions of these committees will be established by the National Energy Secretariat, the institutions will be responsible for developing energy indicators for their respective efficiency programs to monitor the progress of their respective programs. The financing for the energy committees and their activities will be drawn from the regular budget of each institution and smaller institutions can join other institutions to develop and create joint energy committees.

##### i) Energy committees.

- Accreditation of energy professionals and energy service companies.

As per the requirements of the Rational and Efficient Use of Energy Law, individuals and entities providing energy services, energy consulting, audits and other activities related to energy efficiency will need to be accredited by the National Accreditation Council of the Ministry of Commerce and Industry.

The technical requirements and standards to be followed by companies and individuals involved in providing energy services will be defined by the National Accreditation Council for each category of service. Once accredited, a list of service offerings by accredited companies and individuals will be made available online by the Accreditation Council and also provided to SNE.

- Steering committee for Energy Efficiency Standards.

SENER will create a steering committee for Energy Efficiency Standards, which will comprise representatives from different sectors of government, associations and universities.

The major tasks of the committee will be to:

- Develop energy efficiency standards and define the timeframe during which they are to be implemented and completed;
- Develop minimum energy efficiency standards for equipment, machinery and building materials that consume energy;
- Establish a program for the implementation of the standards.

Electrical equipment that does not comply with the newly defined energy standards will not be allowed to be imported or manufactured within the country after January 2014 or as of when the standards are approved.

ii) Financing. The Ministry for Economy and Finance will create a fund for rational and efficient use of energy to be overseen by the National Bank of Panama, allocated for funding energy efficiency projects. The fund will be open to contributions from international and local organizations both public and private. Initial capital will be contributed by the Ministry of Finance and Economy and the National Energy Secretariat. The funds generated will be used to finance Energy Efficiency projects and programs and for promoting energy efficiency markets.

iii) Incentives and subsidies. The incentives and subsidies will be defined and published by SNE and the Ministry for Economy and Finance. It is expected that incentives and subsidies will be provided for electrical equipment, machinery and materials that comply with the new energy efficiency standards to be approved by the Directorate General of Industrial Standards and Technology. Financial incentives in the form of mortgage rate rebates could be provided to construction projects that can demonstrate inclusion of Energy Efficiency measures in their construction design.

#### c) **Institutions active in the area of energy efficiency**

i) Secretaría Nacional de Energía (SNE). SNE is the institution that oversees policy matters in the energy sector. As Panama has been an importer of oil products, it is particularly vulnerable to oil price volatility. Energy Efficiency has been an important issue in Panama since the 1980s, and several steps have been taken to promote energy efficiency within the national energy agenda. In response to the oil crisis in the 1970s, the government of Panama set up the National Energy Commission (CONADE) for formulating Energy Policy and promoting rational energy use in order to reduce energy consumption. CONADE was replaced by the Energy Policy Commission (COPE). The creation of the National Energy

Secretariat (SNE) in 2008 consolidated all energy policy matters of the electricity and hydrocarbons sectors within the SNE. Following its creation, the secretariat released the 2009-2023 National Energy Plan, which details the country's energy policies and programs. The National Energy Plan emphasizes Energy Efficiency as an important factor for the sustainable development of the energy sector and in combating climate change.

ii) Technology University of Panama (UTP). The UTP was created to provide tertiary level science and technology education. The university conducts scientific research relevant to the country. Energy efficiency activities such as energy audits and research on energy efficiency are conducted through the Faculty of Electrical Engineering and through its Investigation Centers. The UTP has been invited to participate on technical committees and consultation groups of the government in the area of energy planning and efficiency. The university also has a plan to create an energy efficiency laboratory for certification of electrical appliances used in Panama. (CEPAL, 2009).

iii) Directorate General of Industrial Standards and Technology (DGNTI). The DGNTI of the Ministry of Commerce and Industry (MICI) is the entity responsible for standardization, conformity assessment, and quality certification in Panama. Despite work on developing energy efficiency standards in Panama being undertaken in the past, as of 2013 there were no approved standards in effect. There is also no labeling and certification program in Panama for electrical equipment. Following the approval of the Rational and Efficient Use of Energy Law in Panama, which requires the creation of energy efficiency standards for electrical equipment and materials, it is expected that energy efficiency standards will be established by the Energy Efficiency Committees.

#### d) Energy efficiency programs, projects and initiatives

Given the country's size and rapid growth in recent years, energy efficiency has been an important topic for Panama. Energy efficiency has been an important tool given Panama's dependence on oil for its energy needs and as a response to the rapid increase in crude oil prices. Below are some of the recent initiatives that have been undertaken:

i) Regional Program on Electrical Energy Efficiency (PEER). Panama was one of the beneficiaries of this program which was designed to remove the barriers that prevent deployment of EE and energy conservation measures and to promote efficient use of electricity in the industrial and commercial service sectors.

ii) Replacement of incandescent lamps in the residential sector. This program was launched between November 2008 and April 2009 to replace 3 million incandescent bulbs with compact fluorescent lamps (CFL) in the residential sector. As part of the program, households were given CFL bulbs in exchange for incandescent bulbs (CEPAL, 2009).

iii) Energy efficiency in the public sector. Measures aimed at the public sector were created more as an emergency measure to reduce the rising peak electricity demand and to achieve quick results. All government offices were instructed to turn on air conditioning systems one hour after commencement of working hours and to shut down the system one hour before the end of working hours to reduce the energy demand caused by air conditioning systems. Additionally, office hours were changed to reduce traffic during rush hour and reduce vehicle energy consumption caused by rush hour traffic. These measures are short term measures and are not implemented on a continuous basis.

iv) The Panama Metro. The Panama Metro Project, the first of its kind in Central America, was launched in 2011. Line 1 of the metro was inaugurated in May 2014. The metro will link the Los Andes Commercial Center in the north to the National Bus Terminal at Allbrook in the south. The total length of line 1 will be 13.7 kilometers, of which 7.2 kilometers will be underground, with the rest of the track above ground. Line 1 will be made up of 12 stations, 6 of which will be located underground, 5 will be elevated and 1 will be at ground level. The metro system is designed to operate at 90 second intervals and is expected to have 19 trains, each consisting of three coaches. Total travel time is expected to be reduced with the introduction of the metro, which is expected to reduce the flow of traffic as a result of people using the metro as opposed to other forms of public transport and private cars. The metro will run entirely on electricity, and information provided by the Panama Metro Authority indicates an estimated annual electricity consumption of approximately 43 GWh of electricity.<sup>8</sup>

## B. COUNTRIES WITH AN ENERGY EFFICIENCY BILL

### 1. El Salvador

The National Energy Council (CNE) is the leading institution in the energy sector. The General Superintendence for Electricity and Telecommunications (SIGET), an autonomous sector entity, is responsible for the regulation of the electricity sub-sector. A specialized entity of the Ministry of Economy (MINEC) is responsible for the regulation of downstream oil activities. With the exception of specific activities in the electricity subsector (e.g. energy transmission and the operations of the main hydroelectric power plants), electricity services, oil downstream activities and marketing of hydrocarbons are handled by private companies. Electricity system operation and management of the electricity market has been assigned to a specialized entity (the Transaction Unit, UT).

#### a) Electricity and hydrocarbon profile

i) Electricity. This subsector was restructured in 1996 and new market entities were created. Generation, Transmission, Distribution and Retail activities were separated. The new entities created in this sector are:

- SIGET (Superintendence of Electricity and Telecommunications), responsible for regulation of the Electricity sector.
- FINET (National Investment Fund in Electricity and Telephony).
- UT (Transactions Unit).
- ETESAL (Transmission Company of El Salvador).

The government of El Salvador created the National Energy Council (*Consejo Nacional de Energía*, CNE) in 2007. The CNE is tasked with creating energy policies for the sustainable development of the country with an emphasis on integrating renewable energy in the energy matrix. In 2010 the CNE released the National Energy Policy (*Política Energética Nacional*).

ii) Generation. The electricity generation sector in El Salvador is primarily in the hands of the private sector. In recent years much of El Salvador's investment in generation assets has been in thermal power plants. The total installed generation capacity as of 2011 was 1503 MW

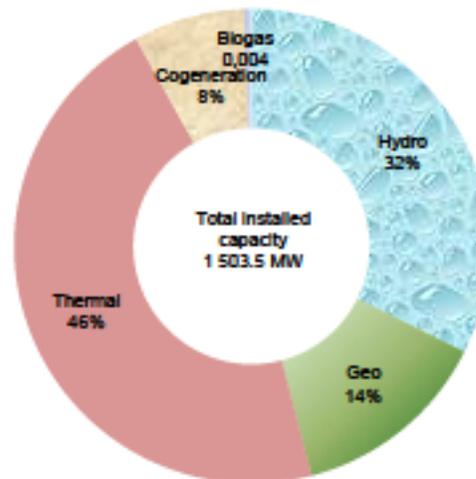
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<sup>8</sup> Panama Metro Authority.

(graph 10), of which 46% was made up of thermal power plants. Hydroelectricity accounts for 32% of installed generation capacity, followed by geothermal electricity which accounts for 14%.

iii) **Distribution.** In El Salvador, distribution of electricity to end users is carried out by eight companies: CAESS, CLESA, EEO, DEUSEM (all belonging to AES El Salvador), the DELSUR Company, owned by the Ashmore Energy International, and three smaller companies (ABRUZZO, EDESAL, and B&D). In 2011 total electricity generated was 5991.4 GWh of which 2080.3GWh was hydroelectricity and 1430GWh was derived from geothermal sources, with the remainder from thermal sources. In 2011, Energy losses in the electricity sector were 12.1% (CEPAL, 2012a).

**GRAPH 10**  
**EL SALVADOR: TOTAL INSTALLED ELECTRICITY**  
**GENERATION CAPACITY, 2011**



Source: ECLAC, based on officially reported figures.

## b) Hydrocarbons

Until the early nineties, hydrocarbon pricing was fully regulated by the state. In January 1994 the government established the System of Import Price Parity (*Sistema de Precios de Paridad de Importación*, PPI), which established the maximum price range for crude and derivative imports. The price of diesel for public transport and Liquefied Petroleum Gas (LPG) for domestic use was not covered under this system, and the prices of these products were fixed and subsidized by the state. In 2001, all diesel subsidies were eliminated leading to the liberalization of the market in 2002. LPG for domestic use is still subsidized.

The Directorate for Regulation of Hydrocarbons and Mines (*Dirección Reguladora de Hidrocarburos y Minas*, DRHM), which is under the Ministry of Economy, is tasked with the regulation and supervision of the hydrocarbon sector.

The department is responsible for defining the technical and legal framework of the sector to ensure that oil markets have adequate supply and to monitor the quality and distribution of oil and derivative products. The department regulates the import, transport, distribution and marketing

activities for oil and oil derivatives. Table 14 provides a breakdown of El Salvador oil derivative consumption by fuel type.

**TABLE 14**  
**EL SALVADOR: CONSUMPTION OF OIL DERIVATIVES, 1990-2011**

Year	Total consumption	Final consumption							Electricity production			
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil	Others
1990	5 450	5 139	505	1 495	393	1 898	756	92	311	42	269	
2000	14 011	11 670	1 638	3 014	767	4 397	1 662	192	2 341	589	1 751	
2005	14 650	13 174	2 182	3 447	919	4 566	1 862	199	1 476	60	1 328	89
2008	15 098	13 051	2 636	3 516	889	4 529	1 268	214	2 048	28	2 020	
2009	15 351	13 875	2 713	3 792	836	4 530	1 848	156	1 476	13	1 463	
2010	15 104	14 031	2 957	3 699	569	4 492	2 229	84	1 074	8	1 065	
2011	15 425	14 328	2 502	4 005	963	4 702	1 985	171	1 097	14	1 083	

Source: ECLAC, based on officially reported figures.

**c) Legal framework for energy efficiency**

As of September 2013, El Salvador did not have any energy efficiency laws in force and nor did it have a dedicated energy agency to handle matters related to energy efficiency. An Energy Efficiency Bill is currently under discussion in parliament and awaiting approval.

The Inter-American Development Bank has provided funding for El Salvador's energy efficiency programs, and part of this funding is being used to develop an energy efficiency bill and associated regulations. As of June 2013 El Salvador's energy efficiency programs are funded through the regular budgets of CNE and through funding obtained from international organizations.

**d) Institutions active in the area of energy efficiency**

i) The National Energy Council (Consejo Nacional de Energía, CNE). The *Consejo Nacional de Energía* (CNE) of El Salvador oversees policy matters concerning the energy sector. Prior to the creation of the CNE in 2007, energy policy matters were handled by the Ministry of Economy.

The creation of the CNE in 2007 through Decree Law No. 404 and the subsequent National Energy Policy 2010 to 2024 that was developed by the CNE has included Energy Efficiency as one of its main components. The creation of the Department of Energy Efficiency within the CNE has further emphasized the importance that the CNE is placing on its energy efficiency programs. The newly created department consists of 5 people that work exclusively on El Salvador's energy efficiency programs.

ii) The El Salvador Production Development Fund (FONDEPRO). The Production Development Fund (FONDEPRO) developed by the Ministry of Economy aims to improve the productivity and competitiveness of micro and small and medium enterprises (SME) operating in El Salvador. In order to meet this goal, FONDEPRO provides support to these enterprises through grants, co-financing of projects and assistance to improve their productivity and processes. In the area of energy efficiency, FONDEPRO supports activities in industry through its Cleaner Production Fund, financing initiatives that are environmentally friendly and/or initiatives that improve energy efficiency. Through

credit lines, FONDEPRO supports small micro and medium enterprises in implementing energy efficiency in their respective industries.

iii) The El Salvador National Center for Cleaner Production (*Centro Nacional de Producción Más Limpia, CNPML*). CNPML, began operations in 1998 with financing from the Swiss government and support from the United Nations Industrial Development Organization (UNIDO). CNMPL works with organizations in El Salvador to promote cleaner production and sustainable development. It provides consulting, financing and training in the area of Energy Efficiency, Renewable Energy and related areas. CNPML has launched projects for small and medium-sized companies providing energy audits and technical assistance. Following are some of the projects undertaken by CNMPL in 2013.<sup>9</sup>

- Executed 70 energy audits.
- Economic and Environmental Feasibility study for implementing a 1 MW solar farm.
- Sustainable use of chemical substances in five Salvadorian enterprises.
- Assisted in developing an efficient lighting strategy for the Central American region.
- Development of energy diagnostic tools in small hotels in El Salvador.
- Energy efficiency pilot projects in four El Salvadorian companies.

iv) El Salvador Industrial Association (*Asociación Salvadoreña de Industriales, ASI*). ASI as a representative of industry in El Salvador plays an important role in promoting issues that are important to its members. To promote Energy Efficiency in industry, ASI has created a program called “*Aprender Haciendo*” that targets the industries, commerce and service sectors of El Salvador. Through this program, high-level training is delivered to professionals from industries so that they can identify energy efficiency opportunities and implement changes within their respective industries. The training consists of 4 phases which cover the following key topics:

- Energy audits and efficient lighting.
- Pumps, compressed air and motors.
- Air conditioning, refrigeration and heating.
- Power quality.

Around 54 audits have been conducted by companies that have participated in the program between 2008 and 2010 and energy efficiency measures have been implemented within these organizations. According to data provided by CNE, participants in the program achieved energy savings of between 5% and 25% and over one millions US dollars were saved through measures implemented after the training program (CNE, 2012).

The El Salvadorian Industrial Association (ASI) identified financing as one of the key barriers to implementing energy efficiency measures. In order to overcome this barrier, ASI in conjunction with the Greenmax Corporation and with the support of (UNDP), created a financial tool for evaluating Energy Efficiency investments. Through this tool, a set of evaluation modules have been developed, one for project developers and the other for financial institutions to facilitate speedy loan approval for energy efficiency projects (CNE, 2012).

v) Central American University (*Universidad Centroamericana, UCA*). The Central American University was established in 1965 and has become an important center for higher education in El Salvador. In the area of energy efficiency, the activities of the university are focused on education and

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<sup>9</sup> Consejo Nacional Energía (CNE), El Salvador.

training. The university has conducted energy audits and provided technical assistance to industry and has offered certificate courses in Energy Efficiency to students. A course on Energy Audits has also been developed which forms part of the Mechanical Engineering degree program offered by the university. As of 2012, 16 students had graduated with an Energy efficiency diploma for industry, 32 students graduated with an energy efficiency diploma specializing in the buildings sector and 75 students had completed the Energy Audit course (CNE, 2012).

vi) Others. Electricity distributors in El Salvador actively participate in projects and programs aimed at promoting Energy Efficiency in the country. The distributors promote efficient energy use through their electricity invoices and through their websites by preparing promotional materials with energy efficiency tips for their customers. The distributors also participate in programs and projects providing technical cooperation and distribution of efficient electrical equipment.

e) **Energy efficiency programs, projects and initiatives**

i) El Salvador Ahorra Energía. An inter-institutional energy efficiency program was launched in El Salvador towards the end of 2011. The Program is called “*El Salvador Ahorra Energía*” (El Salvador Saves Energy), and encompasses several institutions that promote energy efficiency in different sectors of society. The program was a result of the Energy Efficiency Program for Latin America and the Caribbean “*Programa para América Latina y Caribe de Eficiencia Energética*” (PALCEE), which was implemented by the Latin American Energy Organization (OLADE, in Spanish).

Institutions that form part of the Ahorra Energía program promote rational and efficient use of energy within their respective areas. Through the program CNE hopes to promote a culture of energy efficiency among its citizens and through capacity building efforts enable industries and other commercial and public entities in the country to incorporate energy efficiency measures in their activities and processes.

ii) Energy Efficiency Committees in the Public Sector (Comités de Eficiencia Energética en el Sector Público, COEEs). Energy efficiency committees have been created in different public sector departments to carry out activities to reduce energy consumption within their respective organizations. A pilot project for Energy Efficiency committees was launched in 2010 in a few institutions, which was extended to other institutions in 2011 and 2012. The CNE has calculated that energy consumption in the Public sector was approximately 146 GWh in 2009, representing a cost of approximately 20.9 million dollars. The newly formed energy efficiency committees are expected to drive the energy efficiency agenda within their respective public sector organizations and to promote an energy efficiency culture within the organization and among employees, which could result in lower energy consumption and economic benefits. Members of the committees are drawn from the various institutions and are provided EE training by the CNE.

iii) Energy efficiency in government buildings. UNDP and CNE launched the “Energy Efficiency in Public Buildings” project in 2011. The project was launched to reduce energy consumption in government buildings and was created through a co-financing agreement signed between the two institutions with funding from GEF. The project was carried out over 36 months and concluded in 2013. According to CNE,<sup>10</sup> through the project overall potential energy savings of 23% were identified in different public sector entities. Energy audits were conducted in ten hospitals which identified potential energy savings of over 500,000 US dollars.

<sup>10</sup> “Proyecto de eficiencia energética en edificios públicos”, retrieved from <ww.cne.gob.sv>.

The energy efficiency measures implemented through the project include; changes in end use equipment, replacement of inefficient lighting, purchase of energy efficient appliances, remodeling of some facilities and capacity building.

iv) Financing Program by the El Salvador Development Bank (*Banco de Desarrollo de El Salvador*, BANDESAL). The El Salvador Development Bank (BANDESAL) has been financing energy projects since 2006. Through financing of projects in the energy sectors, BANDESAL aims to contribute to the protection of the environment and promotion of efficient use of energy. The first phase of the financing program was launched in 2006 with an amount of \$10 million USD. The second phase of the program was launched in 2009 with an amount of \$27 million USD. The program also has a Technical Assistance Fund (*Fondo de Asistencia Técnica*, FAT) of \$800,000 USD available for financing energy audits and studies. The Technical Assistance Fund (FAT) is channeled to industry and organizations via institutions that collaborate with BANDESAL. Following Phases I and II approximately \$20 million USD in credit had been made available to local companies and approximately \$300,000 USD has been disbursed from the Technical Assistance Fund between 2007 and 2011(CNE, 2012).

## 2. Guatemala

The Ministry of Energy and Mines (MEM) has been assigned the responsibility of the governance of the energy sector. The National Commission for Electric Energy (CNEE), a semi-autonomous decentralized MEM institution (with objectives and tasks set out in specific legislation) is responsible for electricity regulation. A specialized MEM directorate is responsible for the regulation of upstream and downstream oil activities. With the exception of specific activities in the electricity subsector (e.g. energy transmission, and the operations of the main hydroelectric power plants) electricity services, oil downstream activities and marketing of hydrocarbons are performed by private enterprise. The management of the electricity market has been assigned to a specialized entity (the wholesale electricity market administrator, AMM). There are also 14 small municipal distributors responsible for electricity distribution in the same number of medium-sized and small cities.

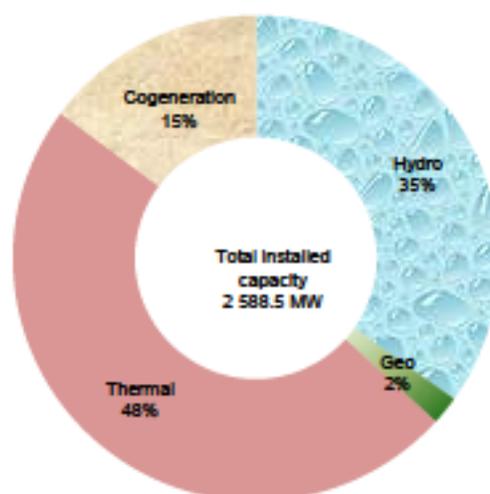
### a) Electricity and hydrocarbon profile

i) Electricity. Guatemala's electricity sector followed a monopoly model and was restructured in the 1990s. Prior to this, the National Institute for Electrification (INDE) was responsible for generation, transmission and distribution of electricity. The passing of the General Electricity Law of 1996 to regulate the energy sector introduced major changes and broke the existing monopoly structure that was in effect. AMM, an independent electricity market administrator, is responsible for executing energy sector contracts and transactions and balancing supply and demand in the national grid.

1) Generation. The liberalization of the electricity sector of Guatemala created many opportunities for private participation in existing and new generation projects. As of 2011, Guatemala had a total installed capacity of approximately 2600 MW (graph 11), with 46% of the electricity generation capacity from thermal sources, 34% from hydroelectric sources, 17% from biomass (sugarcane) and 2% from geothermal sources. In 2011, Guatemala generated 8146.6 GWh of electricity with over 50% of electricity generated, derived from renewable sources. In the 1980s, much of Guatemala's electricity was derived from hydroelectric sources, however with the opening of the market there has been a shift to thermal energy, which has resulted in the country becoming dependent on refined oil products for its generation sector.

2) **Distribution.** In Guatemala distribution of electricity to end users is carried out by three companies Empresa Eléctrica de Guatemala, S.A. (EEGSA), Distribuidora de Electricidad de Occidente, S.A. (DEOCSA) and Distribuidora de Electricidad de Oriente, S.A. (DEORSA). Municipal entities and private distribution companies handle all other distribution.

**GRAPH 11**  
**GUATEMALA: TOTAL INSTALLED ELECTRICITY GENERATION CAPACITY, 2011**



Source: ECLAC, based on officially reported figures.

#### b) Hydrocarbons

Guatemala and Belize are the only Central American countries with oil reserves. Since the 1990s, Guatemala's crude oil production showed an upward trend and peaked in 1998. The period from 1998 to present has seen a decline in oil output and consequently a decline in revenues for the oil sector. Moreover, the oil produced in Guatemala is heavy in nature with high sulfur content, which cannot be processed locally. Most of Guatemala's crude oil is exported to the United States and the country has to import refined petroleum products to meet its domestic needs.

The import, sale and distribution of refined petroleum products are governed by Decree Law 109-97 of 1997, which regulates the activities of market actors and promotes a competitive market. Much of Guatemala's oil imports are destined for the transport sector in the form of diesel and gasoline, while a relatively smaller amount is destined for electricity generation. Production, distribution and refining activities for hydrocarbons are overseen by the Directorate General of Hydrocarbons within the Ministry of Energy and Mines. Table 15 provides a breakdown of Guatemala's oil derivative consumption by type.

TABLE 15  
GUATEMALA: CONSUMPTION OF OIL DERIVATIVES, 1990-2011

Year	Total consumption	Final consumption							Electricity production			
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil	Crude oil
1990	9 875	9 477	1 117	2 712	527	3 823	1 128	170	398	143	145	110
2000	21 534	17 853	2 327	6 413	755	6 803	1 127	428	3 681	721	2 959	
2005	26 385	21 509	2 699	7 024	614	8 512	1 169	1 492	4 876	38	3 029	1 809
2008	25 504	22 869	2 914	7 509	699	8 084	2 415	1 248	2 635	25	2 610	
2009	28 772	24 473	2 701	8 323	601	9 226	2 075	1 546	4 299	59	4 240	
2010	25 681	23 780	2 810	8 181	607	9 225	1 735	1 223	1 901	26	1 875	
2011	26 318	24 491	3 010	7 963	573	9 297	2 294	1 353	1 827	13	1 814	

Source: ECLAC, based on officially reported figures.

### c) Legal framework for energy efficiency

Guatemala's efforts in energy efficiency have been led by the electricity sector. Guatemala recognizes Energy Efficiency as a significant contributor to mitigating climate change and a key factor in its energy policy for sustainable development in the energy sector. Energy efficiency was listed as a component in the 2008 energy policy document of the Ministry of Energy and Mines.

Guatemala's draft Energy Efficiency Bill (*Anteproyecto de Ley de Eficiencia Energética*), which is seen as the first step towards implementing domestic energy efficiency policy, is currently awaiting congressional approval. The draft energy efficiency bill was proposed in 2011, is still under discussion and covers the following main areas:

i) Creation of the Energy Efficiency Council. The draft energy efficiency bill envisions the creation of an Energy Efficiency Council (CONEE) as a technical unit within the Ministry of Energy and Mines, with a dedicated budget and administrative, financial and functional autonomy. The Energy Efficiency Council will be responsible for preparing and executing a National Energy Efficiency Plan and will dedicate itself to activities exclusively related to Energy Efficiency. Its main functions will be:

- Creation and Execution of the Energy Efficiency Plan.
- Management of the Energy Efficiency Fund created for financing energy efficiency projects and programs.
- Development of norms and standards associated with rational use of energy and to ensure compliance therewith.
- Coordination with Public and Private Entities involved in the area of energy efficiency to exchange information and develop a Comprehensive Energy Efficiency Plan.

ii) Development of the energy efficiency plan. The plan will be developed by CONEE and will identify opportunities for energy efficiency and investment needs, developing short-term, medium-term, and long-term energy efficiency programs. The Energy Efficiency Plan will be developed for a fifteen year period and will be reviewed at intervals no greater than five years. Following are some of the aspects that will be covered by the plan:

- Creation of programs for end users of energy, promoting energy efficiency and creating a culture of energy efficiency.

- Programs to establish and adopt norms for certification and labeling of energy efficient equipment and machinery to promote adoption of energy efficient equipment by end users.
- Mechanisms to ensure monitoring and compilation of data on energy consumption and indicators that provides insights on energy use.
- Campaigns and events to disseminate information on efficient energy use to educate the population.
- Impact of projects in reducing greenhouse gas emissions.

iii) **Energy Efficiency Fund.** The Energy Efficiency Fund (*Fondo de Eficiencia Energética, FODEE*) will be created to finance programs, projects, technical assistance and capacity building in the area of energy efficiency. The Energy Efficiency Fund is expected to be financed with resources received from international organizations, through taxes on the sale of energy and contributions from domestic development programs. The fund will be managed by CONEE and will be used for the following activities, among others:

- To finance Energy Efficiency Programs and/or Projects at market rates or below markets rates as determined by CONEE.
- To provide guarantees and credit for energy efficiency projects.
- To develop partnerships and agreements with public and private entities locally and internationally to execute energy efficiency programs in the country.

iv) **Other measures.** In addition to the above, CONEE will be responsible for coordinating the labeling of electric equipment sold in the country which will indicate the energy consumption and the energy efficiency rating of the equipment. In collaboration with other entities, CONEE will develop the standards, norms and technical regulations necessary for this purpose.

Energy companies involved in the distribution of electricity, refined petroleum products and gas, both public and private, will be required to promote rational and efficient use of energy among their customers by educating them in using industry best practices. Distribution companies will also be required to measure, control and reduce energy losses, including losses as a result of theft.

Public sector contracts and tenders for energy intensive appliances and equipment will need to take energy efficiency into account during the lifecycle of the product. CONEE will be responsible for implementing the standards and requirements for incorporation of such measures in public sector contracts and tenders.

The Draft Bill also includes the creation of a National Energy Efficiency Prize that will be awarded by CONEE to individuals, companies or entities that have developed projects or programs in the area of energy efficiency.

As of the writing of this document, Guatemala's Energy Efficiency Bill is still awaiting approval, and the bill could see further changes before it is approved.

#### d) **Institutions active in the area of energy efficiency**

i) **Ministry of Energy and Mines (Ministerio de Energía y Minas MEM).** MEM is responsible for defining the policies of the energy sector. It recently released its policy document for the energy sector titled "*Política Energética: Energía para el Desarrollo 2013-2027*". MEM has identified

five action areas which will enable it to achieve the objectives listed in the policy document. One of the action areas involves efficient use of energy.

ii) The National Commission for Electric Energy (CNEE) (*Comisión Nacional de Energía Eléctrica* (CNEE)). CNEE was created in 1996 by executive decree and is responsible for regulatory activities in the electricity sector. In addition to its regulatory functions CNEE was responsible for preparing the Draft Energy Efficiency bill in Guatemala, preparing the Energy Efficiency Plan for the electricity sector and in the execution of several technical and capacity building events.

e) **Energy efficiency programs projects and initiatives in Guatemala**

Energy efficiency is important for Guatemala given the rapid growth in energy consumption the country has witnessed in recent years. The energy crisis of the 1990s and the country's dependence on external sources for refined crude oil products has required that the government incorporate energy efficiency as a policy tool for mitigating climate change and reducing investments in new generation capacity in the electricity sector. Following are some of the recent initiatives undertaken over the last few years:

i) Energy Efficiency Plan (*Plan Integral de Eficiencia Energética*, PíEE). The Energy Efficiency Plan (PíEE) was developed by CNEE with financing of 600 thousand dollars from the Inter-American Development Bank (IADB). The funding from the IADB was supplemented with an amount of \$150,000 dollars by CNEE to administer the plan (CNEE, 2012).

As part of the PíEE, several initiatives were undertaken, such as consulting services, pilot projects, research, workshops and capacity building measures, aimed at strengthening institutions and training individuals. A key outcome of the PíEE was the development of the draft Energy Efficiency Bill, which was presented to Congress and is awaiting approval. As part of the capacity building efforts, CNEE, through an agreement with FIDE from Mexico, organized energy efficiency training for over one hundred individuals (CNEE, 2012).

A total of nine Energy Efficiency Pilot projects were executed to demonstrate the advantages of investing in Energy Efficiency measures in different areas. The pilot projects covered commercial and industrial entities and the residential sector. The projects involved a total investment of around 120,000 US dollars, which resulted in energy savings of around 300,000 US dollars and 1.12 million kWh of electricity per year (CNEE, 2012).

ii) Energy efficiency campaigns. Over the years, the Ministry of Energy and Mines and National Electric Energy Commission have launched several energy saving campaigns in the country through newspapers, television and radio in order to educate the public on the importance of using energy efficiently. In 2011 the communications firm "Ogilvy & Mather Publicidad S.A." was contracted to create a public awareness campaign to promote energy efficiency (CNEE, 2012).

iii) Replacement of incandescent lamps. The Ministry of Energy and Mines and INDE conducted a pilot project in the Municipality of Estor, where 75-watt incandescent bulbs were replaced with 15-watt energy-saving bulbs in 660 homes. The project involved the delivery of 2,640 bulbs that would result in energy savings of up to 80% when compared with incandescent bulbs (CEPAL 2009).

iv) Educational activities. The Ministry of Energy and Mines, in collaboration with the Ministry of Education, prepared educational material for primary school students in order to develop a culture of efficient energy use among students and future generations (CEPAL, 2009).

v) Modern urban transport systems. Following the recommendations of a urban public transport multisectoral commission and considering the Bus Rapid Transit technology of (BRT), the Municipality of Guatemala (the capital city) and the Government developed, between 2006 and 2011, the systems known as Transmetro and Transurbano, whose aim is to improve urban mobility and reduce problems arising from traffic congestion in the capital city and the metropolitan area.

vi) Energy efficient firewood stoves in rural areas. Recently (May 2014) and with support of the Global Alliance for Clean Cookstoves the country approved the National Strategy for Sustainable Use of Wood, which aims to achieve the deployment of 65,000 improved cookstoves per year over the next ten years, and to inform 70% of the population on the sustainable use of firewood.

### 3. Honduras

The Secretariat for Natural Resources and the Environment (SERNA) is responsible for the governance of the electricity sub-sector and oil upstream activities. The National Commission for Energy (CNE), a semi-autonomous institution, is in charge of electricity regulation. The regulation of downstream petroleum activities is the responsibility of a specialized office attached to the Industry and Trade Secretariat (the Oil Administrative Commission, CAP).

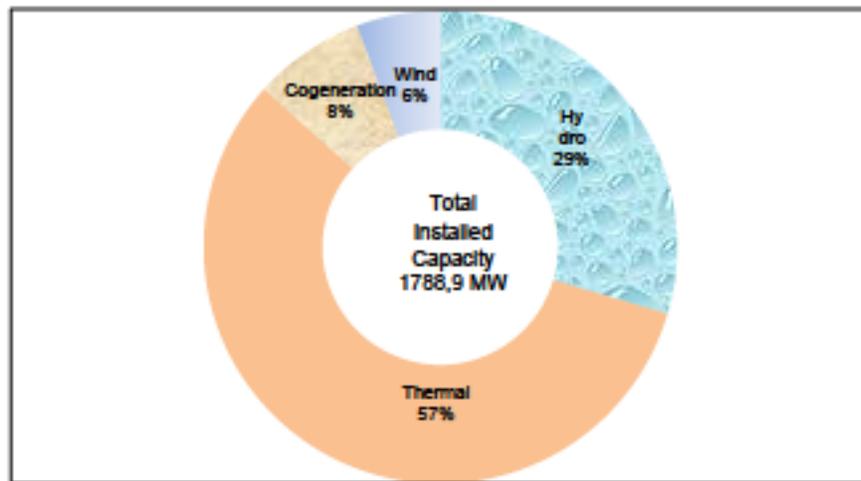
The National Electricity Company (ENEE) continues to be vertically integrated, playing an important role in transmission and distribution as well as in the operation of the main hydro power stations and the operation of the national electricity grid. There are many small and medium-sized independent private generators that own and operate thermoelectric and renewable power plants (hydro and wind). All of their electricity production is sold to ENEE. Oil downstream activities and marketing of hydrocarbons are performed by private companies. Honduras is a signatory country to the ALBA and Petrocaribe Venezuelan initiatives. Within the Petrocaribe framework, Honduras has an oil supply contract which allows it to meet a portion of its consumption with preferential payment terms. In recent years, this supply scheme has not been used, though it was recently reactivated with shipments expected in the fourth quarter of 2013.

#### a) Electricity and hydrocarbon profile

i) Electricity. The electricity sector of Honduras has private participation in the generation sector, which is a result of the electricity reforms of the 1990s. The distribution of electricity follows a state monopoly model. Electricity losses in the country in 2011 were 27%, which is the highest in Central America. The rate of access to electricity in Honduras was 83.2% in 2011, which is low in comparison to countries in Central America, but higher than that of Nicaragua.

1) Generation. Total installed capacity in Honduras was 1788.9 MW (graph 12) in 2011. Honduras is dependent on thermal electricity to meet most of its energy needs. The total hydroelectric installed capacity was 529.1 MW with wind energy installed capacity of 102 MW. Total electricity generated in 2011 was 7124.6 GWh, of which over 50% was generated from thermal sources. The state owned company *Empresa Nacional de Energía Eléctrica* (ENEE) and the National Electric Energy Company control approximately 32% of installed capacity.

**GRAPH 12**  
**HONDURAS: TOTAL INSTALLED ELECTRICITY GENERATION CAPACITY, 2011**



Source: ECLAC, based on officially reported figures.

2) Distribution. The transmission and distribution of electricity in Honduras follows a monopoly model with transmission and distribution of electricity managed by the state owned company ENEE. In 2011, the residential sector in Honduras was the largest consumer of electricity, consuming 2,167.5 GWh of electricity; this was followed by the industrial sector, which consumed 1,376 GWh of electricity, and the commercial sector, which consumed 1,297.7 GWh of electricity.

ii) Hydrocarbons. The hydrocarbon sector in Honduras follows a privatized model with importation of refined crude oil derivatives in the hands of private and foreign companies. The *Comisión Administradora del Petróleo* (CAP) is the entity responsible for policy making and regulation of the hydrocarbon sector. The principal objective of CAP is to ensure that the country has adequate supplies of crude oil derivatives and to monitor the quality, supply and storage of these products.

In 2011, Honduras consumed over 18 million barrels of imported crude oil derivatives. Approximately 29% of these imports were destined for electricity production (table 16). The transport sector in Honduras is a major consumer of crude oil derivatives, consuming around 52% of oil derivatives in the form of gasoline and diesel. The remainder of the imports is destined for the residential sector in the form of LPG and fuel oil and jet fuel for commercial use.

Import of crude oil derivatives in Honduras is carried out by nine companies which include multinationals and privately owned Honduran companies. Distribution of oil derivatives is carried out through 395 gas stations which are owned by multinational oil companies and privately held Honduran companies (CEPAL 2012b).

**TABLE 16**  
**HONDURAS: CONSUMPTION OF OIL DERIVATIVES, 1990-2011**  
*Volume (In thousand barrels)*

Year	Total consumption	Final consumption							Electricity production		
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil
1990	5,449	5,449	127	1,158	761	2,420	925	58			
2000	10,302	8,176	496	2,629	575	3,904	520	53	2,127	206	1,921
2005	14,792	9,794	785	2,761	459	5,061	676	53	4,997	197	4,801
2008	17,935	12,427	917	3,812	708	5,373	1,584	33	5,508	123	5,385
2009	16,907	12,177	857	4,094	733	5,141	1,272	81	4,730	23	4,706
2010	17,714	13,073	876	4,565	736	5,490	1,340	65	4,641	22	4,619
2011	18,228	12,907	946	4,323	744	5,258	1,501	136	5,321	115	5,206

Source: ECLAC, based on officially reported figures.

#### b) Institutions active in the area of energy efficiency

i) Secretariat for Natural Resources and Environment (Secretaría de Recursos Naturales y Ambiente, SERNA). Created in 1996 by executive decree, SERNA is the policymaking entity responsible for the creation, coordination and evaluation of policies related to the electricity sector.

ii) National Electrical Power Enterprise (Empresa Nacional de Energía Eléctrica, ENEE). ENEE is the state owned vertically integrated electricity company in Honduras. It was created in 1957 and is tasked with the generation, transmission and distribution of electricity. ENEE has played an active role in promoting energy efficiency in Honduras through participation in activities organized by SERNA.

#### c) Legal framework for energy efficiency framework

Honduras has a draft rational energy use bill that has been designed to promote energy efficiency policies programs. The draft bill is being discussed in the National Congress of the Republic. According to the draft bill, SERNA will be the entity to promote Rational and efficient energy use in Honduras. A new entity will be created within the organization structure of SERNA for promoting rational and efficient energy use.

The bill proposes the creation of a fund for financing energy audits, energy efficiency pilot projects and projects and programs. The fund will be financed by domestic and international sources and will be managed by SERNA.

Additionally, the bill proposes establishing of a standards and labeling program for electrical appliances. The standards will be developed in cooperation with the Honduran Standards Agency and steps will be taken to ensure compliance with the norms.

Electrical equipment sold in the country would need to have labels in Spanish that provide details of the energy consumption of the equipment. Importers and producers will be responsible for the data that is printed on the labels.

SERNA will be required to create energy information databases to monitor energy consumption patterns in the country. Suppliers and importers of energy will be required to make available energy consumption data to SERNA for the database.

The bill also has a section dedicated to the transport sector to promote efficient energy use within the transport sector through reorganization of traffic flow, modernization of public transport fleet etc. Fiscal incentives for energy efficient equipment in the form of tax exemptions are also covered by the draft bill.

#### d) Honduras energy efficiency programs & projects

i) Energy efficiency standards. The Honduran Standards Agency (*Organismo Hondureño de Normalización*, OHN) has developed energy efficiency standards for compact fluorescent lamps, air conditioners, motors and refrigerators. The standards specify the energy efficiency requirements and also the associated labeling requirements. The standards are voluntary in nature and there is no verification and control mechanism to monitor compliance.

ii) Strategic Plan for Saving Electricity and Fuels (*Plan Estratégico de Ahorro de Combustible y Electricidad*). The strategic plan for reducing energy consumption was approved by Executive Decree PCM010-2012 in March 2012. It includes measures aimed at reducing energy consumption in the public and private sectors. Key measures proposed are:

- Public educational campaigns

Communication entities of the government are required to create publicity campaigns to promote the rational use of energy. The campaigns should include energy savings tips and suggestions to promote efficient use of electricity and fuels.

- Energy efficiency in the transport sector

To improve the flow of public transport, taxis and cargo vehicles, and to reduce traffic congestion on public roads, measures such as parking of vehicles in designated spots, maintenance and repair of roads at times of reduced traffic flow have been mandated.

- Time of use electricity tariffs

Through the decree the state electricity company ENEE is required to develop time of use tariffs to encourage consumers to consume electricity during off-peak hours to reduce peak electricity demand.

- Rational use of energy in public sector offices

Public sector offices are required to reduce energy consumption (fuels and electricity). Key measures include:

- Scheduling public sector vehicle use to reduce fuel consumption
- Mandatory reduction in electricity consumption of 10% in public sector offices and buildings
- Turning off electrical appliances and lighting in public sector offices after office hours
- Limiting the use of air conditioning in public sector offices to between 10:00 a.m. and 3:00 p.m.
- Mandatory energy audits

iii) Project for Energy Efficiency in the Industrial and Business Sectors (PESIC). PESIC was launched in 2005 with the objective of providing technical support and capacity building to promote energy efficiency in the Honduran commercial and industrial sectors. The project was promoted by the Honduran Business Council for Sustainable Development (CEHDES), with cooperation from the Honduran government, SERNA, UNDP and external donors. The program promotes best practices in Honduran Industry in order to cut GHG emissions, improve efficiency, promote use of energy efficient equipment and improve the overall competitiveness of businesses. (CEPAL, 2009). Through the PESIC project financing was made available for energy audits, capacity building efforts and energy efficiency research in commercial and industrial entities in Honduras. According to data available from the PESIC project website<sup>11</sup>, a total of 17 energy audits were conducted in the project's first phase, which identified energy saving potential of around 6.5 GWh/year.

Key activities of the project<sup>12</sup> were:

- Project financing and credit guarantees
- Pilot Projects in the area of energy efficiency
- Training of personnel
- Dissemination of information on energy efficiency projects
- Monitoring of GHG emissions

iv) Autonomous Generation and Rational Use of Electricity Project (*Proyecto generación autónoma y uso racional de la energía eléctrica*, GAUREE). The GAUREE Project, phase I and II, is a project supported by the European Union and commenced in the last decade. The second phase of the project has financed viable projects that were identified in the programs initial phase. The project had five modules, four of which financed projects in specific areas such as renewable energy projects in rural areas, projects involving multiple uses of water resources and energy loss reductions in electricity distribution systems.

#### 4. Nicaragua

The Ministry of Energy and Mines (MEM), which was created in 2007, has been delegated the responsibility of governing the energy sector. It is responsible for formulating, coordinating and executing the Strategic Plan and Public Policies for the Energy Sector. It is also responsible for directing the activities of the state-owned companies involved in the Energy Sector. The organizational structure of MEM dictates that the Department of Energy Efficiency is delegated the task of executing energy efficiency activities, reporting directly to the senior management of MEM.

The Nicaraguan Energy Institute (INE), an autonomous institution, is in charge of electricity regulation and downstream oil regulation. In both sub-sectors (oil and electricity), there is participation of state companies, private equity firms, and venture capital (public/private partnerships). For example, in the electricity subsector, state companies are in charge of transmission, operation of the main hydro plants and system operation and management of the market. The rest of the electricity services are performed by private and mixed companies.

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<sup>11</sup> [www.pesic.org](http://www.pesic.org)

<sup>12</sup> [www.pesic.org](http://www.pesic.org)

In the oil sector, the country has a state company (Petronic), a private refinery (Manref) and several private enterprises. Nicaragua is a signatory country to the ALBA and Venezuelan *Petrocaribe* initiatives. Within the framework of *Petrocaribe*, the country has an oil supply contract which would allow it to meet a portion of its consumption with preferential payment terms. The scheme has been used since 2007.

After the country's entry into ALBA, Albanisa was created, which is a joint venture between Petronic and the Venezuela State Oil Company (PDVSA). Since its creation, Albanisa has diversified rapidly. Apart from import and distribution of oil and oil derivatives, it has covered other activities outside of the energy sector. In 2011, the group imported 36% of the country's oil and produced 21% of the electricity generated in the country.

#### a) Electricity and hydrocarbon profile

i) Electricity. The Electricity sector of Nicaragua is highly dependent on oil to meet most of its electricity needs. In 2011, the total installed capacity for electricity generation was 1,093.7 MW, of which approximately 76% was derived from thermal sources, which is higher than in other Central American countries. The rate of access to electricity for the country stood at 77.9% in 2011, which is much lower than the average for Central America. Electricity losses in 2011 were around 24.1%, which is second only to Honduras (27%) in Central America (CEPAL 2012a).

1) Generation. Following the privatization efforts of the 1990s, much of the generation capacity of the country is in private hands. A total of 25 generation companies exist in Nicaragua, of which five companies are state owned, representing 233 MW of installed capacity, while the remaining 20 privately owned companies represent 860 MW of installed capacity (CEPAL 2012a).

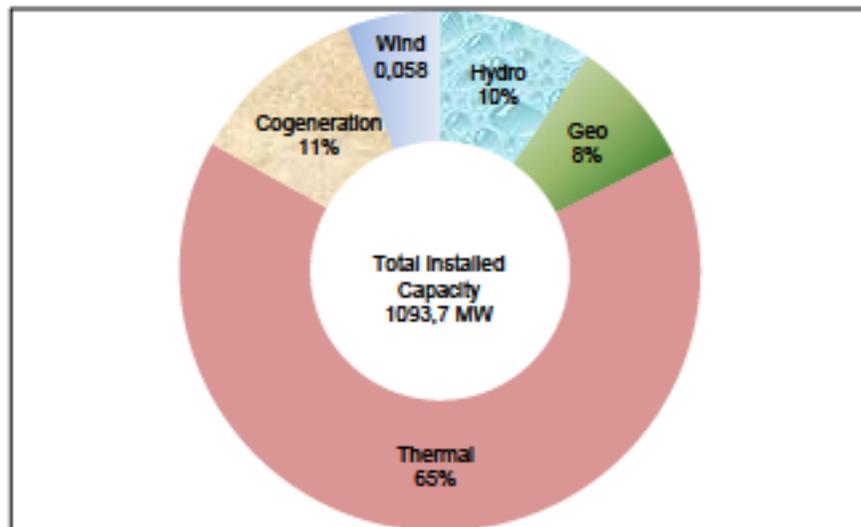
Total installed hydroelectricity capacity was around 105 MW in 2011 (graph 13). The two hydroelectric plants in operation are controlled by the state-owned company *Hidrogesa*. Like in all Central American countries, Nicaragua has abundant geothermal energy potential, though only a small portion of this energy has been exploited. The total installed geothermal capacity in Nicaragua was around 87 MW, which is controlled by private sector companies *Gemosa* and *PENSA*. Total installed thermal capacity was around 709 MW, which is in the hands of sixteen private sector companies, while the three public sector entities account for the remaining thermal capacity of around 128 MW. As of 2011, Nicaragua also had around 63 MW of installed wind power capacity, which is run by a private entity called Amayo since 2009 (CEPAL 2012a).

In 2011 the country consumed around 2,526 GWh of energy, the bulk of which was destined for the residential sector (896.8 GWh), followed by the industrial (662.8 GWh) and commercial sectors (622.5 GWh) (CEPAL 2012a).

2) Transmission & dispatch. The transmission sector of Nicaragua is managed by a state-owned company called ENATREL (the National Transmission Company), which was created by Law 583 of November 2006. ENATREL is responsible for transmission of electricity generated in the country to the distribution network. According to information available on the website of ENATREL, transmission of electricity is through 2,189 kilometers of high-tension lines and 79 substations. In recent years, ENATREL has taken advantage of its transmission networks to install fiber optic cables for telecommunication use. According to ENATREL its fiber optic line spans over 1,000 kilometers in length.

The National Energy Dispatch Center (CNDL) is a state owned company responsible for dispatch functions and administration of the wholesale electricity market and the national interconnected system.

**GRAPH 13**  
**NICARAGUA: TOTAL INSTALLED GENERATION CAPACITY BY TYPE, 2011**



Source: ECLAC, based on officially reported figures.

3) Distribution. Electricity distribution in Nicaragua is dominated by two companies, DISSUR and DISNORTE, which together control over 90% of the distribution market. The rest of the distribution is managed by smaller players.

ii) Hydrocarbon sector. The hydrocarbon sector of Nicaragua is mainly in private hands, with import, refining and distribution of hydrocarbons privatized. In 2011, total import of crude oil and derivatives into Nicaragua was approximately 11 million barrels of oil equivalent, an increase of approximately 20% over the previous year. Of the total hydrocarbon imports, over half was in the form of crude oil, which was destined for the refinery located in Managua. The bulk of Nicaragua's hydrocarbons imports are from Venezuela. Crude oil imported into Nicaragua is processed at the Managua refinery, which provides over 50% of the domestic requirement for refined fuels. Principal products from the refinery include Fuel Oil, Diesel and Gasoline. The remainder of national consumption is made up of imports of refined fuels.

Distribution of Gasoline and Diesel was managed by four suppliers, who together are responsible for 71.5% of the distribution in the country. The distributors are Esso (17.7%), Chevron Texaco (18.1%), DNP (16.6%) and (Uno 19.1%) (CEPAL, 2012b). Distribution of gasoline and other fuels was managed by 280 gas stations spread out across the country.

Nicaragua consumes high amounts of fuel oil and diesel, which together represent over 60% of total demand for refined fuels. Fuel oil is primarily destined for electricity generation, which represents over 95% of total fuel oil consumption, while diesel is destined for the transport sector. Table 17 provides a breakdown of the oil derivative consumption in Nicaragua.

**TABLE 17**  
**NICARAGUA: CONSUMPTION OF OIL DERIVATIVES, 1990-2011**

Year	Total consumption	Final consumption							Electricity production		
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil
1990	4,483	3,396	203	775	268	1,525	553	72	1,087	43	1,044
2000	8,299	5,372	496	1,324	290	2,670	455	137	2,927	164	2,763
2005	9,633	6,542	657	1,585	213	2,871	390	826	3,092	101	2,991
2008	9,960	6,563	708	1,710	216	2,972	222	736	3,397	181	3,216
2009	10,005	6,296	747	1,801	194	3,025	192	339	3,709	122	3,587
2010	9,832	6,624	789	1,866	180	3,185	186	418	3,208	98	3,111
2011	10,766	6,905	793	1,920	187	3,334	173	498	3,862	141	3,721

Source: ECLAC, based on officially reported figures.

#### b) Legal framework for energy efficiency

Nicaragua does not have an Energy Efficiency Law. The matter is currently under discussion and work on an energy efficiency bill is underway. Although Nicaragua has not passed Energy Efficiency legislation, there exists other legislation that deals with energy efficiency issues such as:

- The Electricity Industry Act Law No. 272 of 1998, which promotes efficient use of energy.
- Presidential Decree 1304 of 2004, which establishes the framework for the National Energy Policy.
- Presidential Decree No 2 of 2008 on Energy Use, which was in response to the energy crisis due to a rapid increase in international crude oil prices. Through this decree emergency measures were introduced to reduce consumption of energy to overcome the crisis.
- Presidential Decree No 02 of 2009, focusing on austerity measures aimed at public sector institutions.

#### c) Nicaragua energy efficiency programs & projects

i) Energy efficiency standards. As part of its energy efficiency programs, Nicaragua has developed Mandatory Technical Standards (*Normas Técnicas Obligatorias Nicaragüenses* NTON) for electrical appliances. The process of normalization was coordinated by the Ministry of Energy and Mines (MEM) with the participation of the Ministry of Industry and Commerce, members of academia and industry. The standards cover air conditioners, compact fluorescent lamps, motors and refrigeration (MEM, 2012c). The standards are binding and electrical appliances must comply with these standards. However, Nicaragua does not have a laboratory or the infrastructure necessary for monitoring compliance with these standards.

ii) Energy efficiency campaigns in the education sector. Between 2008 and 2011, Nicaragua launched promotional campaigns to educate students about Energy Efficiency. The campaign was launched with the collaboration of the Ministry of Energy and Mines and the Ministry of Education. A total of 487,180 students were covered by the campaign which also included 12,250 primary school teachers (MEM, 2012c).

iii) Energy audits in the public & private sectors. Energy Audits in private and public sector entities were organized to identify potential energy savings. A total of 28 audits were conducted in the private sector and 20 audits in government institutions. According to data available from the Ministry of Energy and Mines, the private sector audits identified electricity savings of almost two million kilowatt hours per year and fuel savings of over two hundred thousand gallons per year, which could be attained with a total investment of approximately 1.3 million dollars (MEM, 2010 and MEM, 2012c).

iv) Distribution of compact fluorescent lamps (CFL). For the period from 2008 to 2010, Nicaragua launched campaigns to distribute Compact Fluorescent Lamps (CFLs) across the country to substitute incandescent lamps. A total of 1.2 million CFLs were distributed during this period. Data provided by the Ministry of Energy and Mines indicates that the campaign resulted in savings of 43,776 MWh of electricity consumption which in turn resulted in savings of 62,182 barrels of fuel oil. It is estimated that as a result of the distribution of CFLs there was a reduction of 249,593 tons in CO<sub>2</sub> emissions (MEM, 2012c).

v) Upgrading public transit buses. In an effort to upgrade its fleet of buses providing public transit services, Nicaragua, through the Ministry of Transport and Infrastructure, has replaced older public transit busses with modern and fuel efficient busses. As public transit is subsidized by the government, the move towards efficient buses may reduce the subsidy bill.

vi) Deployment of renewable energy

- Photovoltaic Panels with an installed capacity of 90 kWp.

In order to promote renewable energy, the Ministry of Energy and Mines launched a renewable energy project in the offices of MEM. The project included deployment of photovoltaic panels, with a total investment of \$1.2 million USD, jointly financed by the governments of Nicaragua and South Korea, resulting in the deployment of 450 photovoltaic panels, each with a capacity of 200 Wp with a total installed capacity of 90 kWp. Electricity generated from the project has been used by the offices of MEM since December 2009. Data provided by MEM indicates that a total of 322,548 kWh of electricity had been generated until July 2012 (MEM, 2012c).

- Photovoltaic Panels with an installed capacity of 1380 kWp

This project began in 2011 with a total investment of \$12 million USD, which was financed by the governments of Nicaragua and Japan. The solar farm located in the municipality of Diriamba, Carazo province, about 59 kilometers south of Managua, generates electricity from over 5,000 photovoltaic panels installed over an area of 20,120 square meters. The solar farm is the first of its kind in Central America (MEM, 2012c).

- Solar Water Heater Project in Santiago Regional Hospital, Jinotepe

Through this project, solar panels were deployed over an area of 48 square meters to heat up 800 gallons of water stored in storage tanks at the hospital using solar energy. The water is stored at an average temperature of 60 degrees centigrade for the daily needs of the hospital.

vii) Energy efficient firewood stoves in rural areas. Through this project rural families were supplied with efficient firewood stoves for cooking. Efficient use of firewood is a priority for Nicaragua, and through this project 4,000 families were provided with efficient firewood stoves (MEM, 2012c).

### III. QUANTIFYING THE POTENTIAL FOR AND PROGRESS IN ENERGY EFFICIENCY IN CENTRAL AMERICA

#### A. THE POTENTIAL FOR ENERGY EFFICIENCY IN CENTRAL AMERICA

The studies which served as the basis for the Energy Strategy 2020 contain preliminary estimates as to the potential viability of EE initiatives and projects in this sub-region. These studies take into account the conditions of the Central American countries, which like most developing countries have high rates of growth in energy demand and consumption (high-growth economies). In addition, lower-income countries have very low energy consumption per capita, which suggests that even with aggressive EE programs, these countries will always have high rate of increase of energy consumption. As such, the assumptions of the Energy Strategy 2020 may not necessarily be all that conservative. The goals linked to EE in the Energy Strategy 2020 are:

- 1) To reduce the use of electricity in the residential, commercial, industrial and public lighting segments by 12%, by replacing current technologies with efficient lighting systems.
- 2) To reduce the use of electricity by 35% in half of Central American households (2.7 million households), by replacing older refrigerators with more efficient units.
- 3) To reduce the use of electricity by 10% in the industrial sector, by deploying efficient engines.
- 4) To reduce transmission and distribution losses in electrical networks by 26%.
- 5) To reduce consumption of oil derivatives in public and private transport by 10%, by promoting efficient driving, promoting and adopting standards for the import of efficient vehicles, and improving and promoting the use of public transport.
- 6) To reduce the consumption of firewood by 5% through efficient and clean cooking stoves in one million rural homes.

The first five measures correspond to EE initiatives in modern or commercial energy (electricity and hydrocarbon fossil fuels). The sixth measure is related to traditional energy (primarily firewood used for cooking in rural and semi-urban areas).

There has been little progress to date in achieving these EE targets. In most cases the progress made cannot be documented or estimated based on verifiable measurements and data. In other cases, we can categorically assert that no progress has been made. A brief summary is presented below.

1) Energy efficient lighting. All the countries in Central America have implemented programs to replace incandescent light bulbs with CFLs in the residential sector. In some cases these programs have been extended to other sectors (e.g. in Costa Rica and Panama). These initiatives cannot be considered sustainable in all sectors. However, due to the high electricity prices for end users, relatively low subsidies, and non-technical losses present in three or four countries, there is a motivation for users to continue to use efficient lighting. This is especially true in the industrial and commercial sectors, and partly so in the residential sector. Based on the information received from the countries, it is estimated that efficient lighting technologies have resulted in annual savings of about 2,700 GWh. Based on that, we could argue that the goal relating to efficient lighting is 50% complete. However, countries are now discussing a more ambitious goal, which seeks the total eradication of incandescent light bulbs (UNEP's Enlighten initiative).

2) Replacement of refrigerators. With the exception of Costa Rica, which is seeking funding for this initiative, there has been no progress in the area of refrigerator replacement. Programs to replace

inefficient refrigerators have not yet been considered in EE projects that are being promoted in other countries in Central America.

3) Efficient machinery and EEC in industry. As a result of energy audits that have been carried out in almost all countries, some industries have started replacing some of their equipment and implementing other EE measures. However, no records exist to estimate the progress in this area.

4) Losses in transmission and distribution. There has been no progress in this area. In 2006, which was the base year for the Energy Strategy 2020, electricity losses in the sub-region were 16.2%. In 2011, electricity losses had been reduced to just 16%, with an overall increase in absolute terms.

5) Reducing petroleum consumption in transportation. The process of urbanization, rapid growth in large cities and the trend toward greater use of individual motorized transport over public transit is a global phenomenon, which is also happening in Central American countries. Several measures have been taken to promote EE, however more extensive measures have been taken from the viewpoint of improving mobility in large cities (see box 4). Several countries have developed mass public transportation projects, such as BRT (bus rapid transit in Guatemala and Panama), the resumption of rail services (Costa Rica) and the reorganization of roads and routes to improve traffic flow. In addition to efficient driving programs, there have also been educational campaigns to reduce fuel consumption in the transport sector. In response to the high prices of diesel and gasoline, there have been some changes in user behavior; available data indicate that countries are importing more compact vehicles as well as motorcycles. However, Central American countries have still not approved efficiency standards for cars and have not restricted the import of used cars. As for diversification in fuel used in transport, broader action was taken by Panama with the approval of the Biofuels Act (April 2011), which includes a program for mandatory blending of ethanol, which began in September 2013. Through this program Panama aims to use 5% ethanol in all gasoline by the end of 2014.

6) Reducing consumption of firewood. Countries have taken up the issue and in several cases have included actions and targets for sustainable use of firewood in their energy policies. El Salvador and Guatemala have joined the Global Alliance for Clean Cookstoves (GACC). The sub-region as a whole, through SICA, also joined the GACC. Discussions are in advanced stages on several initiatives, which aim to launch a program for the installation of one million clean and efficient cook stoves. The biggest challenge will be managing these projects, which will have to involve public and private actors, including health, forestry, rural development, environment and energy organizations, as well as municipalities, NGOs, universities and small businesses.

The section above clearly indicates that of the six EE measures from the Energy Strategy 2020, there has been progress in only two of them (lighting and reduction of oil derivative consumption in the transport sector). However, there is no available data (statistics or surveys) to measure the actual progress and benefits of EE actions. Given the importance of measuring progress in energy efficiency and overcoming this lack of data, in 2011, ECLAC initiated in South America a program to create a database of Energy Efficiency Indicators, which has since been extended to nine Mesoamerican countries: six Central American countries, Dominican Republic, Mexico and Colombia. Through this program, the countries will have the necessary data to determine the progress and sustainability of EE programs (see box 5).

#### **BOX 4**

#### **TRANSPORT MOBILITY AND ENERGY EFFICIENCY**

In every country transportation uses significant amounts of energy, fueling every mode of transport to get people and cargo to their destinations. According to the International Energy Agency (IEA), the transport sector accounted for 19% of global final energy consumption in 2007 and it will account for 97% of the increase in global primary oil consumption between 2007 and 2030. The impact of the greenhouse gas emissions (GHG) from an increase in oil consumption of this magnitude will be significant (Kazunori and Ryan, 2010).

There is a need to reduce fuel consumption in the transport sector and to find ways to transport people and goods more efficiently. There is no single solution that is right for everyone, as efficiency gains in transport can be obtained through a variety of measures. However, the IEA recommends actions in the following areas (Kazunori and Ryan, 2010):

- Improving vehicle technology leading to increased energy efficiency in vehicles;
- Changing driver behavior to use less fuel per mile driven;
- Reducing the distances travelled per vehicle; and
- Shifting travel to the most sustainable means of transport.

The transport sector in Central America is the largest consumer of oil derivatives like diesel and gasoline, which are responsible for most GHG emissions. However, it is important to note that Central American countries are very low emitters of greenhouse gases. Due to the complications inherent to the administration and management of transport, many of the energy efficiency initiatives in the region are focused on efficiency in the electricity industry. Apart from measures to improve traffic flows, upgrades to public transport fleets and restriction on use of vehicles, no other measures have been deployed to improve energy efficiency in the transport sector.

For a handful of decades transport problems have been addressed with the issues of sustainable development and quality of life in mind. Urban areas are part of the development process, and their continued expansion is causing added pressure on infrastructure and public services, such as water and sanitation, energy and transport, and basic needs such as housing, education and health. Within this context, the concept of mobility has arisen, referring to the availability of adequate infrastructure to transport people and goods in a sustainable, timely, reliable and affordable manner. Mobility is considered an important principle, especially for developing countries, given its implicit redistributive benefits. Its implementation requires a multi-sector approach. Energy is one of the basic inputs of mobility, but it is not necessarily the most important. The infrastructure associated with transport is considered critical to economic development. The main mechanism whereby the mobility system can affect the economy is through a change in transportation costs and mobility. The phenomenon of motorization, which manifests itself in rising stocks of vehicles, a lag in infrastructural investments, road safety and social problems, such as crime in traditional means of public transportation, are the main problems affecting mobility in developing countries.

On considering the concept of mobility, major cities in Latin America have made important decisions in the design and planning of transportation systems. One of the most difficult issues is the relationship and interaction between systems and models of individual and collective transport. Most decisions relate to whether to focus on increasing capacity for private vehicles through urban highway construction and the expansion of the geometry of streets and avenues to accommodate a larger number of vehicles, or to extend, expand, or improve mass transit systems, such as subways and city buses, including the implementation of innovative integrated mass transit systems, such as bus rapid transport (BRT) solutions (Lupano, 2009). Central American countries have begun to identify and solve their mobility problems. Examples include the first BRT systems in three capital cities: Guatemala City (2007), Panama City (2011) and San Salvador (with feasibility studies completed). Panama City has gone even further with the construction of the first metro line, which will begin operations in 2014.

Source: Prepared by the author.

### **BOX 5 THE BIEE PROJECT**

In 2011, ECLAC launched the Energy Efficiency Indicators Database Project (known by its Spanish acronym: BIEE). The Project was launched with technical support of the Environment Agency of the French Government (ADEME), which coordinated the ODYSSEE Project on Energy Efficiency (EE) indicators in Europe.

The goals of the BIEE project are to develop a set of common and comparable indicators that will guide governments when formulating, implementing, monitoring and evaluating national energy efficiency policies. Through the BIEE project ECLAC has been conducting several seminars and workshop dealing with the topic of EE indicators, capacity building and data collection techniques.

Countries participating in the BIEE project workshops have made presentations on their energy efficiency policies, the challenges in their respective countries, information gaps, evaluation needs, the priority sectors identified, and their experience with building and using indicators.

In 2011 and 2012, the BIEE project was rolled out in the MERCOSUR countries, and in 2013 the project was extended to the five Mesoamerican countries (Mexico, Costa Rica, El Salvador, Guatemala and Panama) and in 2014 Colombia, Nicaragua, Honduras and the Dominican Republic joined the BIEE project.

Source: CEPAL <[www.cepal.org/dmi/urme/](http://www.cepal.org/dmi/urme/)>.

## **B. REEVALUATING THE POTENTIAL FOR ENERGY EFFICIENCY BASED ON THE GOALS OF THE ENERGY STRATEGY, 2020**

### **1. EE in the electricity industry**

Taking into consideration comments and feedback, the benefits and potential for EE in the Energy Strategy 2020 were updated. It is assumed that as a result of the "rebound effect", part of the energy saved goes back to the end users, who then can decide how to use this savings to improve their quality of life (comfort and standard of living in the case of families) or improve productivity and quality of services (in the case of productive sectors, see box 6). In the residential sector, families and households would experience the main impacts of a rebound effect, while a smaller rebound effect could happen in countries with higher per capita income (Costa Rica and Panama) and vice versa. In this estimate, the following percentages of saved electricity are reused: 10% in Costa Rica and Panama, and 25% in the other countries. In the case of electricity losses for the two countries with higher losses (Honduras and Nicaragua), it is assumed that half are non-technical losses, and so, a reduction in these losses would result in direct savings to distribution companies. In the other EE axes (refrigerators in the residential sector and in industrial equipment, as well as hydrocarbons for transport) no correction for rebound effect has been made. Table 18 shows a summary of the potential EE savings initiatives and projects. Following are a summary of other assumptions made:

a) Data used for the estimates are based on the electricity industry in 2011. From this year the demand for electricity and energy was projected following the trends considered by the Central America Council of Electrification (CEAC) in its most recent planning study. The estimates have been made through the year 2025.

b) The following breakdown of electricity consumption has been used: lighting: 12% in Costa Rica and Panama, 15% in El Salvador, and 20% in other countries. In addition, some of the lighting

has been replaced with efficient CFLs (10% in Honduras and Nicaragua and 20% in other countries). In 2020, 75% of lighting will be efficient (with CFLs), and in 2025 this number would increase to 100% (with CFL and LED technologies).

c) The estimates also take into account the involvement of commercial, industrial and other (government and public lighting) entities in lighting programs. However, conservative estimates have been used.

#### **BOX 6 THE REBOUND EFFECT**

Energy efficiency is seen as an important factor in reducing greenhouse gas emissions at a relatively low cost. It is often assumed that improvements in energy efficiency of appliances and equipment will reduce overall energy consumption. While this is true in theory, the observed reality is very different. The expected reduction in energy consumption due to improvements in energy efficiency often does not materialize and in many cases results in increased energy consumption. Energy efficiency gains are often offset by other factors which reduce the overall energy savings. These factors are known as the Rebound Effects.

Rebounds effects have been classified in three categories:

**Direct rebound effect.** Improving motor vehicle efficiency is seen as an important factor to reducing energy consumed by the transport sector. It is often assumed that energy efficient vehicles will result in lower energy costs; however a 10% improvement in vehicle efficiency does not always lead to a 10% reduction in fuel consumption. An owner of an efficient vehicle may decide to travel more as it would cost less per kilometer to travel, which in turn could result in higher overall fuel consumption. This is known as the direct rebound effect, which results from consumers increasing their use of an efficient appliance or vehicle because of its lower cost of operation, which in turn leads to an increase in energy consumption.

**Indirect rebound effect.** An indirect rebound effect occurs when consumers re-deploy energy costs saved following the acquisition of an energy efficient vehicle or appliance. In the case of an efficient vehicle, savings from fuel costs could be re-spent to fulfill other needs. Savings from fuel consumption as a result of using an efficient vehicle could be used to buy additional electrical appliances like a second television or a computer, which could result in more energy being spent. The indirect rebound effect here is a result of the *income effect*, where increased income from energy efficiency enables consumption of goods and services which in turn may also consume energy.

**Economy-wide rebound effect.** The Economy-wide rebound effect from energy efficiency improvements is the sum of the direct and indirect rebound effects. An economy-wide rebound effect of 60% implies that 60% of the potential energy savings are lost as a result of direct and/or indirect rebound effects and 40% of energy has been saved. When all of the energy savings are lost through direct or indirect rebound effects, then the rebound effect would be 100% and there would be no savings. A rebound effect great than 100%, indicates that more energy has been spent than saved.

Researchers do not dispute the existence of rebound effects however, there is no consensus on the size and magnitude of rebound effects as rebound effects are difficult to measure and quantify in real world situations. There is no doubt that Energy efficiency will play an important role in tackling climate change. Using energy more efficiently is not an option but a necessity. However, policymakers must take into account the rebound effects that could result from gains in energy efficiency.

Source: Herring & Sorrell (2009).

**TABLE 18**  
**CENTRAL AMERICA: ESTIMATED BENEFITS OF ENERGY EFFICIENCY INITIATIVES, 2014-2025**

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2020	2025
<b>Energy savings (GWh)</b>														
Total	628.0	1,521.2	2,680.1	3,884.9	5,168.2	6,415.6	7,904.4	8,983.8	9,725.7	10,491.9	11,307.6	12,255.7		
% of demand	1.3	3.0	5.1	7.1	9.0	10.6	12.4	13.5	14.0	14.4	14.8	15.3		
Losses	271.5	569.6	893.7	1,245.5	1,627.1	2,043.5	2,851.4	3,133.4	3,433.4	3,755.7	4,100.7	4,468.0	36%	35%
Lighting	256.5	537.4	844.8	1,180.4	1,547.4	1,947.4	2,383.6	3,120.8	3,501.0	3,880.1	4,282.3	4,792.0	30%	35%
Refrigerators		100.0	393.8	656.3	912.5	1,165.6	1,350.0	1,350.0	1,350.0	1,350.0	1,350.0	1,350.0	17%	15%
EE in industry	100.0	314.1	547.8	802.8	1,081.3	1,259.1	1,319.4	1,379.7	1,441.3	1,506.2	1,574.6	1,645.7	17%	15%
<b>Reduction in peak power</b>														
MW	119.5	289.4	509.9	739.1	983.3	1,220.6	1,503.9	1,709.2	1,850.4	1,996.2	2,151.4	2,331.7		
% of peak	1.5	3.4	5.7	7.9	10.1	11.9	14.0	15.2	15.7	16.2	16.6	17.2		
<b>Savings (millions of dollars)</b>														
Fuels	50.2	121.7	214.4	310.8	413.5	513.2	632.4	718.7	778.1	839.4	904.6	980.5		
End consumer	75.4	182.5	321.6	466.2	620.2	769.9	948.5	1,078.1	1,167.1	1,259.0	1,356.9	1,470.7		
<b>CO2 emissions prevented</b>														
Millions of tons	0.5	1.1	2.0	2.9	3.8	4.7	5.8	5.8	6.3	6.8	7.3	7.9		
<b>g /kWh</b>														
Coal	902													
Oil	666													
Natural gas	390													
Billing 2014-2020	736.8													
Billing 2021-2025	646													

(continued)

TABLE 18 (Conclusion)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>Energy Savings (GWh)</b>												
Total	628.0	1 521.2	2 680.1	3 884.9	5 168.2	6 415.6	7 904.4	8 983.8	9 725.7	10 491.9	11 307.6	12 255.7
Percentage of demand (%)	1.3	3.0	5.1	7.1	9.0	10.6	12.4	13.5	14.0	14.4	14.8	15.3
<b>Losses</b>												
Lighting	271.5	569.6	893.7	1 245.5	1 627.1	2 043.5	2 851.4	3 133.4	3 433.4	3 755.7	4 100.7	4 468.0
Refrigerators		100.0	393.8	656.3	912.5	1 165.6	1 350.0	1 350.0	1 350.0	1 350.0	1 350.0	1 350.0
EE in Industry	100.0	314.1	547.8	802.8	1 081.3	1 259.1	1 319.4	1 379.7	1 441.3	1 506.2	1 574.6	1 645.7
<b>Reduction of peak demand</b>												
MW	119.5	289.4	509.9	739.1	983.3	1 220.6	1 503.9	1 709.2	1 850.4	1 996.2	2 151.4	2 331.7
Percentage of peak (%)	1.5	3.4	5.7	7.9	10.1	11.9	14.0	15.2	15.7	16.2	16.6	17.2
<b>Savings (millions of dollars)</b>												
Fuels	50.2	121.7	214.4	310.8	413.5	513.2	632.4	718.7	778.1	839.4	904.6	980.5
Electricity billing	75.4	182.5	321.6	466.2	620.2	769.9	948.5	1 078.1	1 167.1	1 259.0	1 356.9	1 470.7
<b>CO2 emissions prevented</b>												
Millions of tons	0.5	1.1	2.0	2.9	3.8	4.7	5.8	5.8	6.3	6.8	7.3	7.9

Source: Prepared by the Chief of the Energy and Natural Resources Unit.

d) It is assumed that the effects of the reduction in electricity losses will begin in 2014. Honduras and Nicaragua will reach a target of 12% electricity losses in 2020 and then achieve a further 1.2% reduction by 2025. The other four countries will reduce their level of losses by 10% by 2020 and an additional 10% in 2025 (i.e. a reduction in losses of 20% compared to 2012 values).

e) In the case of refrigerator replacement, it is assumed that the number of units that can be replaced is proportional to the existing units in each country. It is also assumed that the program will begin in Costa Rica (2015-2017), continuing with Panama, El Salvador, Guatemala, Honduras and Nicaragua, and will end in 2020. A total of 2.7 million units will be replaced in the following proportions: 30% in Costa Rica, 20% in Guatemala, 17% in El Salvador, 14% in Panama and 7% to 11% in Honduras and Nicaragua. The program will cost \$945 million, including the collection and destruction of the replaced refrigerators. The rate of return is expected to be 12%.

f) The industrial machinery replacement program reflects the goals of the Energy Strategy 2020. Figures are based on estimates, as there is no industry information on inventories and characteristics of equipment to be replaced. An assessment of industrial equipment could be undertaken by the Chambers of Industry and Commerce and related associations within each country.

## 2. EE in the transport sector

In the period 2000-2011 the comparison of two sub-periods (2000-2006 and 2006-2011) shows that three countries (Costa Rica, El Salvador and Guatemala) have decreased their rates of growth in consumption of transport fuels (gasoline and diesel), while the other three countries have increased them (see table 19). A strict interpretation would require a detailed study of both the macroeconomic and microeconomic sides, which goes beyond the scope of this evaluation. However, the above results could be correlated to the energy prices and the growth of the economies. The three countries mentioned (Costa Rica, El Salvador and Guatemala) apply a higher tax rate on fuels for transportation, and are also those which have seen a greater slowdown in their economies.

All six countries have taken some action to promote the efficient use of fuels in transportation, but there are many information gaps which do not allow a reliable assessment of the impact of such measures. Table 20 summarizes the potential savings that could be obtained from partial and total fulfillment of the Energy Strategy 2020 EE goals (5% and 10% savings projected in fuel costs by the year 2020), representing benefits in the range of 418 and 835 million dollars a year. These estimations were calculated assuming that the growth rate observed in the in the period 2000-2011 will continue in the same pattern through 2020.

**TABLE 19**  
**CENTRAL AMERICA: COMPARISON OF ANNUAL GROWTH**  
**IN CONSUMPTION OF TRANSPORT FUELS AND GDP**

	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panamá
<b>Annual growth in consumption of gasoline and diesel (%)</b>						
2000-2006	4.0	1.5	3.2	2.6	0.5	3.1
2006-2011	1.8	1.4	1.5	4.6	5.1	9.5
<b>GDP annual growth (%)</b>						
2000-2006	3.2	3.2	7.0	4.4	2.1	3.9
2006-2011	10.3	2.2	6.8	6.8	4.6	10.2

Source: ECLAC, based on official figures.

**TABLE 20**  
**CENTRAL AMERICA: ENERGY EFFICIENCY IN TRANSPORT.**  
**ESTIMATED BENEFITS, 2020**

Country	Fuel costs in 2011	Projected savings in consumption in 2020, reduction of	
		5%	10%
Total	6,140.1	417.7	835.3
Costa Rica	1,330.9	80.5	161.0
El Salvador	703.7	40.7	81.5
Guatemala	1,581.0	91.0	181.9
Honduras	932.9	75.8	151.6
Nicaragua	443.8	34.7	69.5
Panamá	1,147.7	94.9	189.9

Source: ECLAC, prepared with internal estimations.

### C. DISCUSSION OF SPECIFIC EE CASES

In this section, three specific cases of energy efficiency are discussed: public lighting, automotive transportation, and transport of fuels. The three cases correspond to country-specific situations, which could be extrapolated to other countries bearing in mind the information and respective conditions of each individual case.

#### 1. Public lighting. The case of Guatemala

Public lighting is an essential public service. Adequate street lighting ensures visibility for vehicles and pedestrians at night, facilitating movement of people and vehicles and reducing road accidents. Public lighting also contributes to crime prevention by increasing personal safety and the security of public and private properties.<sup>13</sup>

Public lighting in most countries is the responsibility of municipal governments and electricity distribution companies. This service should be provided based on technical standards and charged according to rates set by regulators of electricity services. Unfortunately, in many cases there is no clear incentive for the parties to improve the quality and efficiency of this service. In some countries, public lighting costs are included in the costs of other municipal services without proper segregation. In Central America, public lighting energy consumption represents between 2.4% to 4.8% of total energy consumed, and much of the public lighting technology is based on technologies that use High Intensity Discharge (HID) lamps. Table 21 shows the energy consumption for street lighting in Central America.

<sup>13</sup> European Investment Bank, The European PPP Expertise Centre (EPEC), "Factsheet: Energy Efficient Street Lighting".

**TABLE 21**  
**CENTRAL AMERICA: SALES OF ELECTRICITY AND ENERGY**  
**BILLED FOR PUBLIC LIGHTING, 2008-2011**

Country		Public lighting GWh	Total consumption GWh	% of total sales
Costa Rica	2008	207.5	8,359.5	2.5
	2009	212.6	8,248.6	2.6
	2010	220.2	8,495.3	2.6
	2011	224.7	8,522.6	2.6
El Salvador	2008	110.9	5,066.4	2.2
	2009	121.7	5,047.7	2.4
	2010	127.7	5,138.2	2.5
	2011	130.2	5,267.5	2.5
Guatemala	2008	289.3	6,553.7	4.4
	2009	321.3	6,910.1	4.7
	2010	336.1	7,140.1	4.7
	2011	351.4	7,391.9	4.8
Honduras	2008	124.5	5,226.7	2.4
	2009	124.9	5,081.7	2.5
	2010	124.7	5,122.1	2.4
	2011	124.6	5,233.9	2.4
Nicaragua	2008	71.2	2,229.1	3.2
	2009	74.5	2,297.3	3.2
	2010	76.1	2,452.6	3.1
	2011	77.5	2,526.4	3.1
Panama	2008	128.3	5,450.0	2.4
	2009	135.9	5,739.4	2.4
	2010	131.7	6,231.3	2.1
	2011	143.5	6,263.1	2.3

Source: ECLAC, based on official figures.

In Guatemala, public lighting represented 4.8% of total energy consumption in 2011, and provides an excellent opportunity for efficiency gains. Moreover, public lighting costs are added to the electricity bills of the population on the basis on an antiquated law. Each local government decides the percentage of the electricity bill that corresponds to public lighting. This represents an unfair and inequitable criteria (low energy consumers and low-income users pay more for a service that is often inadequate or nonexistent), but as an easy source of income, municipalities are reluctant to change it. Currently, discussions are being held to change this mechanism for the payment of street lighting. The following evaluation was made assuming a fair settlement between municipalities and the regulator for tariffs on the price of street lighting.

Public lighting technology used in Guatemala and in Central America is the High Intensity Discharge Lamp (HID). The common types of high intensity discharge lamps (HID) technologies in use include sodium vapor (SV) and mercury vapor (MV) lamps. High-pressure sodium vapor lamps are the more efficient technology when compared to the rest of the HID technologies.

Light-emitting diode (LED) technology is a newer technology that is being deployed for street lighting and has good energy-saving potential. High quality LEDs last longer than High Intensity Discharge lamps, consume less energy, and produce adequate lighting.

To estimate the potential energy savings in public lighting, this paper simulates the reduction in energy consumption that would be possible from replacement of existing mercury vapor lamps to more energy efficient lamps in the case of Guatemala. The key assumption used was a growth rate in population of 3%, which would directly impact the growth in public lighting in the country.

According to data available from the Ministry of Energy and Mines (MEM) in Guatemala, there were 439,915 public lamp posts in operation in 2012. The Public Lighting fixtures are managed by the electricity distributors, EEGSA, DEOCSA and DEORSA. Table 22 provides a breakdown of the public lighting fixtures by electricity distributor.

EEGSA manages the largest number of public lighting posts, followed by DEOCSA and DEORSA. The predominant technology in use for public lighting was mercury vapor lamps at 315,538, followed by Sodium Vapor Lamps at 110,332.

In order to calculate the potential energy savings from a move to efficient lighting technologies, the LEAP (Long-term Energy Alternatives Planning) software was used to simulate the following scenarios.

a) The Business as Usual (BAU) scenario. This scenario assumes that there is no change in the existing public lighting strategy. There will be no replacement of existing technologies with newer efficient lamps. The simulation indicates that consumption of electricity in 2011(Base Year) was 286 GWh and would reach a figure of 501.4 GWh in 2030. The total number of Mercury Vapor Lamps would rise to 529,900 lamps and the number of sodium vapor lamps would rise to 120,300.

**TABLE 22**  
**GUATEMALA: PUBLIC LIGHTING TECHNOLOGY BY DISTRIBUTOR**

Lighting technology	EEGSA	DEOCSA	DEORSA	TOTAL
Mercury lamps, 175 W	67,164	137,364	97,572	302,100
Mercury lamps, other	43	3,940	9,455	13,438
Sodium lamps, 100 W	60,156	2,677	5,829	68,662
Sodium lamps, other	38,580	961	2,119	41,660
Other technologies	3,890	4,894	5,271	14,055
Total	169,833	149,836	120,246	439,915

Source: Ministerio de Energía y Minas de Guatemala.

b) Sodium 100 scenario. In this scenario, the assumption is that there will be a gradual replacement of inefficient 175W mercury vapor lamps, from 2011 (base year) to 2030, with more efficient 100W sodium vapor lamps. Although newer technologies such as LEDs are more efficient when compared to sodium vapor lamps, the technology is considered more expensive and not as mature.

Sodium vapor lamps continue to be the choice for replacement of mercury vapor lamps due to higher efficiency, lower costs and faster payback periods. This scenario assumes a reduction in the number of mercury vapor lamps from 68% of the public lighting mix in 2011 to around 44% in the year 2030.

The LEAP projection for this scenario results in public lighting consumption of 439 GWh of electricity in the year 2030, an overall reduction of 62 GWh of electricity consumption when compared to the business as usual scenario. The proportion of 100W sodium vapor lighting in the public lighting mix would increase to 40%, or 308,600 units, while the share of 175W mercury vapor lamps would decline to 341,700 units.

The sodium 100 scenario is not aggressive, as it considers only a gradual replacement of mercury vapor lamps with sodium vapor lamps. A more aggressive strategy would be to replace existing public lighting technologies with LED lighting, which could result in significantly higher reductions in energy consumption.

## 2. Pipelines for the modernization of the ground fuel transport infrastructure

Cargo transportation services available in Central America are far from meeting the quality standards required for foreign trade, which also affects the regional market for hydrocarbons. A clear example of this is the limited development of fuel pipelines for the transport of fuels. Despite being recognized as the most efficient and economical way to transport fuel over land, this option is rarely used. Only Costa Rica has achieved a significant development of hydrocarbon pipeline systems serving local consumption, which has seen significant expansion in recent years. There are some pipelines dedicated to the export or transfer of crude oil (in Guatemala and Panama), or for transport to one of the existing refineries (in Nicaragua). (CEPAL, 2006).

The bulk of fuel and oil derivative imports arrive by sea at ports across the region, where the fuels are either stored or transported using fuel trucks. This service, as required for the supply and distribution of petroleum products (from import terminals, storage and refining) is provided largely by transport unions and by oil companies who have their own fleets. With the exception of some modern units acquired by the distribution companies, the vehicle fleet in most cases is very old and in poor condition.

In addition to reducing costs, a modern fuel transport system using pipelines would eliminate a significant portion of heavy transport on highways linking major ports to capital cities. Studies have shown that using rail or other forms of transport like pipelines for freight over longer distances and using trucks for shorter distances is generally more cost effective. However, the viability of these projects depends on the market size and distance between supply centers and main consumption points. Preliminary studies have shown that the only feasible regional project is a pipeline to transport liquid fuels, mainly gasoline, diesel and aviation fuels, from the Atlantic ports to the cities of Guatemala and San Salvador (CEPAL, 2002). Current demand conditions for liquid fuels would certainly make this viable for other pipelines to other capital cities and urban centers. (CEPAL, 2002)

In addition to economic reasons, there are also safety and environmental reasons for promoting pipelines. The process of transporting fuels over long distances by road is energy intensive, as it uses up fuel for transportation and also results in CO<sub>2</sub> emissions. The transport of fuels using trucks also raises safety issues due to the potential for accidents on the highways and potential fire hazards.

For illustrative purposes, this paper discusses the possibility of installing a pipeline in Guatemala, which is the largest consumer of fuels in the region. The study takes into account two transport options:

- Transport via land using fuel trucks from the port of San José on the Pacific coast and the port of Santo Tomás on the Atlantic coast.
- Transport via a fuel pipeline from the Barrios Port located on the Atlantic coast.

The distance from San José to Guatemala City is around 100 kilometers, while the distance from the Santo Tomás port to Guatemala City is around 230 kilometers. Approximately 75% of total crude oil imports into Guatemala arrive via the San José port, of which 90% is dispatched to Guatemala City via fuel trucks, where it is consumed or transported to nearby areas. On the other hand, around 10% of crude oil derivative imports arrive via the Santo Tomás port, of which two thirds is dispatched to Guatemala City via fuel trucks. It is assumed that a total of 17 million barrels of oil derivatives could be transported in 2011 via a fuel pipeline.

For the case of the fuel pipeline the study assumes that a fuel pipeline would pump fuel from the Barrios port over a distance of 230 km to the city of Guatemala. In this case around 70% of imports would arrive via the Atlantic ports and the rest via the pacific ports. Fuels received via the pacific coast would continue to be shipped using fuels trucks. Pumping of fuels is assumed to be carried out by highly efficient motors. Costs of operation of the fuel pipelines were calculated based on electricity tariffs currently in force in the country.

The cost/benefit of using fuel pipelines instead of fuel trucks is presented in graph 14. The analysis indicates that using a fuel pipeline would reduce total transport costs by 42%, while resulting in a 50% reduction in CO2 emissions. Total reduction in costs would average around 30 million dollars per year for the first ten years, which suggests that the fuel pipeline would be financially viable if we consider a total project cost of 80 million dollars. The benefits could be greater when also considering the extension of the pipeline to supply petroleum products to El Salvador. A full assessment requires feasibility studies that go beyond the scope of this document.

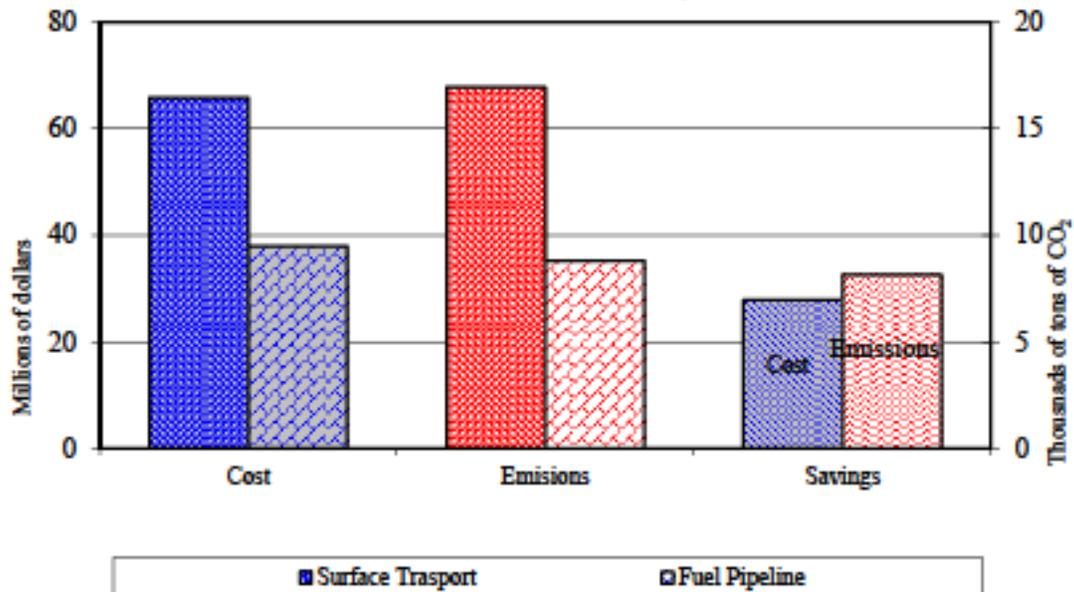
### 3. EE in transportation. The case of Costa Rica

As mentioned earlier, the transport sector in Central America is the largest consumer of oil derivatives such as diesel and gasoline. For the purpose of the study, the transport sector of Costa Rica was used as an example to estimate the savings that could be achieved from implementation of energy efficiency measures. The study uses the LEAP (Long-term Energy Alternatives Planning) software to simulate the impact of efficiency measures in the Costa Rican transport sector on fuel consumption over the period from 2011 to 2030.

Costa Rica has set an ambitious goal of becoming Carbon Neutral by the year 2021. Taking into account the Carbon Neutrality goal and the policy of promoting efficient energy use, the sixth National Energy Plan of Costa Rica includes a LEAP Forecast for the transport sector which simulates the potential impact of several policy measures for the transport sector aimed at reducing the use of energy by the year 2030. Some of these policy measures are:

- Improvement of Public Transit Systems
- Deployment of trains and urban transport solution for public transit
- Telecommuting, carpooling and reduced working hours
- Improving vehicle efficiency and deploying hybrid vehicles
- Increased use of ethanol and biodiesel in the fuel mix
- Restricted vehicle use

**GRAPH 14**  
**GUATEMALA: COMPARISON OF COSTS AND EMISSIONS**  
**FOR TRANSPORT OF FUELS, 2011**



Source: Prepared by ECLAC.

According to the above mentioned plan, overall energy consumption in the transport sector could fall by 38% in the year 2030 as a result of the application of energy efficiency policy measures, when compared to a business as usual scenario. The forecast assumes improved public transport will reduce distance travelled by passenger vehicles by 10%, and a reduction in the overall number of passenger vehicles by 10% with an increase in the number of public transport vehicles by 10%. It is assumed that policy measures could commence in 2012 and will be fully deployed in 2017. Additionally, the simulation projects a 50% extension of the existing train routes by 2015, which will further contribute to a 0.6% reduction in the distance travelled by passenger vehicles. The study assumes that around 50% of the train services will run on electricity in 2020 and 75% in 2025. The vehicle fleet in 2030 will be made up of high efficiency vehicles which will represent 50% of vehicle sales in 2030 and will commence sales in 2015. Vehicles running on gas could reach 5% of sales by 2030. The plan also assumes sale of alternative fuels like ethanol and biodiesel in the country. Although the above policy measures are ambitious, they are attainable, and if implemented, will require a strong commitment from the government to ensure that they are executed as planned.

The above policy measures can be applied to other transport sectors in the region; however, for the purpose of this study, a series of less ambitious policy measures have been proposed. The CEPAL simulation incorporates the measures proposed in the National Energy Plan of Costa Rica, but uses less ambitious goals. The CEPAL simulation assumes penetration of efficient vehicles in the Costa Rican market will be half of what is proposed in the Costa Rican national energy plan. Moreover, the CEPAL scenario assumes a reduction of 10% in vehicle energy intensity due to advances in vehicle technology and a lower impact in the remainder of the measures proposed in the National Energy Plan. Three scenarios were developed using LEAP, as follows:

- a) Business as Usual (BAU) scenario, called the base scenario, which assumes no policy measures aimed at energy efficiency and an evolution of the transport sector between 2011 and 2030 based on historical data.
- b) The National Energy Plan scenario which takes into account the measures indicated in the Costa Rican National Energy Plan.
- c) ECLAC scenario with less ambitious goals.

The Leap study used estimations of Costa Rica's economic growth, the historical data of the number of vehicles in the country and estimations of population growth for the period simulated.

Table 23 and graphs 15 and 16 provide the results of the LEAP simulations. The base scenario which assumes business as usual, with no policy measures, resulted in energy consumption of 75.6 thousand terajoules by the transport sector in the year 2011 and consumption of 216.9 thousand terajoules of energy in 2030.

**TABLE 23**  
**COSTA RICA: ENERGY CONSUMPTION IN THE TRANSPORT SECTOR, 2011-2030**

*(In thousands of terajoules \*)*

Scenario	2011	2015	2020	2025	2030
Base	75,606	100,557	141,996	199,328	216,899
National Energy Plan	75,606	84,616	100,415	123,588	130,619
ECLAC	75,606	88,361	113,372	153,54	169,611

Source: ECLAC, based on officially reported figures, using the LEAP model.

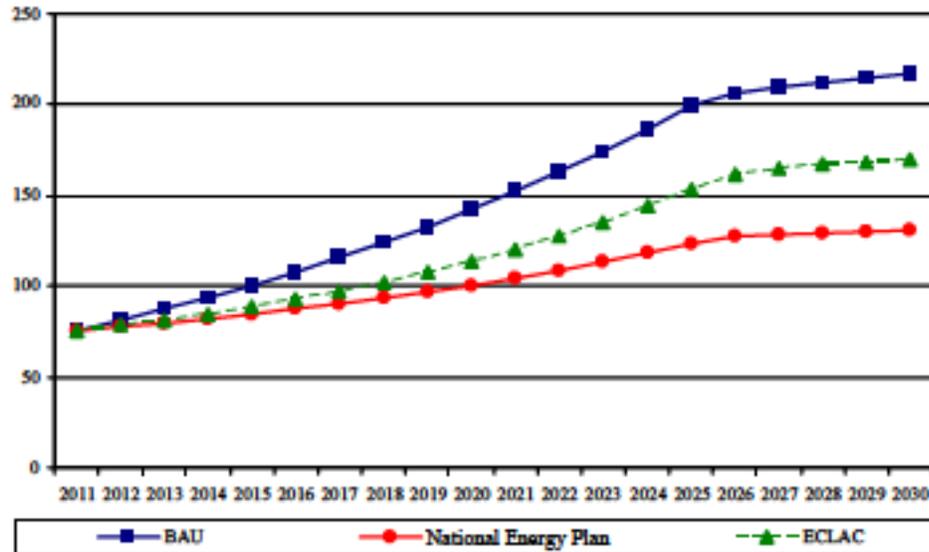
Notes: \* One terajoule = 172.21914 barrels of oil equivalent (boe).

The ECLAC scenario results in energy consumption of 169.9 thousand terajoules in 2030, a reduction of 22% from the base scenario.

In terms of greenhouse gas emissions, total emissions of greenhouse gasses in the base scenario go from 5.6 million tons of CO<sub>2</sub> in 2011 to 16.8 million tons in 2030. The National Energy Plan and ECLAC scenarios result in reductions of CO<sub>2</sub> emissions by 45% and 22%, respectively.

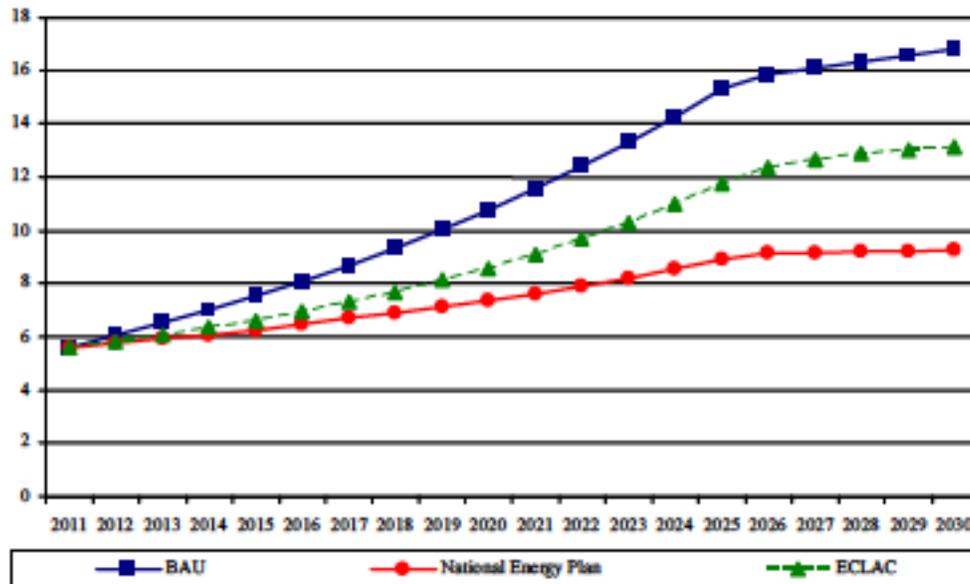
The National Energy Plan scenario which assumes successful deployment of all the measures indicated in the National Energy Plan, results in energy consumption of 130.6 thousand terajoules in the year 2030, which represents a reduction of almost 40% from the base scenario.

**GRAPH 15**  
**COSTA RICA: ENERGY CONSUMPTION BY THE TRANSPORT SECTOR, 2011-2030**  
*(In thousands of terajoules)*



Source: ECLAC, based on official figures, using LEAP.

**GRAPH 16**  
**COSTA RICA: GREENHOUSE GAS EMISSIONS**  
**BY THE TRANSPORT SECTOR, 2011-2030**  
*(In millions of tons of CO<sub>2</sub> equivalent)*



Source: ECLAC, based on official figures, using LEAP.

## IV. CONCLUSIONS AND RECOMMENDATIONS

### 1. Conclusions

a) The status and progress of the programs, projects and initiatives on national energy efficiency (EE) in Central America are varied. The restructuring and transformation of the energy sector conducted during the nineties has had differing results across the region. As such, actions in some countries have resulted in the creation of a ministry or secretariat for the sector, with global responsibility for energy policy. This has been a positive factor for the organization and promotion of EE initiatives and projects. However, this may not be enough, as often there is no clear mandate to prioritize such initiatives and there are no mechanisms and funding resources to promote EE.

b) The countries of the region are net oil importers and are under the influence of high oil prices. This has raised awareness among governments, institutions and civil society of the importance of EE. The regional integration bodies and the Central American Sustainable Energy Strategy 2020 (Energy Strategy 2020) are also important factors in the promotion of EE. However, several highly sensitive energy issues (especially those related to energy supply, reviews and price adjustments, tariffs and subsidies, internal energy market supervision, tendering and procurement of new electricity generation, social opposition to hydroelectric projects and easements for expansion of transmission and distribution systems, and in some cases, discussion of proposals to reform the energy sector and decisions related to oil and electricity megaprojects) continue to dominate the energy agendas, resulting in the postponement of decisions related to the creation and strengthening of institutions dedicated to EE.

c) The political and institutional energy contexts have many similarities. There are two identifiable models: one with high government involvement in the provision of energy services, and the other with a fully or partially liberalized sector, with predominant involvement of private enterprise. In the case of this sub-region, the two countries that have adopted legal frameworks to promote EE represent both such models (Costa Rica and Panama). However, both countries still have a long way to go.

d) The Costa Rica EE law (dating from 1994) needs to be revised and updated. The issue of having dedicated resources to promote and coordinate EE activities while reducing dependence on the two large state-owned electricity and oil companies needs to be addressed. In the case of Panama, the EE law is very recent (2012), but there has been significant progress toward seeking sustainability for EE activities.

e) Significant progress has been made in the EE programs and initiatives, for example in the role that the private sector and universities have begun taking to promote EE. However, there is excessive dependence on international cooperation, despite the fact that the prices of the energy reflect global conditions of the international oil market, which should result in high profitability of EE investments. This indicates the presence of a barrier relating to a lack of knowledge on the part of end use energy consumers.

f) Electricity losses (technical and non-technical) in transmission and distribution networks (primary and secondary) have barely decreased since the adoption of the Energy Strategy 2020 (16.2% in 2006 versus 16.0% in 2011). Only three of the six Central American countries have achieved a significant reduction (El Salvador, Guatemala and Panama). Losses remain at very high levels, over 21%, in two countries (Honduras and Nicaragua). Only in two cases (El Salvador and Panama) has the Energy Strategy 2020 goal to reduce losses to below 12% been achieved. It is estimated that fulfillment of the

goal established for electricity loss reduction would translate to profits of around \$300 million annually. Proper implementation of loss reduction programs would allow those profits to be shared with power companies (mainly distributors) and end users of electricity services.

g) Although EE goals established in the Energy Strategy 2020 are considered conservative, attaining some of these goals has been difficult, especially in some areas and countries (e.g. transport in all countries, and the reduction of electricity losses in Honduras and Nicaragua). The goals for efficient lighting seem achievable, however the main obstacles could result from unwillingness to reach agreements for harmonized standards and norms and for the creation of a regional market that is expected to lower the prices of energy efficient light bulbs. In this regard, it should be emphasized that a successful regional efficient lighting program could pave the way for the replacement programs for inefficient refrigerators in the residential sector. For efficient industrial engines, there should be extensive engagement with the respective chambers, unions and industry associations.

h) Some conclusions and country-specific observations concerning the institutionalization of EE are mentioned below:

- Panama has taken an important step with the recent adoption of the Law on the Rational and Efficient Use of Energy (2012). The actions that this country is taking to comply with the law (e.g. the creation of Committees on Energy, Standards and Performance Indexes for EE), could produce successful outcomes in the coming years.

- The Costa Rica EE law (dating from 1994) needs to be revised and updated. The issue of having dedicated resources to promote and coordinate EE activities while reducing dependence on the two large state-owned energy companies needs to be addressed. The goals of carbon neutrality will require prioritizing and expansion of EE activities as well as a profound energy transition. The current organization and resources of the energy sector appear to be unprepared for this challenge.

- El Salvador, Honduras and Guatemala must complete the process of passing their EE bills (finalizing the proposal and debate and submitting them to the respective legislative assemblies). Nicaragua will continue to discuss the best ways to institutionalize EE and approve the respective strategies, which must take into account the time these processes require and the changes in administration of the authorities in the executive and legislative branches.

i) This assessment has reaffirmed the EE priorities identified in the Energy Strategy 2020 and has allowed for a better understanding of energy efficiency in certain activities and specific energy uses. Some observations are summarized below:

- All countries have undertaken major actions to replace incandescent lamps with more efficient technologies. This has helped increase the level of awareness in society about the positive impacts of these new technologies. The next steps should include the adoption of minimum energy efficiency standards and norms, which will facilitate the phasing out of the remaining inefficient lighting (still a significant proportion), as well as ensuring efficiency and quality levels, with affordable prices to ensure the sustainability of this transition.

- Air conditioners and climate control systems are the second most widely used appliances, which if modernized will have a significant impact on energy consumption in Central American countries. However, priorities can vary significantly between countries. Research and audits on

energy end uses and temperature conditions in major metropolitan areas should provide guidelines for the promotion of actions in this segment, which is primarily a priority in Panama, El Salvador, Honduras and Nicaragua.

- Now would be a good time to reevaluate the proposal for the replacement of inefficient refrigerators, considering recent research available on this issue. The number of electrical appliances in need of replacement may be lower in some countries, based on decisions that have already been made as a result of high electricity prices. Nevertheless, most countries have yet to adopt minimum energy efficiency standards for refrigeration.

j) Transport problems are beginning to be addressed within the context of sustainable development and quality of life. The concept of mobility has emerged, referring to the availability of adequate infrastructure to transport people and goods in a quality, timely, reliable and affordable manner. Energy is one of the basic inputs for mobility, though not necessarily the most important; it must be considered together with other infrastructure associated with transport. Based on the criteria of mobility and following the example of other major Latin American metropolises, Central American capital cities have begun to identify and resolve their mobility problems. Mobility and sustainable transport require a multi-sector approach, involving the entities responsible for transport, energy and the environment, as well as municipalities and institutions for metropolitan regions.

k) In the case of traditional energy sources (wood and biomass), the recent admission of the region (represented by SICA) and two countries (El Salvador and Guatemala) to the Global Alliance for Clean Cookstoves, as well as the promise of funds and support from donors and multilateral development banks, represent very significant achievements. The main challenge remains in the establishing of multi-sector units responsible for the coordination and implementation of programs and projects for sustainable use of firewood in these countries.

## 2. Recommendations

### a) Dedicated resources for energy efficiency

Energy Efficiency programs require dedicated resources and a strong government commitment. Most Central American countries have created Energy Efficiency divisions and units within the organizational structure of their national agencies, but only a few (Panama and to a lesser extent El Salvador and Costa Rica) have allocated resources exclusively for Energy Efficiency. Over the short term, we recommend that these countries provide the necessary resources for Energy Efficiency programs within the existing organizational structures of their ministries or agencies. Over the medium term, we recommend that these countries begin to think of developing dedicated energy efficiency agencies. In El Salvador, the progress made through the administrative directives of the Central Government and of the National Energy Commission can be seen as an example to be followed by other countries in the region that have yet to establish laws or institutions dedicated to EE. To this end, we recommend that these countries implement activities and programs that include goals and results that are both attainable and verifiable over the short and medium term (1 to 4 years).

### b) Approval of energy efficiency bills

Given the prevailing conditions and current political situation (mid of 2014), in which several countries in Central America will have recently elected new governments, it seems very unlikely that EE

laws will be passed in El Salvador, Guatemala, Honduras and Nicaragua over the short or medium terms. With this in mind, we recommend that these countries find systems to facilitate the continuity of their EE initiatives and programs, especially after the change in administrations. However, efforts should be made to include energy efficiency bills in the agenda of the newly elected Assemblies. That being said, given the specific circumstances of some countries, EE initiatives may achieve greater institutionalization through an Executive Order.

**c) Meeting the goals of the 2020 energy strategy**

Considering the challenges faced in achieving the goals of the 2020 Energy Strategy, the following recommendations are offered:

i) Prioritize regional support for Honduras and Nicaragua in the reduction of electricity losses, with the aim of achieving the goals of the 2020 Energy Strategy. The other countries in Central America should develop electricity loss reduction programs which are adjusted according to the specific circumstances of each case.

ii) All countries in the region have implemented programs to replace incandescent lamps in the last few years. The results of these programs cannot be easily measured, and in some cases, these programs cannot be considered sustainable. It is recommended that Central American countries provide support to the Enlighten Initiative, which aims to phase out inefficient lighting by the year 2016.

iii) Policies and programs to promote energy efficient refrigerators in the residential sector should be taken up on a priority basis if the corresponding goals of the Energy Strategy 2020 are to be achieved.

iv) In the case of traditional energy, the priority lies in the distribution and installation of clean and efficient cook stoves, especially in Guatemala, Honduras and Nicaragua, which consume the most firewood in the region. Reliable data on firewood consumption would allow the establishing of a base scenario, necessary to determine the best strategies and projects and to measure progress in the sustainable use of firewood in the abovementioned countries. It is recommended that a database be created to track firewood consumption and monitor the effect of clean and efficient biomass cook stoves, not only for firewood conservation policies but also for policies aimed at reducing environmental emissions and negative effects on the health and wellbeing of rural populations.

**d) Develop efficiency indicators to measure policy effectiveness**

It is difficult to measure the success of Energy Efficiency programs, due to the lack of data and indicators to monitor the impact of government EE policies on energy use. The CEPAL BIEE project aims to bridge these gaps by creating energy efficiency indicators in Central America. Energy Efficiency indicators, when implemented, will not only help in the creating a database to measure the impact of EE policies, but will also allow for benchmarking between countries in the region. It is recommended that countries commit the necessary resources to ensure the successful creation of the energy efficiency indicators that are proposed in the BIEE project.

**e) Energy efficiency in the transport sector**

The transport sector is the largest consumer of hydrocarbons. Energy Efficiency measures aimed at the transport sector are crucial to the success of any national energy efficiency program. At present, there are no fuel subsidies in Central America, though in many countries there are pressures to reduce taxes on diesel and gasoline, which in addition to having a negative fiscal impact could send the wrong signals by encouraging fuel consumption. The modernization of both public and cargo transport is an important priority. The resumption of urban train services in Costa Rica, bus rapid transit systems (BRT) in the capital cities of Guatemala and Panamá and the first subway line in Panama City, are all important projects whose benefits should be assessed, and which can be replicated. Central American countries should look at developing modern, efficient and cost-effective public transport services to reduce dependence on private vehicles. Energy Efficiency standards for passenger and transport vehicles must be established as part of the measures aimed at the transport sector.

**f) Engage stakeholders in the energy sector**

The success of Energy Efficiency programs depends a lot on the commitment of all parties involved. In this respect, it must be stressed that the commitment of the Electricity and Petroleum Distribution Companies is essential to the success of end use energy efficiency programs. Electricity Companies in the region should be encouraged to set up Demand Side Management (DSM) programs to promote energy efficiency among their customers. DSM can play a major role in reducing demand for new electricity generation capacity, though care should be taken that there are sufficient incentives for electricity companies to promote DSM initiatives.

**g) Regional energy efficiency initiatives**

At the regional level, SICA and the Central American countries should coordinate with other agencies and integration initiatives, especially:

i) The Secretariat Council for Economic Integration (SIECA), for discussion and approval of technical regulations and standards for energy efficiency and harmonization of all proceedings of national conformity assessment, with a view toward promoting a regional market of products and services for EE;

ii) The Central American Council for the Environment and Development (CCAD) should be a key partner in seeking green funds for EE programs;

iii) The Mesoamerica Project, with respect to the Enlighten Initiative and other energy efficiency programs.

Each country will have to prioritize its respective national actions in order to make progress in the sustainability and goals of EE programs.



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**STATISTICAL APPENDIX**  
**Statistical Appendix**

**TABLE 1**  
**CENTRAL AMERICA: SUMMARY OF THE ENERGY STATISTICS, 2011**

	Unidad	Total	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama
<b>Net generation</b>	<b>GWh</b>	<b>42,292.0</b>	<b>9,759.6</b>	<b>5,991.4</b>	<b>8,146.6</b>	<b>7,124.6</b>	<b>3,567.3</b>	<b>7,702.5</b>
Hydroelectricity	"	20,626.0	7,134.6	2,080.3	4,094.2	2,806.8	438.2	4,071.9
Geothermal	"	3,188.2	1,279.5	1,430.0	237.1	-	241.6	-
Thermal	"	17,740.2	931.0	2,481.1	3,815.3	4,201.2	2,681.1	3,630.6
Wind	"	737.6	414.5	-	-	116.7	206.5	-
Exports of electricity	"	387.7	42.9	101.6	193.4	1.1	40.6	8.1
Imports of electricity	"	872.6	4.8	215.8	525.6	44.3	9.9	72.2
<b>Total energy for consumption</b>	<b>"</b>	<b>42,407.3</b>	<b>9,721.5</b>	<b>5,991.5</b>	<b>8,478.8</b>	<b>7,167.8</b>	<b>3,453.6</b>	<b>7,594.1</b>
Self production	"	369.5	-	114.0	-	-	83.1	172.4
<b>Electricity sales</b>	<b>GWh</b>	<b>35,640.1</b>	<b>8,522.6</b>	<b>5,267.5</b>	<b>7,391.9</b>	<b>5,233.9</b>	<b>2,621.1</b>	<b>6,603.1</b>
<b>Regulated</b>	<b>"</b>	<b>32,157.4</b>	<b>8,522.6</b>	<b>4,668.8</b>	<b>4,942.7</b>	<b>5,233.9</b>	<b>2,526.4</b>	<b>6,263.1</b>
Residential	"		3,384.1	1,601.7		2,167.5	896.8	2,084.1
Commercial (general in CR)	"		2,907.0			1,297.7	622.5	2,797.1
Industrial	"		2,006.8			1,376.0	662.8	469.8
Other	"		224.7	3,067.1		392.6	344.3	912.1
<b>Not regulated</b>	<b>"</b>	<b>3,482.6</b>		<b>598.7</b>	<b>2,449.3</b>		<b>94.7</b>	<b>340.1</b>
<b>Customer</b>		<b>8,688,216</b>	<b>1,497,001</b>	<b>1,531,604</b>	<b>2,620,013</b>	<b>1,334,601</b>	<b>864,168</b>	<b>840,829</b>
Residential			1,295,995	1,414,234		1,214,024	804,735	750,594
Commercial (general in CR)			192,090			107,280	49,158	78,346
Industrial			8,916			1,632	7,606	1,612
Other				117,370		11,665	2,669	10,277

**TABLE 2**  
**CENTRAL AMERICA: AGENTS IN THE ELECTRIC INDUSTRY, 2011**

	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama	Central America
<b>Total</b>	<b>39</b>	<b>44</b>	<b>128</b>	<b>35</b>	<b>37</b>	<b>44</b>	<b>327</b>
Generation	36	19	55	35	14	27	186
Transmission	1	1	4	1	1	1	9
Distribution	8	8	19	1	13	3	52
Commercialization		12	12				24
Large consumers		5	38		9	13	65

Source: CEPAL, on the basis of official figures.

Footnote: In the total, Agents who take part twice or more times in the different activities it counts only one; by that, the sum can be different.

**TABLE 3**  
**CENTRAL AMERICA: DISTRIBUTION COMPANIES INFORMATION, 2011**

	Sales (MWh)	Customer	Income (000 s M.N.)	Average value (M.N./kWh)	average consumption (kWh/customer)
<b>Costa Rica</b>	<b>8 522 591</b>	<b>1497 000</b>	<b>649 322 087</b>	<b>76.19</b>	<b>5 693</b>
ICE	3 431 198	652 834	272 654 541	79.46	5 256
CNFL	3 318 034	499 843	250 822 687	75.59	6 638
Coopealfar	22 760	6 424	1 732 188	76.11	3 543
Coopeguana	342 384	64 124	26 087 060	76.19	5 339
Coopelesca	364 234	76 498	24 255 158	66.59	4 761
Coopesanto	101 577	37 948	9 611 252	94.62	2 677
ESPH	545 852	70 014	31 952 923	58.54	7 796
JASEC	396 552	89 315	32 206 278	81.22	4 440
<b>El Salvador</b>	<b>4 668 826</b>	<b>1531 604</b>	<b>964 113</b>	<b>0.21</b>	<b>3 048</b>
CAESS	2 013 728	541 780	390 059	0.19	3 717
Delsur	1 169 943	329 731	242 646	0.21	3 548
EEO	482 372	253 818	114 419	0.24	1 900
Deusem	111 452	66 488	27 105	0.24	1 676
AES-CLESA	832 045	328 643	178 224	0.21	2 532
Edesal	30 912	11 033	6 346	0.21	2 802
B&D	26 113	10	4 186	0.16	2 611 288
Abruzzo	2 261	98	385	0.17	23 070
<b>Guatemala</b>	<b>4 942 663</b>	<b>2620 013</b>	<b>903 479</b>	<b>0.18</b>	<b>1 887</b>
Deorsa	796 893	539 882	178 566	0.22	1 476
Deocsa	1 040 895	903 906	234 422	0.23	1 152
EEGSA	2 678 748	982 996	438 933	0.16	2 725
EEM	426 127	193 191	66 268	0.16	2 206
<b>Honduras</b>	<b>5 233 907</b>	<b>1334 601</b>	<b>17 847 010</b>	<b>3.41</b>	<b>3 922</b>
ENEE	5 233 907	1334 601	17 847 010	3.41	3 922
<b>Nicaragua</b>	<b>2 526 390</b>	<b>864 168</b>	<b>10 474 625</b>	<b>4.146</b>	<b>2 923</b>
Disnorte	1 253 067	457 004	5 256 998	4.195	2 742
Dissur	1 232 994	377 007	5 087 956	4.127	3 270
Aprodelbo	620	864	2 593	4.186	717
ATDER-BL	1 327	2 381	5 187	3.908	557
Bluefields	21 591	8 797	58 960	2.731	2 454
Bonanza	2 348	2 979	8 534	3.635	788
El Bluff	742	470	2 047	2.759	1 578
Kukra Hill	1 031	1 213	4 170	4.044	850
L. Parlas	1 082	840	3 887	3.5927	1 288
Mulukuku	2 849	3 326	10 475	3.677	857
Rosita	3 278	3 104	12 984	3.961	1 056
SIUNA	4 208	4 078	16 457	3.911	1 032
Wiwilí	1 255	2 105	4 376	3.488	596
<b>Panama</b>	<b>6 263 050</b>	<b>840 829</b>	<b>1 066 573</b>	<b>0.170</b>	<b>7 449</b>
Edemet	3 197 360	369 577	551 654	0.173	8 651
ENSA	2 525 780	359 900	441 109	0.175	7 018
Edechi	539 910	111 352	73 810	0.137	4 849

Source: ECLAC, on the basis of official figures.

Note: In El Salvador and Guatemala the incomes are estimated in thousands of dollars.

**TABLE 4**  
**CENTRAL AMERICA: OIL DERIVATIVES CONSUMPTION, 2011**

Country	Total consumption	Final consumption							Electric generation		
		Subtotal	LPG	Gasoline	Kero/Jet	Diesel oil	Fuel oil	Others	Subtotal	Diesel oil	Fuel oil
Volume (Thousand barrels)											
Total	111,497	93,949	10,359	29,703	7,105	36,978	6,954	2,852	17,548	2,221	15,327
Costa Rica	18,323	16,666	1,365	6,234	1,387	6,646	772	262	1,657	662	995
El Salvador	15,425	14,031	2,502	4,005	963	4,702	1,985	171	1,097	14	1,083
Guatemala	26,318	24,491	3,010	7,963	573	9,297	2,294	1,353	1,827	13	1,814
Honduras	18,228	12,907	946	4,323	744	5,258	1,501	136	5,321	115	5,206
Nicaragua	10,766	6,905	793	1,920	187	3,334	173	498	3,862	141	3,721
Panama	22,496	18,712	1,744	5,257	3,250	7,742	229	490	3,784	1,277	2,508
Structures (Percentages)											
Total		100.0	11.0	31.6	7.6	39.4	7.4	3.0	100.0	12.7	87.3
Costa Rica		100.0	8.2	37.4	8.3	39.9	4.6	1.6	100.0	40.0	60.0
El Salvador		100.0	17.5	27.9	6.7	32.8	13.9	1.2	100.0	1.2	98.8
Guatemala		100.0	11.4	30.5	6.7	40.5	7.0	3.9	100.0	6.1	83.1
Honduras		100.0	7.3	33.5	5.8	40.7	11.6	1.1	100.0	2.2	97.8
Nicaragua		100.0	11.5	27.8	2.7	48.3	2.5	7.2	100.0	3.6	96.4
Panama		100.0	9.3	28.1	17.4	41.4	1.2	2.6	100.0	33.7	66.3
Global structure (Percentages)											
Total	100.0	84.3	9.3	26.6	6.4	33.2	6.2	2.6	15.7	2.0	13.7
Costa Rica	100.0	91.0	7.4	34.0	7.6	36.3	4.2	1.4	9.0	3.6	5.4
El Salvador	100.0	92.9	16.2	26.0	6.2	30.5	12.9	1.1	7.1	0.1	7.0
Guatemala	100.0	93.1	11.4	30.3	2.2	35.3	8.7	5.1	6.9	0.0	6.9
Honduras	100.0	70.8	5.2	23.7	4.1	28.8	8.2	0.7	29.2	0.6	28.6
Nicaragua	100.0	64.1	7.4	17.8	1.7	31.0	1.6	4.6	35.9	1.3	34.6
Panama	100.0	83.2	7.8	23.4	14.4	34.4	1.0	2.2	16.8	5.7	11.1

Source: ECLAC, based on official information.

Note: Final consumption in others includes 1 403 kbl coke consumption in the region, 1 185 kbl from Guatemala and 325 kbl from Nicaragua.

TABLE 5  
CENTRAL AMERICA: IMPORTERS OF OIL AND DERIVATIVES, 2011

	Total	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panamá
Total liquid derivatives	32	1	10	15	9	11	4
1. Multinacional	2		1	2	2	1	2
			Chevron- Texaco	Esso Chevron-Texaco	Esso Chevron- Texaco	Esso <sup>a</sup>	Esso Chevron- Texaco
2. Nacional							
a) Big size							
Non diversify	8	1 Racopa <sup>a</sup>	3 Alba Puma <sup>a</sup> Uno <sup>a</sup>	2 <i>Blue Oil</i> Puma	1 Petrorela/ Petrosur	4 Alba Dup Petronic Uno	
Diversify (electric)	8		2 Duke Nejapa	2 Duke Genor	3 Emco Enerva Lufussa	1 Eec	1 Petrotermi- nales
b) Small size	7			3 Combustibles y Derivados Pacific Petrolatin	1 Hondupetrol	3 Aeroservicios Astaldi Comax	
Total LPG	9	1	4	6	2	2	2
Multinacional	2		Elf				Chevron- Texaco
Regional	2		Tropigas <sup>b</sup> Z Gas <sup>c</sup>	G. del Pacifico <sup>b</sup> Tropigas <sup>b</sup> G. Metropolitano <sup>c</sup>	Gas Caribe <sup>d</sup> Z Gas <sup>c</sup>	Tropigas <sup>b</sup> Z Gas <sup>c</sup>	Petroport <sup>b</sup>
Nacional	5	Racopa	Coinver	Global Guatogas Orwal			

Source: ECLAC, based on official information. It appears only the companies that reports imports for the local markets on 2011. It not appears the companies with operations in the free taxes zones of Panama Channel.

<sup>a</sup> Refineries owner companies. Rasa refinery its property of Puma and Uno (Terra Group) that buys the shares of Esso and Shell respectively.

<sup>b</sup> Refer to the companies of E. Zaragoza group.

<sup>c</sup> Refer to the companies of M. Zaragoza group.

<sup>d</sup> Refer to the companies of T. Zaragoza group.



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