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PROMOTING SUSTAINABLE ENERGY INTEGRATION IN CENTRAL AMERICA

Assessment for USAID/El Salvador and USAID Central America and Mexico Regional Program

SEPTEMBER 2010
This publication was produced for review by the United States Agency for International Development. It was prepared by Nexant, Inc. under Contract No. EPP-I-00-03-00007-00 Task Order No. 596-TO-10-00001.

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ACOFOP	Asociación de Comunidades Forestales de Petén (Guatemala)
AHPPER	Asociación Hondureña de Pequeños Productores de Energía Renovable
ALBA	Alianza Bolivariana para los Pueblos de Nuestra América
ALBANISA	Alba de Nicaragua S.A.
AMDEE	Asociación Mexicana de Energía Eólica
AMM	Administrador del Mercado Mayorista (Guatemala)
ANAM	Autoridad Nacional del Ambiente (Panama)
ARESEP	Autoridad Reguladora de Servicios Públicos (Costa Rica)
ASEP	Autoridad Nacional de los Servicios Públicos (Panama)
BAL	Belize Aquaculture Limited
BID	Banco Interamericano de Desarrollo
BECOL	Belize Electric Company Limited
BEL	Belize Electricity
BELCOGEN	Belize Cogeneration Energy Limited
BNE	Belize Natural Energy
CABEI	Central American Bank for Economic Integration/Banco Centroamericano de Integración Económica (BCIE)
CAF	Corporación Andina de Fomento
CAFTA-DR	Dominican Republic-Central America-United States Free Trade Agreement
CAP	Comisión Administradora del Petróleo (Honduras)
CATHALEC	Centro del Agua del Trópico Húmedo para América Latina y El Caribe
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CCAD	Comisión Centroamericana de Ambiente y Desarrollo
CCHAC	Comité de Cooperación de Hidrocarburos de América Central
CEAC	Consejo de Electrificación para América Central
CEL	Comisión Ejecutiva Hidroeléctrica del Río Lempa (El Salvador)
CEHDES	Consejo Empresarial Hondureño para el Desarrollo Sostenible
CEPAL	Comisión Económica para América Latina y el Caribe/Economic Commission for Latin America and the Caribbean (ECLAC)
CCU	Climate Change Unit (Panama)
CFE	Comisión Federal de Electricidad (Mexico)

CIPORE	Caribbean Information Platform on Renewable Energy
CND	Centro Nacional de Despacho (Panama)
CNDC	Centro Nacional de Despacho de Carga (Nicaragua)
CNE	Consejo Nacional de Energía (El Salvador)
CNE	Comisión Nacional de Energía (Honduras)
CNE	Comisión Nacional de Energía (Nicaragua)
CNEE	Comisión Nacional de Energía Eléctrica (Guatemala)
CNEE	Comisión Nacional de Energía Eléctrica (Honduras)
CNFL	Compañía Nacional de Fuerza y Luz (Costa Rica)
CNP+L	Centro Nacional de Producción Más Limpia (Honduras)
CONACYT	Consejo Nacional de Ciencia y Tecnología (El Salvador)
CONAE	Comisión Nacional para el Ahorro de la Energía (Mexico)
CONUEE	Comisión Nacional para el Uso Eficiente de la Energía (Mexico)
COPE	Comisión de Política Energética (Panama)
CRE	Comisión Reguladora de Energía (Mexico)
CREDP	Caribbean Community Renewable Energy Development Project
CRIE	Comisión Regional de Interconexión Eléctrica
DEE	Dirección de Energía Eléctrica (El Salvador)
DGE	Dirección General de Energía (Honduras)
DGH	Dirección General de Hidrocarburos (Guatemala)
DGNTI	Dirección General de Normas y Tecnología Industrial (Panama)
DIGECA	Dirección de Gestión de Calidad Ambiental (Costa Rica)
DNH	Dirección Nacional de Hidrocarburos (El Salvador)
DSE	Dirección Sectorial de Energía (Costa Rica)
DT	Derechos de Transmisión
ECOE	Empresa de Comercialización de Energía (Guatemala)
EGEE	Empresa de Generación de Energía Eléctrica (Guatemala)
EEGSA	Empresa Eléctrica de Guatemala S.A.
ENATREL	Empresa Nacional de Transmisión Eléctrica (Nicaragua)
ENEE	Empresa Nacional de Energía Eléctrica (Honduras)
ENEL	Empresa Nicaragüense de Electricidad
EPR	Empresa Propietaria de la Red

ESEPSA	Energía y Servicios de Panamá, S.A.
ETCEE	Empresa de Transporte y Control de Energía Eléctrica (Guatemala)
ETESA	Empresa de Transmisión Eléctrica (Panama)
ETESAL	Empresa Transmisora de El Salvador
FIDE	Fideicomiso para el Ahorro de Energía Eléctrica (Mexico)
FIDE	Fondo de Inversión de Desarrollo Empresarial (Honduras)
FIRCO	Fideicomiso de Riesgo Compartido (Mexico)
FOFER	Fondo de Fomento de Energías Renovables
FONAFIFO	Fondo Nacional de Financiamiento Forestal (Costa Rica)
FOSODE	Fondo Social de Electrificación (Honduras)
GAUREE	Generación Autónoma y Uso Racional de Energía Eléctrica (Honduras)
GIURE	Grupo Interinstitucional para el Uso Racional de la Energía (Honduras)
GTZ	German Agency for Technical Cooperation
HML	Hydro Maya Limited (Belize)
ICE	Instituto Costarricense de Electricidad
INDE	Instituto Nacional de Electrificación (Guatemala)
INE	Instituto Nicaragüense de Electricidad
IHRE	Instituto de Recursos Hidraulicos y Electrificación
INTECO	Instituto de Normas Técnicas de Costa Rica
MARENA	Ministerio del Ambiente y los Recursos Naturales (Nicaragua)
MARN	Ministerio de Medio Ambiente y Recursos Naturales (El Salvador)
MARN	Ministerio de Medio Ambiente y Recursos Naturales (Guatemala)
MEF	Ministerio de Economía y Finanzas (El Salvador)
MEF	Ministerio de Economía y Finanzas (Panama)
MEM	Ministerio de Energía y Minas (Guatemala)
MEM	Ministerio de Energía y Minas (Nicaragua)
MER	Mercado Eléctrico Regional
MICI	Ministerio de Comercio e Industrias (Panama)
MINAET	Ministerio de Ambiente, Energía, y Telecomunicaciones (Costa Rica)
MINEC	Ministerio de Economía (El Salvador)
MOP	Ministerio de Obras Públicas (Costa Rica)
OCIC	Oficina Costarricense de Implementación Conjunta

OHN	Organismo Hondureño de Normalización
ONDL	Oficina Nacional de Desarrollo Limpio (Guatemala)
ONDL	Oficina Nacional de Desarrollo Limpio (Nicaragua)
OLADE	Organización Latinoamericana de Energía
PAESE	Programa de Ahorro de Energía del Sector Eléctrico (Mexico)
PDVSA	Petróleos de Venezuela S.A.
PEER	Programa en Eficiencia Energética para Centroamérica
PEG	Proyecto Eólico Guanacaste (Costa Rica)
PEMEX	Petróleos Mexicanos
PER	Programa de Electrificación Rural (Guatemala)
PERA	Proyecto de Energía Renovable para la Agricultura (Mexico)
PERZA	Programa de Electrificación Rural en Zonas Aisladas (Nicaragua)
PESIC	Programa de Eficiencia Energética en el Sector Industrial y Comercial (Honduras)
PLANER	Plan Nacional de Electrificación Rural (Panama)
PNESER	Programa Nacional de Electrificación Sostenible y Energías Renovables (Nicaragua)
PRONACE	Programa Nacional de Conservación de la Energía (Costa Rica)
PUC	Public Utilities Commission (Belize)
RECOPE	Refinadora Costarricense de Petróleo
RMER	Reglamento del Mercado Eléctrico Regional
RTCA	Reglas Técnicas Centroamericanas
RTMER	Reglamento Transitorio del Mercado Eléctrico Regional
SAGARPA	Secretaría de Agricultura, Ganadería Desarrollo Rural, Pesca y Alimentación (Mexico)
SC	Superintendencia de Competencia (El Salvador)
SENER	Secretaría de Energía (Mexico)
SERNA	Secretaría de Recursos Naturales y Ambiente (Honduras)
SF	Secretaría de Finanzas (Honduras)
SIC	Secretaría de Industria y Comercio (Honduras)
SICA	Sistema de la Integración Centroamericana
SIEPAC	Sistema de Interconexión Eléctrica para los Países de América Central
SIFER	Sistema de Fomento de Energías Renovables (El Salvador)

SIGET	Superintendencia General de Electricidad y Telecomunicaciones (El Salvador)
SIN	Sistema Interconectado Nacional (Nicaragua)
SNE	Secretaria Nacional de Energía (Panama)
UCA	Universidad Centroamericana
UI	Unidad de Implementación
URE	Uso Racional de Energía (Costa Rica)
UT	Unidad de Transacciones (El Salvador)

Executive Summary

This report is intended to provide an overview of the status of clean energy development and the implementation of projects in the international carbon market in Central America. The report also gives particular attention to the progress made by regional institutions to put the infrastructure of regional energy integration in place, particularly the regional high-voltage interconnection, the Sistema de Interconexión para América Central (SIEPAC), which will eventually link six of the seven countries in the region with Mexico and Colombia. Given this regional context and the relevance of Mexico's experience in the area of clean energy, the report includes reference to the history and results of Mexico's initiatives to promote energy efficiency and, more recently, renewable energy development.

The ultimate goal of this review and assessment is to create the foundation for program development activities and identify areas of opportunity for USAID's Central America and Mexico Regional Program during the period FY 2011 to FY 2013.

POWER SECTOR

Evolution of the Regional Energy Mix

Within the electricity sector, Central American countries have heavily emphasized the development of thermal power plants over the last two decades. The share of conventional and non-conventional renewable generation capacity decreased to 54%, down from 70% in 1990. At the same time, growth in non-conventional renewable capacity has been notable, even if the pace of growth reflects the very small amount in place at that beginning of the period. The distribution of the region's hydropower and non-conventional renewable resources has been and remains uneven, but there are indications that this distribution is shifting in countries where fossil-fired generation has been most prevalent.

Recent reviews of the national and regional long-term expansion plans (detailed in Sections 1 and 2 of the Statistical Annex), which are based on more systematic assessments of near term and longer-term options, suggest that the share of fossil-fired resources in new capacity additions will decrease relative to previous periods. Developments from 2008 to the present, as well as projects expected to reach completion in the next year or two, provide examples of new generation capacity based on non-conventional and hydroelectric resources, thereby supporting (albeit more anecdotally) the view that the long-term trend toward heavier reliance on fossil generation resources has slowed and begun to reverse itself.

Marginal Costs and Tariffs

Spot market prices, which offer empirical data on marginal generating costs in the competitive wholesale markets of El Salvador, Nicaragua, and Panama, increased significantly after 2004 due to the sharp increase in the price of bunker fuel used by less efficient and more expensive marginal generation plants. Guatemala saw a definitive but less dramatic increase. Costa Rica and Honduras do not have spot prices, owing to their adherence to an integrated market model, but there is clear evidence that marginal costs have risen due to fuel-price increases and the need for emergency generation (in Costa Rica).

Electricity prices for end users have generally risen due to higher generation costs, but residential tariffs remain relatively low, particularly in Honduras (due to high subsidies) and Costa Rica (due to low generation costs and hidden subsidies).

The existence of direct and indirect subsidies, the high cost of generating emergency electricity (mostly in Costa Rica), and various imperfections or interventions in the mechanisms for transferring costs from generation to retail rates (especially in Nicaragua and El Salvador) have imposed a significant financial burden for governments and utilities.[1] Furthermore, the increases in electricity losses occurring in some countries (except Costa Rica and El Salvador) have added to the financial burden on distribution companies. World Bank estimates suggest that the total deficit associated with insufficient tariffs totaled approximately USD 554 million in 2008; this figure does not include the effect of cross-subsidies or the cost of additional losses, so it must be considered a lower bound for the total cost of shielding consumers from the impact of higher electricity tariffs.[2]

Data from a simulation included in the recent regional power sector analysis by the World Bank Energy Sector Management Assistance Program (ESMAP) show that short-term marginal costs may decrease in the next several years in all countries due to fuel-price decreases and increased thermal and hydroelectric power generation. Thus, in most countries the current generation component in the tariff should be sufficient to cover generation costs through 2012, even at a WTI price of USD 75/bbl.

The results of simulations and planning by the Consejo de Electrificación de América Central (CEAC) indicate that increased participation of renewable resources (particularly hydroelectric) will reduce total expansion costs, because lower operation costs will offset higher up-front investment costs. ESMAP's data on renewable energy pricing echo CEAC's assessment that the switch to renewable energy for electricity generation can result in cost advantages compared to fossil fuels.

Energy Demand and Intensity

Central America's electrification rate, at 82%, is relatively high compared to other developing regions. The region's energy and power demand will increase to 68,000 GWh and 12,000 MW, respectively, in 2020.[3] This will represent a 4.5% annual increase rate for a total demand increase of 6,000 MW.

Intensity of energy use (expressed as unit of energy consumed per unit of GDP) has decreased slightly since 2004, more noticeably for liquid fuels than for electricity sales, driven by higher

[1] World Bank Energy Sector Management Assistance Program (ESMAP), "América Central: Estudio Programático para el Sector Energético, Módulo de Aspectos Generales y Opciones," May 2010, p. 68 (hereinafter ESMAP study, 2010).
[2] Ibid., p. 155. Other analyses have put the figure considerably higher. According to José María Blanco, president of BUN-CA, presentations given in the last year at various fora in the region have estimated the total cost in 2008 at around USD 1 billion. Interview with José María Blanco, President of BUN-CA (Costa Rica), August 3, 2010.
[3] Consejo de Electrificación para América Central (CEAC), "Plan Indicativo Regional de Expansión de la Generación 2007-2020," 2007, p. 34, http://cdm.unfccc.int/UserManagement/FileStorage/8VJ12WE0ITD7CUSNA3HRKM9PZQF4B5.

petroleum prices. Line losses decreased from 2005 to 2008 in every country except Costa Rica, which saw a 0.9% increase.

Regional Electricity Market

Beginning in 1987, the region began to discuss a project to link all countries through regional transmission lines. SIEPAC broke ground in 2006. This high-voltage interconnection consists of a 1,800 km, 230 kV transmission line running from Panamá to Guatemala. As of the summer of 2010, the SIEPAC line is 60% finished; it is scheduled to be complete and energized by the end of 2011. When fully operational, the line will be able to transfer 300 MW.

With the completion of the first circuit of the SIEPAC transmission line, the regional energy market in Central America will be poised to enter a second phase based on the addition of a separate regional transmission infrastructure to the existing network of border interconnections, which are uneven in terms of the transfer capacity that they offer across the different cross-border links. The uniformity of the cross-border transfer capacity provided by SIEPAC, and the added capacity, effectively create a new market for electricity. Moreover, this development comes at a time when cross-border flows have decreased as a result of tighter supply-demand balances throughout the region, which have left countries with limited amounts of excess capacity to sell in the regional market. Although electricity is traded between countries, the quantities traded remain limited (under 10% in 2005 and under 3% in 2008) compared to the countries' total electricity consumption.

Liquid Fuels

Only Belize and Guatemala have domestic petroleum production, but they export most of their output due to a lack of refining capacity. As such, the region is almost totally dependent on the rest of the world for its supply of hydrocarbon fuels. Petroleum infrastructure in Central America is inadequate, with most domestic petroleum products being shipped by truck. The region's total refining capacity is 35 million barrels per year (96,900 barrels per day); only three countries have refining capacity. The region consumed 97.6 million barrels in 2006 (more than 267,000 barrels per day), and petroleum products consumption has increased at a rate of 5.8% per year since then.

As in other renewable energy sectors, Costa Rica has arguably advanced the furthest in developing a domestic biofuels market, but overall, the progress to date has been limited and slower than anticipated. Production of biofuels in Central America has been for export purposes and mostly concentrated in ethanol. The Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR), passed in 2005 by the U.S. Congress and signed by five Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua) and the Dominican Republic, provides other incentives for ramping up biofuels imports from the region. Counties such as Guatemala and El Salvador have developed projects that take advantage of those initiatives. Current biofuel production could represent about 6% of transportation consumption and 3% of total liquid fuels consumption.

REGULATORY AND INSTITUTIONAL FRAMEWORKS

Beginning in the 1990s, most of the countries in the region implemented electricity reforms to attract private investment, establish independent regulators, and foster competitive markets with

the goal of improving quality, reliability, and efficiency as well as improving the fiscal position of the government and increasing access to service at reasonable prices. El Salvador, Nicaragua, and Panama moved away from a vertically integrated monopoly structure, opening the segments of generation, transmission, and distribution to competition. Honduras tried to introduce reforms following the same lines but remains a de facto single buyer owing to the failed privatization of distribution. Costa Rica preserved its vertically integrated structure but its state utility acts as a single buyer, procuring additional generation from independent power producers. Private sector participation in generation in Honduras and Costa Rica is significant.

The new market model promotes the use of market prices for generation, tariffs that recover costs of service, and transparent subsidies. However, the threat of large tariff increases given high and volatile petroleum prices has compelled governments to intervene in the market and establish subsidies, undermining the credibility of the governments' commitments to market reforms and regulatory frameworks. Actions to control prices and implement vast subsidies have also weakened energy companies' financial position and increased investment risks.

Renewables and Energy Efficiency

The institutional and regulatory frameworks for renewables and energy efficiency are nascent in almost every country in the region. The legal frameworks for renewables tend to emphasize incentives over requirements; these incentive-based policies are not likely to shift Central America's energy matrix significantly away from fossil fuels. While a policy mandate for energy efficiency exists in almost every country, Costa Rica is the only one to have a law in place (Panamá is in the process of preparing one). Absent a strong legal framework and institutional capacity, energy efficiency has also not become a systematic policy objective. Institutional capacity is a major hindrance across the region. Government agencies, utilities, and regulatory bodies alike suffer from frequent turnover and a lack of funding.

Liquid Fuels

Few energy efficiency efforts have taken place in the transportation sector. As in the power sector, public support and planning and coordination among disparate government agencies and institutions are uneven and sporadic. As mentioned above, interest in biofuels remains strong despite volatility in petroleum prices, but progress remains limited.

Regional Energy Integration

The period 2010–2011 is the "moment of truth" for the notion of regional energy integration. Policymakers, donors and market participants generally agree that a regional plant is needed, and the project needs to be large enough to cover needs in various countries.[4] In addition to investment in infrastructure, efforts to promote regional electricity integration will need strong political backing and resources to overcome the many regulatory hurdles in its path, such as reciprocity among dissimilar market structures and long-term transmission rights.
A broader challenge is streamlining decision-making at the regional level and reducing the potential for bottlenecks at the national level.

CLEAN ENERGY ANALYSIS

[4] Interview with Claudio Artavia, Executive Secretary, CEAC, May 19, 2010.

While the amount of hydroelectric and non-conventional renewable resources anticipated in the expansion plans is considerable and larger than the amounts added in previous decades (both in absolute and relative terms), it obviously represents a small part of the estimated potential that could be developed based on the region's renewable energy resources. There have been numerous obstacles to achieving rapid expansion in generation capacity, including small market size, resource constraints and lack of consistent public-sector support for project preparation, public opposition to large-scale hydropower development, lack of information on project opportunities, political change, lack of economic incentives, and financing challenges.

Energy Efficiency

The Inter-American Development Bank (IDB) published an analysis showing that a USD 550 million investment could avoid the need to invest USD 1.7 billion in new generation facilities (12 open-cycle natural gas–fired facilities) over ten years. Separately, Nexant's analysis shows that a USD 118 million investment in a relatively small suite of residential, commercial, and industrial measures could produce annual savings in electricity consumption of 276 GWh, equivalent to about 25% of average annual growth in sales, and reductions in demand of some 54 MW, equivalent to about 20% of average annual load growth during 2005–2009, at an average incremental cost of USD 0.03 per kWh.

Several recent assessments of the region's progress in implementing programs to exploit the potential savings from energy efficiency improvements have concluded that this aspect of the larger Strategy 2020 is limited. To date, each of the countries has undertaken activities to articulate a national policy on energy efficiency, and in several countries studies and audit programs have been executed to assess the scale and scope of the potential savings from energy efficiency improvements on the demand side. Yet, the actual implementation of a coherent regulatory framework has occurred only in Costa Rica, and comprehensive measures to achieve savings have been scattered and limited in scale at best. Development of a regional energy efficiency policy and program framework has been more limited than activities undertaken at the national level.

On the supply side, there are two significant potential sources of savings. Technical and non-technical losses of the national distribution systems throughout the region are high compared to major industrial markets; in the cases of Honduras and Nicaragua, they are extremely high and threaten the long-term financial integrity of the distribution companies involved. This situation is also tied to the higher level of subsidization observed in those two countries. Another important opportunity is the rehabilitation and repowering of existing hydroelectric facilities.

In the area of vehicles and transportation, even less has been done compared to the power sector, although several studies and assessments have been conducted to examine potential strategies for inducing changes in patterns of vehicle use, restructuring public transportation systems, and improving the fuel efficiency and/or altering the fuel consumed by the vehicle fleet. Since fuel consumption by the transportation sector accounts for more than one-half of total consumption of refined products in the region as a whole (see Annex 5), efforts to reduce fuel consumption in this sector could deliver considerable benefits in environmental, macroeconomic, and social terms.

The challenges associated with the adoption of more vigorous initiatives to alter vehicle and transportation patterns are considerable, both in terms of the degree of public support that is required as well as the importance of improving planning and coordination between disparate government agencies and institutions, specifically agencies with responsibility over transportation, public finance, international trade, basic infrastructure, land use, and urban planning.

Biofuels

Despite the volatility in petroleum prices since late 2008, interest in biofuels remains strong. While there does appear to be momentum toward more comprehensive policies and programs to promote the production and utilization of biofuels, the broader development of biofuels in the region faces several important limitations, such as availability of land, environmental and social concerns, production volumes, international markets, quality assurance, technical limitations and costs, political and administrative complexity, and public communication. Overall growth in biofuels output has not exceeded that of growth in petroleum-based fuel consumption, and its rate of growth is projected to slow relative to fossil fuels in future.

Opportunities for Increasing Electricity Access

Based on a total regional population on the order of 40 million, some 8 million people in the region do not have access to the grid, and if they use electricity, they are likely to pay considerably more for it than the average end user in the region (average rates in the region are considerably higher than in many other countries in Latin America). Electrification programs are ongoing, and recent experiences underscore the importance of a subsidy requirement and dedicated resources, role for the private sector, community engagement and training, and income generation to achieve sustainability.

Central America's urban population is roughly 22 million, or slightly more than one-half of the total, a rate of urbanization that is in line with the global average. More than 42% of these urban inhabitants are estimated to live in slums,[5] where electric service is likely to be more precarious than elsewhere. This population of approximately 9 million offers a target (of about the same size as the population living in non-electrified areas) for programs intended to improve the quality of electricity distribution service, reduce unserved energy, improve utility collections and improve the efficiency of electricity consumption.

Alternatively, the region's more affluent urban populations, together with commercial and even industrial energy consumers, offer a potential market for the implementation of distributed generation projects based especially on the use of solar PV technology.

Renewables in the Regional Market

SIEPAC offers the opportunity for an expanded market for renewable generation resources and capacity to manage intermittent resources. Energy efficiency initiatives could quickly free up excess capacity for trade in SIEPAC. Challenges associated with achieving expanded regional renewable energy capacity are related to making policy more expansive, especially at the regional level, in order to create a stable and attractive environment for investment in the context of a larger, regional market; addressing specific obstacles, such as public opposition to

[5] United Nations Human Settlements Programme, *The State of the World's Cities 2004/2005* (2004), p. 112.

hydropower development, and building consensus to support renewable energy and energy efficiency at national level; and mobilizing capital from public sources (incentives) and the private sector (investment) to create new capacity and exploit potential for savings.

CLIMATE CHANGE

The "carbon market" is a collection of diverse and fragmented markets on which quantities of greenhouse gas (GHG) emission reductions and emission allowances are exchanged. GHG emission reductions are generated and exchanged through projects or activities that reduce or avoid emissions of GHGs, whereas emission allowances represent rights to release emissions of GHGs under a cap-and-trade system. The trading of emission reductions is driven both by compliance at international, regional, or national levels and by voluntary initiatives.

GHG Inventories

Most of the Central American countries have one GHG inventory, except for Costa Rica, which already has three GHG inventories. As noted by Gabriel Quadri, Regional Manager for Mexico and Central America for EcoSecurities, all of the inventories in the region are "incomplete and obsolete."[6] From a regional standpoint, the fact that the data correspond to different base years means that the information is not easily comparable, thereby complicating the elaboration of programs to change emissions trends. One of the barriers encountered by Central American countries in the elaboration of inventories is the lack of, or slow flow of funds for the development of such studies.

A review of the sources of emissions covered reveals a common pattern among the different GHG inventories. All of them focus primarily on five sources of emissions: energy, industrial processes, agriculture, land-use change and forestry, and waste. In addition, the highest emissions appear to correspond to land-use change and forestry, energy, and agriculture; within energy, transportation appears to have higher emissions than the electricity sector for some of the countries.

Engagement in the Carbon Market

Central American governments have invested a great deal of time and effort in the Clean Development Mechanism (CDM) over the years. They were early movers, particularly Costa Rica, which has been at the forefront of carbon mitigation for 30 years. Except for Belize, all countries in the region have developed a pipeline of projects, which clearly demonstrates a systematic effort to engage and take advantage of the carbon market and its mechanisms.

All of the countries in this study have established Designated National Authorities (DNAs). The majority have housed their DNAs within their ministries or authorities of environment and/or natural resources. Most of the DNAs need additional support and funding to establish national capacity building plans and programs in order to deliver sound CDM training to all sectors and encourage additional activities such as Programmatic CDM (as in the case of El Salvador).

The country with the most success in terms of number of registered projects is Honduras, followed by Guatemala. In third place are Panama, Costa Rica, and El Salvador with six

[6] Interview with Gabriel Quadri, Regional Manager for Mexico and Central America for EcoSecurities, June 7, 2010.

registered projects each. At the end of the list is Belize, which does not have any registered projects or projects in validation. The country with the highest rate of issuance (defined as the volume of Certified Emissions Reductions (CERs) issued in aggregate for the country's portfolio as a percentage of the country's total volume of CERs expected through 2012) is Nicaragua (13%), followed by El Salvador (12%).

The rather disappointing results of participation in the CDM—low levels of registration and issuance of CERs (less than 15% on average) —have led some governments in the region to question whether market mechanisms are indeed the way forward to curb emissions. Specifically, El Salvador and Nicaragua, which aligned with Venezuela and Bolivia (the ALBA countries) in recent international negotiations,[7] advocate for the creation of an adaptation fund (financed by developed countries) that can then be administered by governments to combat climate change. While they offer criticisms of market mechanisms, they are not opposed to participating in the CDM as a source of revenue for projects. Belize, Guatemala, Honduras, and Panama appear to be in favor of implementing both mitigation and adaptation measures financed by developed-country financial resources that flow either by market mechanisms or otherwise. In general, despite the appearance of an ideological divide within the region on the importance of mitigation activities, all governments in Central America recognize that mitigation and adaptation go hand in hand; the real issue for them comes down to what vehicles and instruments to put into practice for mitigation and adaptation strategies.

Opportunities for Emissions Reductions

Marginal abatement curves (MACs) for emission reduction opportunities in LAC suggest that the largest volume of low-cost or no-cost emissions reductions are in the energy and transport sector. Preliminary data for 2009 suggest that 39% of Central America's installed generation capacity comes from fossil fuels (see Section 1 of the Statistical Annex).[8] Even though the use of renewable energies is higher than thermal energy, thermal is still significant in the region and signifies that there is still room for developing more renewable energies that can displace the use of thermal electricity and thus generate emission reductions. At a regional and national level, transportation has not been exploited significantly for GHG emissions reductions.

Forestry's large mitigation potential could be tapped at a relatively low cost and with significant benefits to other sustainable development objectives. Deforestation is a problem across the region (although it is more critical in some countries than in others). Belize, Costa Rica, and Panamá present less pressure for deforestation, while in El Salvador, Honduras, and Nicaragua, deforestation already represents a real and critical threat.

DONOR AND GOVERNMENT PROGRAMS

Over the last two decades, Central America has received considerable donor assistance and financial support from various multilateral financial institutions. Based on a review of publicly

[7] Venezuela and Bolivia, the so-called ALBA countries, which appear to retain a "G-77 mentality", by which they wouldn't be in a position to do anything that they are not paid to do, and have an overwhelming preference for adaptation measures

[8] Comisión Económica para América Latina (CEPAL), "Istmo Centroamericano: Estadísticas del Subsector Eléctrico," April 30, 2010, http://www.eclac.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/3/39413/P39413.xml&xsl=/mexico/tpl/p9f.xsl&base=/mexico/tpl/top-bottom.xsl.

available information from major bilateral and financial institutions, a minimum of USD 567 million in grants and USD 1.38 billion in lending has been mobilized to support renewable energy, energy efficiency, and climate change programs in the last decade, with the real numbers certain to be higher.

Energy sector areas targeted by donor programs include energy efficiency, renewable energy, rural electrification, and power sector integration (SIEPAC). Types of support provided include capacity building and institutional development support, support for feasibility and other technical studies, grant resources for program implementation, project preparation, pilot projects, and commercial project implementation.

While considerable donor support has been given to regional institutions and initiatives, available data on donor lending and grants for activities in the renewable energy and energy efficiency subsectors appear to confirm what anecdotal evidence has suggested, namely that donor support has tended to be more significant for activities in specific countries (that is, at the national level) as opposed to initiatives undertaken at the regional level. Moreover, the distribution of grants and lending has been uneven, with Belize having received the least.

These programs have had considerable impact within a relatively narrowly defined scope or geographic area (national program, specific infrastructure project, group of trainees, or agency benefiting from capacity building). Programs have had broader regional impact to a limited extent, with examples including SIEPAC and the Biomass Users Network-Central America's (BUN-CA) Programa en Eficiencia Energética para Centroamérica (PEER) effort. National programs benefitting from domestic resources are most likely to have had a clear impact in terms of quantitative indicators. Donor-funded programs have had considerable impact, but their results are more short-lived and likely to be overwhelmed by broader trends; a generally accepted conclusion is that more substantial resources are required for implementation of system-wide programs.

While the forces that reinforce this trend are understandable at various levels, the emphasis on national-level programs is not conducive to the achievement of environmentally sustainable and robust economic development over the long term. The markets of the region are too small when taken individually to achieve economies of scale that will facilitate investment; create an attractive market for suppliers of new, greener technologies; permit the effective exploitation of energy resource diversity within the region; and generate volumes of emissions reductions that will be marketable in the international market.

RELEVANT EXPERIENCE IN MEXICO

Mexico offers an example from nearby the region of how national strategies to foster clean energy development have been implemented with considerable success in terms of the incorporation of energy-efficient technologies and the prospect of rapid deployment of wind generation capacity.

Energy Efficiency

Since their constitution almost 20 years ago, the Comisión Nacional para el Ahorro de la Energía (CONAE, recently converted into the Comisión Nacional para el Uso Eficiente de la Energía,

CONUEE) and the Fideicomiso para el Ahorro de Energía Eléctrica (FIDE) have been the guiding lights for energy efficiency in Mexico.

FIDE's programs are focused on fostering social responsibility schemes for industrial companies that have expressed a commitment to protecting the environment by developing carbon emissions reduction programs. Energy savings for 2010 are an estimated 1,374.2 GWh, which would bring FIDE's total 20-year savings to approximately 18,152 GWh. The evolution of the annual FIDE budget has been critical for its success over the years, as has strong commitment from all parties of its Technical Committee and collaboration agreements with multilateral financial institutions.

CONAE focused on two key areas that provided a broad measure of success in energy efficiency in its first 10–15 years of operation: energy efficiency standards for key equipment and an excellent promotional web site, with case studies, examples, facts and figures data sources, and other useful information for end users and policymakers.

Renewable Energy

Mexico has also successfully deployed renewables for rural and off-grid applications (particularly in the agricultural sector), modified the regulatory framework to facilitate interconnection of wind generators into the grid, and implemented a series of tenders for wind.

A component of the October 2008 energy reform, the objective of the Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética is to reduce Mexico's dependence on hydrocarbons by promoting specific renewable energy technologies: wind, solar, hydro, tidal, geothermal, biofuels (as stipulated in the biofuels law), and other technologies sanctioned by the Secretary of Energy.[9] It provides long-awaited focus on the renewables sector and begins to address the idea that renewables need significant promotional support as well as financial incentives.

Wind power in particular is on the rise in Mexico, and several projects are under construction or in development. According to the Asociación Mexicana de Energía Eólica (AMDEE) in Mexico City, Mexico's installed wind generation capacity to date is 518.63 MW, the product of eight wind energy projects installed from 1994 to 2010, including the two Comisión Federal de Electricidad (CFE) projects of La Venta I and La Venta II (84.9 MW), five private self-supply projects, and one Baja California state-owned project.

In order to promote greater use of wind energy, CFE worked jointly with the Secretaría de Energía (SENER) and the Comisión Reguladora de Energía (CRE) to develop a new mechanism called Temporada Abierta (Open Season), which allowed joint participation of public and private sectors in the planning and construction of a transmission line. Through this mechanism, four CFE projects and seven private projects located on the Isthmus of Tehuantepec will invest more than USD 300 million to create new transmission infrastructure allowing wind power generated in that region to be evacuated and transmitted to other consumption centers in the country.

[9] The law explicitly excludes some technologies including nuclear energy and methane from landfills that do not comply with environmental rules.

Participating firms have committed to install up to 1,985 MW of new capacity that will systematically enter into operation over the period of 2010–2012.

With the aim of fostering sustainable rural development through the use of renewable energy systems for productive applications, the GEF-funded Proyecto de Energía Renovable para la Agricultura (PERA), a USD 31 million, four-year program from 2000 to 2004, helped the expansion and transformation of the Mexican renewable technology market, including products and services; developed a steadily growing national register of vendors and service providers; and led to program replication by other producers utilizing their own resources; wider cooperation with suppliers, leading to a decline in equipment prices; motivation and interest for further studies of new productive applications using renewable technologies; and specialized training for technicians, officials, and leading producers who promote renewable technologies.

Private companies are also beginning to harness renewables for self-generation. Over the last few decades, companies, grouped in associations or power consortia, have begun to obtain permits from CRE in order to generate their own electricity at costs that are 30–40% cheaper than CFE's tariffs, often using renewable energy. To date, the CRE has granted 595 self-supply power generation permits for a total of 6,556 MW.

GAP ANALYSIS AND RECOMMENDATIONS

Based on current trends, the region appears to be on a path to achieving some but not all of the targets presented in the Sustainable Energy Strategy for 2020. Achievement of targets for electrification, generation mix, and line losses seems likely; achievement of biofuels and energy efficiency targets appears unlikely.

A recent Sistema de la Integración Centroamericana (SICA) priorities assessment for national directors of energy and hydrocarbons suggests that the major gaps, as perceived by policymakers in the region, are energy efficiency, energy planning, harmonization of regulatory frameworks, and support to regional entities.

As mentioned above, donor activities show a preponderance of national-level programs, reflecting the impact of various factors, including defense of domestic prerogatives, continuous political change, uneven donor coordination, limitations on donor resources, and uneven capacity in recipient agencies.

Criteria

Activities undertaken by USAID's Central America and Mexico Regional Program in the area of clean energy and climate change must meet four sets of criteria: (1) the requirements established in Congressional language on Global Climate Change and Clean Energy activities (and, when relevant, language on Microfinance and Renewable Energy); (2) the Mission's programmatic criteria; and, if approved based on this report, (3) criteria recommended here regarding their relevance to achieving the objectives set forth in the Strategy 2020, and (4) potential quantitative performance indicators for future programs.

Program Recommendations

Based on these criteria, the report contains five summaries of concepts for programs that might be supported by the USAID Central America and Mexico Regional Program:

I. Support for Renewable Energy Generation: Social/Environmental Impact Issues. This program aims to improve community participation in the development of large-scale hydropower facilities and manage social and environmental risks to facilitate development of low-carbon generation capacity.

II. Support for Renewable Energy Generation: Uniform Procurement Processes. The program will foster regional dialogue to develop a set of procedures for procurement of renewable energy generation in the regional market and develop template documents for use in completing contracts for renewable energy projects. The establishment of uniform procedures and templates for key documents will create a more favorable investment environment in the regional power market.

III. Support for Renewable Energy Generation: Grid Analyses for Intermittent Resources. The proposed program will increase the familiarity of regional and national officials with the specific issues associated with wind development, methods and tools for evaluating system impacts, advances in technology, and strategies for attracting and managing the investment in necessary system upgrades to facilitate wind development.

IV. Support for Energy Efficiency Programs: Accelerating Investment in Energy Efficiency. This program will provide support to national governments for development of national energy efficiency programs. It will analyze the national-level economic and financial benefits of energy efficiency programs implemented to date; introduce economic and finance policy officials to these results; and foster capacity building and development at regulatory and planning agencies to incorporate strategies to accelerate investment in energy efficiency into regulatory frameworks and long-term planning.

V. Enhancing Readiness to Participate in Carbon Markets: Regional Inventories. This activity will result in the development in monitoring and verification systems and procedures that deliver country inventories that are easily comparable, thereby facilitating more effective analyses of emissions trends at the regional level and development of regional strategies and nationally appropriate mitigation actions (NAMAs).

Section 1 Introduction

In the last two decades, the seven countries of Central America have made dramatic progress in political and economic terms. Following the conclusion of peace accords to end armed conflict in the early 1990s, the countries have established reasonably robust democratic institutions. A period of economic liberalization has led to the creation of a regional marketplace integrated with the global economy through international trade agreements, regional agreements have established the basic framework for economic integration, and a signature project to create a regional power sector is on the verge of completion.

In the environmental sphere, the countries of the region have made significant gains, and indeed, some countries in the region have played leadership roles in clean energy development, forest conservation, and the development of the global market for greenhouse gas (GHG) emissions reductions. However, the advances achieved in sustainable development are offset by a marked deterioration in the diversification of the region's energy matrix.

This report is intended to provide an overview of the status of clean energy development and the implementation of projects in the international carbon market in Central America. The report also gives particular attention to the progress made by regional institutions to put the infrastructure of regional energy integration in place, particularly the regional interconnection, the Sistema de Interconexión para América Central (SIEPAC). Given this regional context, the report includes reference to Mexico's experience in the area of clean energy. The ultimate goal of this review and assessment is to create the foundation for program development activities and identify areas of opportunity for USAID's Central America and Mexico Regional Program during the period FY 2011 to FY 2013.

The report begins with the overview of the regional energy sector contained in Section 2, Overview of the Energy Sector, with a discussion of the power sector as well as liquid fuels. The emphasis in this section is a discussion of the status of the physical resources in the region, including the existing infrastructure as well as resources that could be developed in the future. This section highlights the rapid evolution of the power sector toward more intensive reliance on fossil energy resources.

In Section 3, Regulatory and Institutional Frameworks, the presentation of the regulatory and institutional frameworks in place at the national and regional levels illustrates how the rapid transformation of the sector in the last two decades has flowed from the implementation of regulatory reforms in the region. With the introduction of power sector reforms based on competition, renewable energy resources faced special challenges, leading to the rapid deployment of fossil resources.

Section 4, Clean Energy Analysis, analyzes the challenges and opportunities associated with clean energy development in the region. In general, this analysis concludes that the region is at a turning point in the evolution of energy development; further interventions could reinforce a

trend toward more renewable energy development and accelerate the deployment of more energy-efficient technologies.

Section 5, Climate Change, reviews Central America's experience in international cooperation on the issue and participation in the international market for GHG emission reductions. After a period during which countries in the region, particularly Costa Rica, exercised leadership on the issue, Central America's role has been eclipsed by the very rapid progress in many other countries, and the results of the region's participation in the carbon markets, in terms of the number and volume of carbon emission reductions transacted, have been disappointing.

Section 6, Donor and Government Programs, provides a review and analysis of various multilateral and bilateral donor programs in the clean energy area. This review suggests that programming to support renewable energy and energy efficiency development at the regional level has been limited compared to activities at the national level.

As an example of how national strategies to foster clean energy development have been implemented with considerable success in terms of the incorporation of energy-efficient technologies and the prospect of rapid deployment of wind generation capacity, Section 7 reviews the policies and programming implemented in Mexico over the last two years.

Finally, in Section 8, Gap Analysis and Recommendations, a series of five program options are presented and assessed in the light of the criteria for programming established in accordance with Congressional language, the priorities of the Program, and the policy objectives articulated by the Sistema de la Integración Centroamericana (SICA) in the context of its sustainable energy strategy. These options address opportunities for the Regional Program to support the continued expansion of renewable energy development in the region, to accelerate the deployment of energy efficiency technologies, and to support the region's efforts to renew its institutional capacity in the area of carbon inventories and preparation of national programs on climate change.

Section 2 Overview of Energy Sector

This section briefly summarizes the power and liquid fuels sectors by country and highlights major developments. It also highlights the commissioning of SIEPAC and trends in the regional energy market, which paradoxically are toward lower volumes of energy exchanged over time since 2002. Thermal resources are providing immediate additions of generation capacity, and fuel consumption has increased in recent years.

2.1 OVERVIEW

Primary energy consumption in Central America is dominated by petroleum, biomass, and electricity. Petroleum accounts for 45% of consumption, biomass for 38%, electricity for 12%, and other forms for 5%.

2.1.1 Power Sector

Within the electricity sector, Central American countries have heavily emphasized the development of thermal power plants in the last decade. While liquid fuels were used only to produce 9% of the electricity in 1990, their use became widespread in the 1990s and 2000s, and they now account for 40% of electricity generation. Meanwhile, non-conventional renewable capacity increased by a factor of six, compared to fossil resources, which nearly quadrupled, and hydropower capacity, which increased by just 57%. The share of conventional and non-conventional renewable generation capacity decreased to 54%, down from 70% in 1990, but the growth in non-conventional renewable capacity is notable, even if the pace of growth reflects the very small amount in place at that beginning of the period. Recent reviews of the national and regional long-term expansion plans also suggest that the share of fossil-fired resources in new capacity additions will decrease relative to previous periods.

With the completion of the first circuit of the SIEPAC transmission line, the regional energy market in Central America will be poised to enter a second phase based on the addition of a separate regional transmission infrastructure to the existing network of border interconnections, which are uneven in terms of the transfer capacity that they offer across the different cross-border links. The uniformity of the cross-border transfer capacity provided by SIEPAC and the added capacity effectively create a new market for electricity. Moreover, this development comes at a time when cross-border flows have decreased as a result of tighter supply-demand balances throughout the region, which have left countries with limited amounts of excess capacity to sell in the regional market.

2.1.2 Liquid Fuels

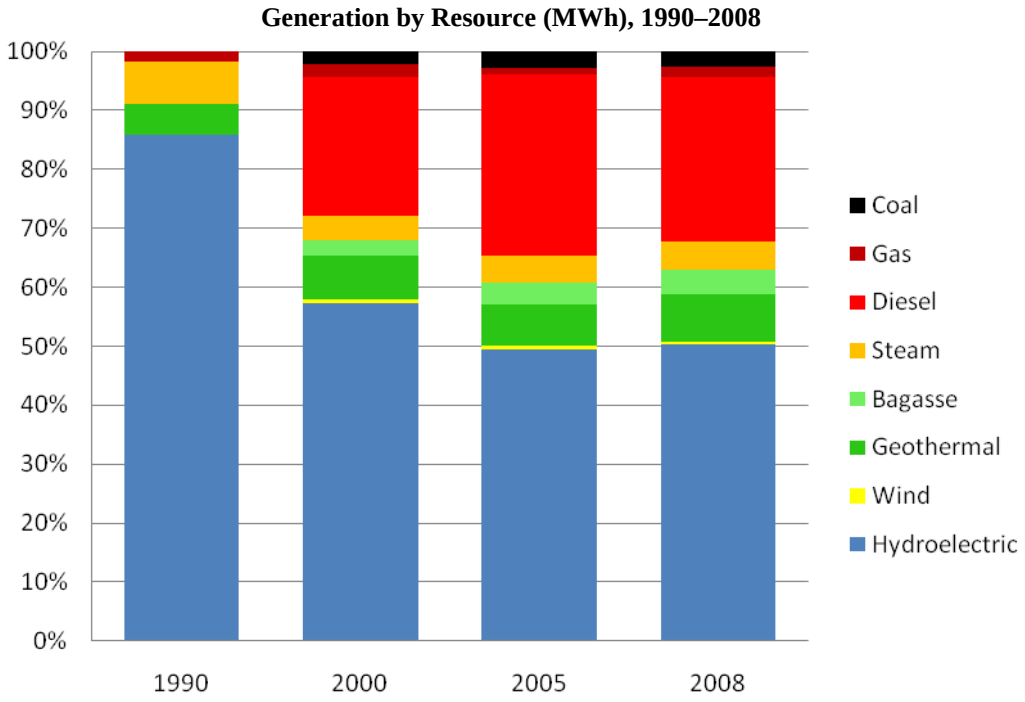
Only Belize and Guatemala have domestic petroleum production, but they export most of their output due to a lack of refining capacity. As such, the region is almost totally dependent on the rest of the world for its oil supply. Petroleum infrastructure in Central America is inadequate, with most domestic oil products being shipped by truck.

As in other renewable energy sectors, Costa Rica has arguably advanced the furthest in developing a domestic market with a biofuels mandate, but overall, the progress to date has been limited and slower than anticipated. Production of biofuels in Central America has been for export purposes and mostly concentrated in ethanol. The Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR), passed in 2005 by the U.S. Congress and signed by five Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua) and the Dominican Republic, provides other incentives for ramping up biofuels imports from the region. Counties such as Guatemala and El Salvador have developed projects that take advantage of those initiatives.

2.2 POWER SECTOR: SUPPLY, DEMAND, AND FORECAST

2.2.1 Generation

Within the electricity sector, fossil-fired generation posted a broad and sustained expansion in Central America over the last 20 years. In 1990, installed generation capacity in the region stood at just under 4,130 MW, with hydropower resources representing 66% of the total, while conventional thermal, diesel-cycle, and gas turbine facilities made up 30%. A decade later, the region had added 3,127 MW of generation capacity. This increment included 488 MW of wind, geothermal, and bagasse cogeneration capacity (about 16%) and 604 MW of hydroelectric capacity (about 19%); the balance (65%) came from expansion of the same fossil-fired technologies present in 1990, with the addition of 142 MW of coal-fired capacity. During the following eight years, the mix of new generation resources in the region showed a slight improvement in diversification: 3,014 MW of new capacity came online, with fossil-fired resources accounting for 48%, hydropower another 31%, and wind, geothermal, and bagasse cogeneration facilities for the remaining 21%.



Thermal. Renewable generation capacity additions have been dwarfed by the expansion of non-renewable generation capacity, primarily diesel-cycle facilities powered with fuel oil or diesel oil. A small but growing share of the thermal electricity production relies on coal-fired power plants, which take advantage of the low price of coal and the relative proximity of Colombian coal mines. A few small coal-fired power plants are currently in operation, and three 200 MW coal-fired power plants are planned for construction in El Salvador, Guatemala, and Honduras. Gas is absent from the power mix in Central America so far, though recent attempts have been made to develop gas capacity.

Hydroelectric. Hydroelectric power represents almost one-half of the installed electric power in Central America at 4,313 MW. Costa Rica is the biggest producer of hydroelectric power, with an installed capacity of 1,524 MW. Undeveloped but viable hydroelectric resources have been estimated at 18,000 MW. Development of new hydroelectric power tends to be controversial because of its impact on the local populations and fragile ecosystems. One potential, partial solution currently being explored would consist of repowering existing hydropower installations.

Geothermal. Central America straddles a seismic region with large geothermal power potential. As of 2008, the region had 503 MW of installed geothermal power, with a theoretical remaining potential of 2,500 MW. A large share of this potential might not be developed due to environmental impact concerns. Costa Rica, for instance, has 865 MW of remaining potential geothermal power, but only 69 MW are left for development because most potential sites are located in national parks.

Wind. The Solar and Wind Energy Resource Assessment (SWERA) program has estimated that an onshore area of almost 13,000 km^2 in the region offered good or excellent wind resources.[10] While it is difficult to assign an estimated capacity number based on the available data because actual capacities will depend on specific site characteristics, it does not seem unreasonable to assume that a minimum of 500–1,000 MW could be developed in the years ahead, compared to existing capacity (as of early 2010) on the order of 180 MW. The 2009 regional expansion plan from the Consejo de Electrificación para América Central (CEAC) contemplates development of wind but does not provide a discrete figure; instead, wind and hydropower development are grouped together.

According to SWERA's assessment (which excludes Costa Rica), Nicaragua offers the most good-to-excellent potential, particularly in the Rivas province and Lake Nicaragua shores and islands. El Salvador's elevated northwest and southwest terrain areas and border with Honduras also offer promise, as do Honduras' ridge crests and elevated terrain areas in the region near Tegucigalpa.

Solar. SWERA has estimated solar potential of 250 MW; its assessment indicates that Nicaragua has the highest $kWh/m^2/day$ of solar potential. Assessments of the region's solar resources are also still preliminary, and in any case, the economic limitations will likewise be considerable.

[10] Solar and Wind Energy Resource Assessment (SWERA), "Central America Wind Energy Resource Mapping Activity."

Cogeneration. Cogeneration plants are fairly common in Central America, as they are implemented in conjunction with sugarcane processing plants. Cogeneration plants produced 1,721 GWh in 2009[11]; the remaining cogeneration potential has been estimated at about 1,200 GWh.[12] The numbers of cogeneration plants in countries throughout the region are as follows: Belize has 1, Costa Rica 2, El Salvador 3, Guatemala 9, Honduras 6, Nicaragua 2, and Panama 0. Guatemala is the region's leader in terms of cogeneration energy produced at 1,068 GWh.[13]

The distribution of the region's hydropower and non-conventional renewable resources has been uneven, but there are indications that this distribution is shifting in countries where fossil-fired generation has been most prevalent.

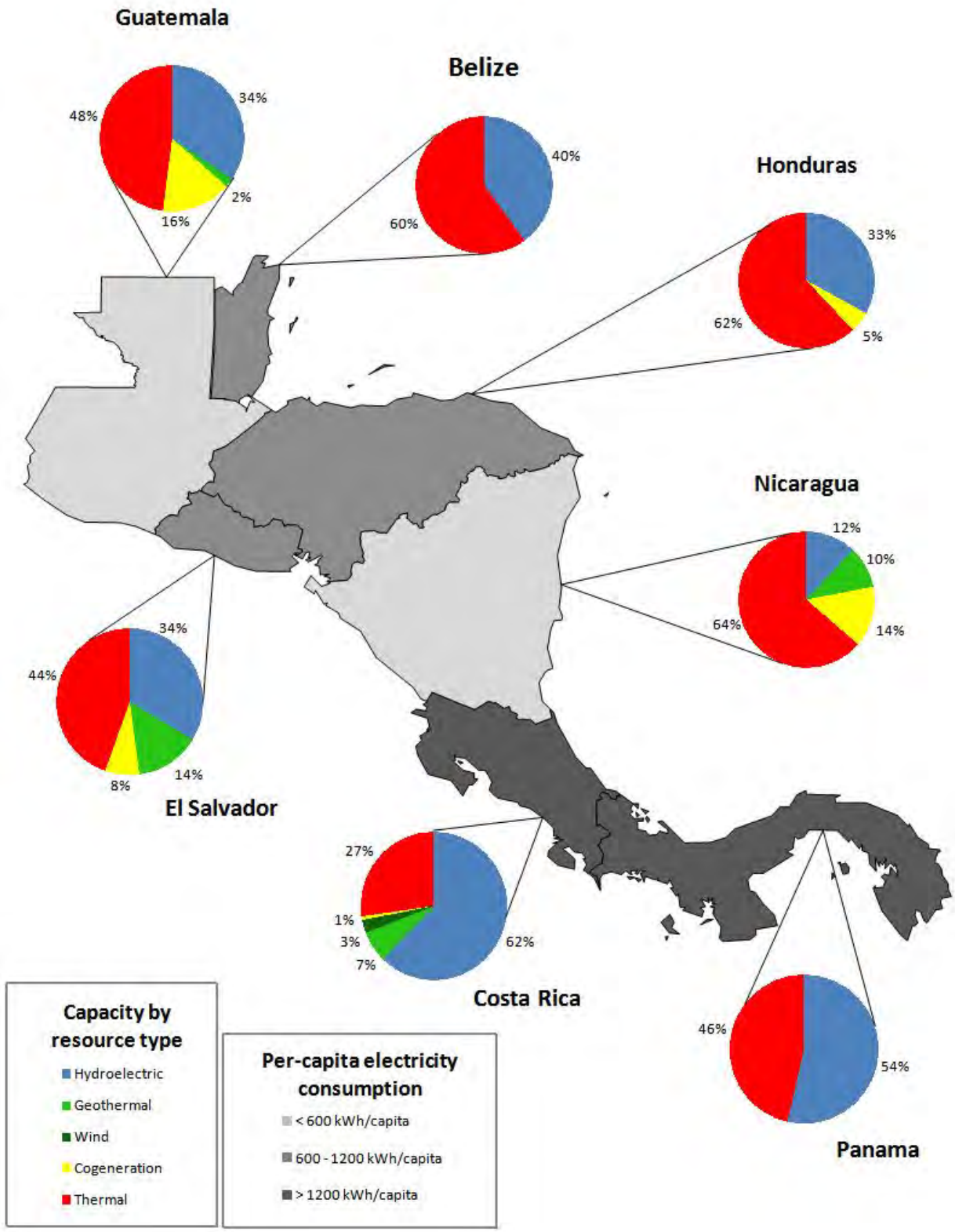
Costa Rica has the largest share (on the order of 73%) of installed capacity coming from hydroelectric and non-conventional renewable resources; its 2,446 MW of installed capacity breaks down into 62% hydroelectric, 27% thermal, 7% geothermal, 3% wind, 1% cogeneration.

El Salvador, Guatemala, and Panama form a second category, with 50–55% of installed capacity based on hydropower and other renewable resources. El Salvador has 906 MW installed capacity (34% hydroelectric, 45% thermal, 14% geothermal, 16% cogeneration); Guatemala has the region's second-largest installed capacity at 2,251 MW (34% hydroelectric, 47% thermal, 2% geothermal, 1% solar, 16% cogeneration); and Panama, with 1,623 MW installed capacity (54% hydroelectric, 46% thermal), is the only country in the region that does not use geothermal, wind, solar, or cogeneration.

Finally, the systems of Belize, Honduras, and Nicaragua have 35–40% provided by hydropower and other renewables. Belize poses a special case, as it relies on thermal-based imports from Mexico for a very large portion of its electricity supply. Belize has only 74 MW of installed capacity (60% thermal, 40% hydroelectric). Honduras has 1,581 MW of installed capacity (32% hydroelectric, 62% thermal, 5% cogeneration, 1% solar). Nicaragua, with 880 MW installed capacity (64% thermal, 14% cogeneration, 12% hydroelectric, 10% geothermal), uses the highest percentage of thermal energy. For more detailed generation statistics, including power plants by resource type, see Section 1 of the Statistical Annex.

[11] CEPAL, "Istmo Centroamericano: Estadísticas del Subsector Eléctrico," 2009, p. 4 (hereinafter CEPAL electricity statistics, 2009).
[12] CEPAL/SICA, "Estrategia Energética Sustentable Centroamericana 2020," 2007, p. 60, http://www.ceaconline.org/pdf/Doc_Relevantes/EstrategiaCentroamericana2020.pdf.
[13] CEPAL electricity statistics, 2009, p. 17.

Regional Power Mix and Energy Consumption Per Capita, 2008



2.2.2 Recent Renewables Development

Developments from 2008 to the present, as well as projects expected to reach completion in the next year or two, provide examples of new generation capacity based on non-conventional and hydroelectric resources, thereby supporting (albeit more anecdotally) the view that the long-term trend toward heavier reliance on fossil generation resources has slowed and begun to reverse itself, albeit to a very limited degree. Some specific examples include:

- *Belize*. The 31.5 MW Belize Cogeneration Energy Limited (BELCOGEN) facility that came on line in January 2010[14] features 27.5 MW based on bagasse supplemented by heavy fuel oil (HFO), together with 4 MW using HFO exclusively.[15] The facility will provide 13.5 MW of base load capacity to Belize Electricity (BEL), accounting for approximately 20% of total demand in the country. The timing of BELCOGEN's start-up is very opportune. BEL has relied on imports from Mexico's Comisión Federal de Electricidad (CFE) for up to 45% of supply, but in late 2009, CFE announced that it would cancel the contract due to supply constraints in Mexico.[16] While BELCOGEN will use fossil fuel to supplement the bagasse, there is no question that its operation will result in a net displacement of fossil-fired capacity.

- *Costa Rica*. In late 2009, the 49.5 MW Proyecto Eólico Guanacaste (PEG) began commercial operations, increasing the country's installed wind generation capacity to nearly 120 MW; PEG is privately owned and financed, selling electricity to the Instituto Costarricense de Electricidad (ICE) under a 20-year contract that was awarded competitively in 2006. Recent political developments in Costa Rica suggest that ICE will come under increasing pressure to add more wind to its portfolio, which may lead to an acceleration of the timetable for bringing new wind power facilities online.

- *El Salvador*. Other than the prospect of importing 30 MW of additional hydroelectricity from Hidroxacbal in Guatemala beginning in the next year, El Salvador has few other renewable energy projects on the immediate horizon. The El Chaparral hydropower facility (66 MW) and three geothermal facilities totaling 77 MW (Berlín, Ahuachapán, and Chinameca) appear in the near term expansion plan to begin service around 2013.

- *Guatemala*. Some 905 MW of new hydroelectric capacity are slated to begin operations in 2010 and 2011, including Hidroxacbal (94 MW), which will be the largest privately owned hydropower facility in the country and will export 30 MW of its output to El Salvador.[17]

- *Honduras*. In Honduras, the Empresa Nacional de Energía Eléctrica (ENEE) awarded 52 power purchase agreements (PPAs) from a series of small-scale facilities (primarily hydroelectric plants) with a combined capacity of more than 250 MW. These facilities will

[14] Interview with Dennis Gonguez, Chief Meteorologist, National Meteorological Service (Belize), June 2, 2010.
[15] Corporación Interamericano de Inversiones, "IIC Investment Summary," http://www.iic.int/projects/view.asp?id=285&printview=1.
[16] Belize Electricity Limited (BEL), "2009 Annual Report: Standing Strong," p. 14 (hereinafter BEL annual report, 2009).
[17] Interview with Carlos Echeverría, Director General of Energy, Ministerio de Energía y Minas (Guatemala), May 28, 2010.

begin operations in 2010–2016. [18] ENEE has also issued a tender for the rehabilitation of the El Cajón dam, which currently has a total capacity of 300 MW.[19]

- *Nicaragua*. In late 2009, the second phase of the 60 MW Amayo wind farm located in the southwestern part of the country on the Rivas Isthmus came online. In addition, state-owned generation company Empresa Nicaragüense de Electricidad (ENEL) has 34 MW of new hydropower capacity under construction. Together with the 160 MW Tumarin hydropower facility, in which Eletrobrás of Brazil is participating as an equity partner, these projects would shift the country's installed capacity enough to put the country almost in the same category as El Salvador, Guatemala, and Panama in terms of the penetration of hydropower and non-conventional renewables. In the case of off-grid electrification using renewables, the recently completed Programa de Electrificación Rural en Zonas Aisladas (PERZA) program delivered a considerable number of solar home systems through a program that provided a subsidy on the order of USD 600 per system. The program provided a considerable amount of business for one of the region's most successful solar photovoltaic (PV) installers, Technosol, a Managua-based company with 16 other offices through Nicaragua and an interest in developing business elsewhere in the region.[20]

- *Panama*. According to the Ministerio de Economía and Finanzas (MEF), more than 90 new hydropower projects are currently in the development or construction stage. 17 wind projects have been issued temporary licenses. Energía y Servicios de Panamá, S.A. (ESEPSA), a subsidiary of Unión Fenosa, increased its hydroelectric capacity by 10 MW.

See Section 2 of the Statistical Annex for current renewables statistics and Section 1 for potential capacity and expansion plans.

2.3 RECENT COST AND PRICING TRENDS

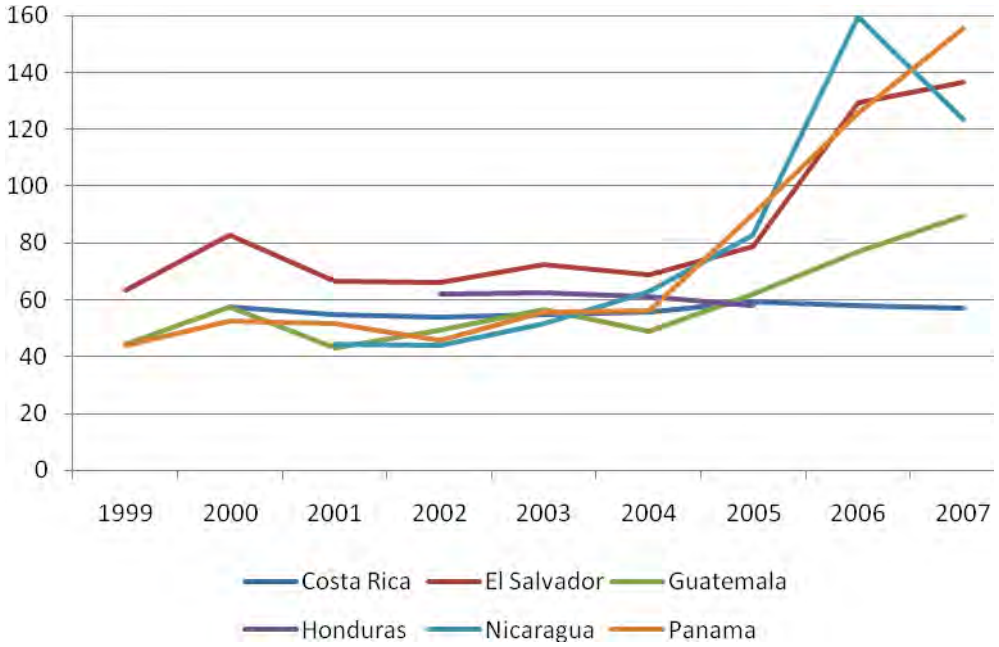
Beginning in 2004, as petroleum prices began to increase sharply, national governments became increasingly concerned with the impact of higher tariffs on rate payers, particularly the poor, while at the same time they grappled with the challenge of covering the costs of fossil generation. The existence of direct and indirect subsidies, the high cost of generating emergency electricity (mostly in Costa Rica), and several imperfections or controls the mechanisms for transferring costs from generation to retail rates (mainly in Nicaragua and El Salvador) have led to a significant financial burden for some governments and electric utilities.[21] Furthermore, increases in electricity losses occurred in some countries led to an additional financial burden for some distribution companies.

Spot market prices can provide empirically observed data on marginal generating costs. Spot prices in the competitive wholesale markets of El Salvador, Nicaragua, and Panama increased significantly after 2004 due to the sharp increase in the price of bunker fuel used by less efficient

[18] Interview with Rigoberto Cuéllar, Secretary of Natural Resources and Environment, and Dario Cardona, Deputy Secretary (Honduras), May 20, 2010; Empresa Nacional de Energía Eléctrica, http://www.enee.hn.
[19] Interview with Rigoberto Cuéllar, Secretary of Natural Resources and Environment, and Dario Cardona, Deputy Secretary (Honduras), May 20, 2010.
[20] Interview with Vladimir Delagneau, President, Technosol (Nicaragua), May 26, 2010.
[21] ESMAP study, 2010, p. 68.

and more expensive marginal generation plants; Guatemala saw a definitive but less dramatic increase. Costa Rica and Honduras do not have spot prices owing to their integrated market model, but pricing decisions in these countries indicated a choice to keep prices low and stable despite fuel-price increases and the need for emergency generation (in Costa Rica).

Wholesale Market Spot Prices (USD/MWh), 1999–2007



Note: Costa Rica: regulated price for high-voltage customers. El Salvador: includes spot price, auxiliary services, and transmission charges. Honduras: projected short-term marginal costs.
Source: ESMAP, p. 68.

Electricity prices have generally risen due to higher generation costs, but residential tariffs remain relatively low, particularly in Honduras (due to high subsidies) and Costa Rica (due to low generation costs and hidden subsidies). The lowest residential electricity rates as of 2007 are found in Honduras (USD 0.086 per kWh) and Costa Rica (USD 0.083 per kWh), whereas Belize's rates reach USD 0.44 per kWh.[22] Other countries' rates are in the range of USD 0.153–0.184 per kWh.

World Bank estimates suggest that the total deficit associated with insufficient tariffs totaled approximately USD 554 million in 2008; this figure does not include the effect of cross-subsidies or the cost of additional losses, so it must be considered a lower bound for the total cost of shielding consumers from the impact of higher electricity tariffs.[23] In 2008, Costa Rica generated the highest tariff-related deficit (USD 238 million); Nicaragua's was by far the lowest at USD 25 million. Other countries' deficits were in the range of USD 62 to 80 million. According to the

[22] ESMAP study, 2010, p. 72; BEL annual report, 2009, p. 6. Belize's figure refers to the average cost for all consumers.
[23] ESMAP study, 2010, p. 155. Other analyses have put the figure considerably higher. According to José María Blanco, president of BUN-CA, presentations given in the last year at various fora in the region have estimated the total cost in 2008 at around USD 1 billion. Interview with José María Blanco, President of BUN-CA (Costa Rica), August 3, 2010.

World Bank's analysis, this cost has been allocated to different power sector entities or the government, depending on the country, with the result that the cost of subsidization has in some instances weakened national utilities or the distribution companies instead of posing an immediate burden on the national budget.[24]

Countries in the region have used different approaches to bridge the gap between tariffs and the actual cost of service. In Costa Rica, El Salvador, Guatemala, and Nicaragua, the economic rents generated by state-owned hydropower facilities have been used to cross-subsidize thermal generation using fossil fuels, whereas in Honduras and Panama, subsidies have been financed directly through the national budget.[25]

2.3.1 Expansion Plans and Projected Marginal Costs

Data from a simulation included ESMAP's recent regional analysis show that short-term marginal costs may decrease in all countries due to fuel-price decreases and increased thermal and hydroelectric power generation. Thus, in most countries the current generation component in the tariff should be sufficient to cover generation costs through 2012, even at a WTI price of USD 75/bbl.[26] Honduras's ability to meet generation costs will continue to be impeded by low residential tariffs, high electricity losses, and high prices that ENEE pays to private generators (which supplied 70% of electricity in 2008). In Costa Rica, ICE assumed USD 100 million in debt to pay for emergency generation in 2007–2008 due to limited excess capacity and high fuel prices. Moving forward, expectations of lower fuel prices and the expansion plan should allow ICE to recover generation costs by 2012 if not sooner. For detailed data, see Section 1 of the Statistical Annex.

ESMAP notes that the costs resulting from the simulation are likely to underestimate the actual price at which private entrepreneurs are willing to develop new projects, as they do not account for the risk premium required to justify projects with environmental and social risks. For example, a relatively recent tender held in Guatemala to develop a new hydroelectric power plant failed to respond to a reference price of approximately USD 75/MWh. Thus, a preliminary approximation seems to indicate that the expansion plan is sustainable, but the seemingly large margin between the generation component of the tariff and the costs described in the simulation could very well be smaller.

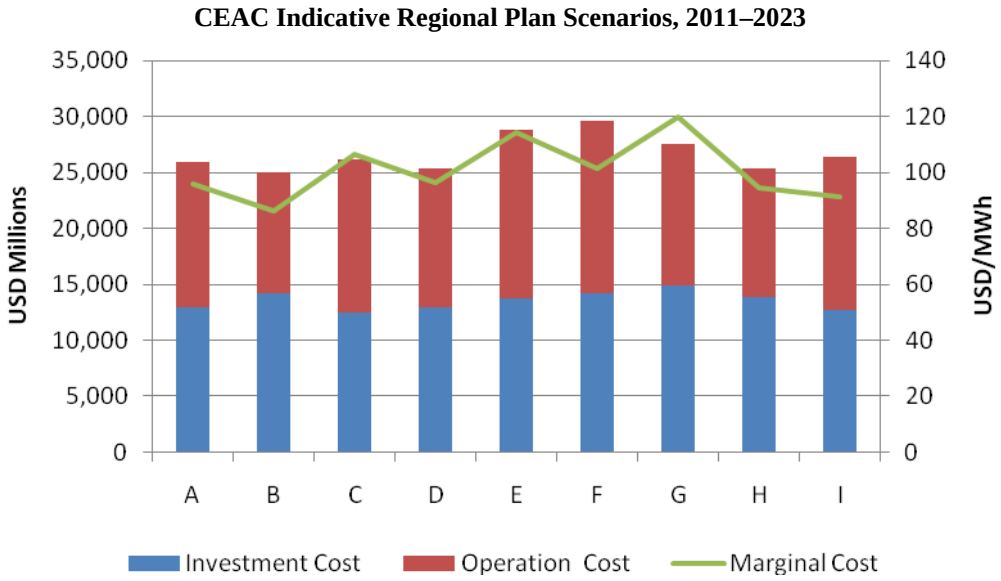
The financial sustainability of new projects is fundamental issue for the future of Central America's generation capacity. To better understand potential outcomes, the CEAC indicative regional plan for 2011–2023 identifies the four primary factors that will impact Central America's generation expansion plans: conditions for the development of hydroelectric and other renewable plants, fossil-fuel prices, demand growth, and the Panama-Colombia interconnection.[27] The report then combines these factors into nine scenarios to analyze how they will impact the costs of expansion. The investment, operation, and marginal costs of each scenario are listed in Section 1 of the Statistical Annex.

[24] Interview with José María Blanco, President of BUN-CA (Costa Rica), August 3, 2010.
[25] ESMAP study, 2010, pp. 69–73, 154–155.
[26] Ibid., p. 120.
[27] CEAC Indicative Regional Plan, pp. xii, xviii.

CEAC Indicative Regional Plan Scenarios, 2011–2023

Scenario	Restriction on hydroelectric development	Interconnection with Colombia	Fuel prices	Demand growth	Small and medium renewable generation
A:Base	Medium	Without	Medium	Medium	Without
B: No hydro restrictions	**None**	Without	Medium	Medium	Without
C: Strong hydro restrictions	**Strong (<75 MW only)**	Without	Medium	Medium	Without
D: Colombia interconnection	Medium	**With**	Medium	Medium	Without
E: High fuel prices	Medium	Without	**High**	Medium	Without
F: High demand growth	Medium	Without	Medium	**High**	Without
G: No hydro restrictions and high fuel prices	**None**	Without	**High**	Medium	Without
H: Renewable generation	Medium	Without	Medium	High	**With**
I: Thermal generation only	**Strong (no hydro plants)**	Without	Medium	Medium	Without

Source: CEAC, "Plan Indicativo Regional de Expansión de la Generación, Período 2009-2023," p. 45.



Source: CEAC, "Plan Indicativo Regional de Expansión de la Generación, Período 2009-2023," p. xiii.

The results of CEAC's simulation indicate that increasing the participation of renewable resources (particularly hydroelectric) reduces total expansion costs, as their higher initial investment costs are counteracted by lower operation costs. As such, Scenario B, which removes restrictions on hydroelectric development, has the lowest marginal cost (USD 89.19/MWh) and the lowest combined investment and operation costs (USD 24.96 million). Case H, which allows for small-scale renewable development, has the third-lowest marginal cost (USD 94.29/MWh) and second-lowest combined investment and operation requirement (USD 25.3 million). Moreover, these scenarios are less vulnerable to increases in fossil-fuel prices.

On the other hand, scenarios C, E, G, and I illustrate the high potential costs of Central America's imported fuel dependence. Cases C (no hydroelectric development above 75 MW), E (high fuel prices), and G (a combination of B and E) have the highest marginal costs in the study; Scenario E has the second-highest investment and operation costs at USD 28.9 million. Case I shows the second-lowest marginal cost (USD 91.24) and a mid-range total cost of USD 26. 4 million, but it would leave the region exposed to fuel-price fluctuations.

Scenario F illustrates the effect of the higher unit costs of dispatching additional thermal generation to meet high demand growth. Its marginal cost is USD 101.43/MWh, and it has the highest operation costs in the study (USD 15.4 million).

2.3.2 Technology Comparison

ESMAP's data on renewables pricing echoes CEAC's assessment that the switch to renewable energy for electricity generation can have cost advantages compared to fossil fuels. The standard cost for hydroelectric plants in the region ranges from USD 50–60/MWh to USD 90–116/MWh, well below all open-cycle gas or medium-speed diesel turbine projects (USD 140–170/MWh).[28] The standard cost for large-scale wind power plants in Mexico has been estimated

[28] ESMAP study, 2010, p. 10.

at USD 60–90/MWh. Coal plants can be competitive (USD 100–120/MWh depending on fuel prices), as can combined-cycle LNG turbines (USD 77–96/MWh).

2.4 DEMAND

The region's energy and power demand will increase to 68,000 GWh and 12,000 MW, respectively, in 2020.[29] This will represent a 4.5% annual increase rate for a total demand increase of 6,000 MW (520 MW of additional power installed annually at the regional level). The largest average growth over the 2000–2008 period took place in Honduras (5.5%) while the lowest growth rates were found in El Salvador (3.7%) and Panama (3.8%).

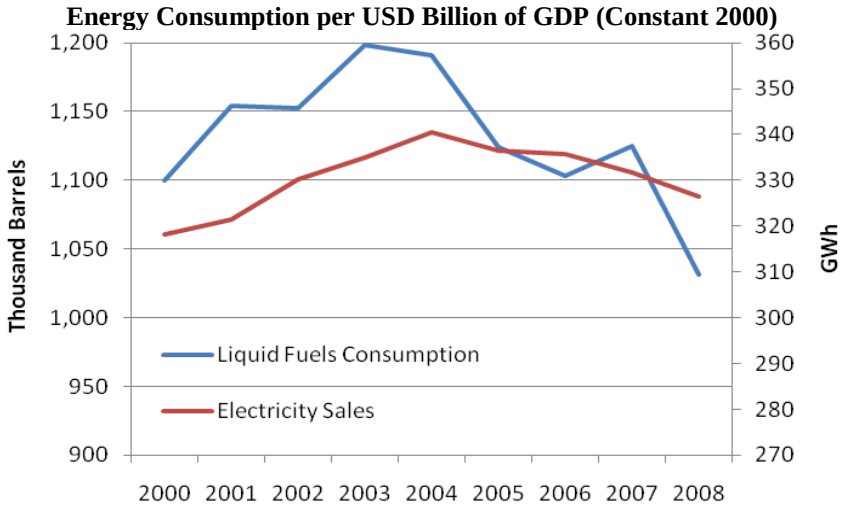
The region's total peak demand in 2009 was 6,832 MW, with Costa Rica accounting for 1,497 MW. Belize has by far the lowest peak demand at 76 MW, with the next lowest demand coming from Nicaragua (524 MW).

Electrification in Central America is relatively high compared to other developing regions of the world, with Costa Rica leading at 98%, followed by Belize, Panama, Guatemala and El Salvador (90%, 87%, 83% and 83%, respectively). Coverage in Honduras and Nicaragua is lower, at 78% and 55%, respectively; these countries fall far below the Latin America and Caribbean (LAC) region's 92.7% average.[30]

2.4.1 Energy Efficiency

Longer-term trends in the efficiency of energy consumption may be measured by calculating the intensity of energy consumption (expressed as unit of energy consumed per unit of GDP). Over the last decade, this indicator (presented separately for liquid fuels and electricity) show a clear reversal in trend, from increasing intensity in the early part of the decade to a decrease. Given the timing of the inflection point, it would appear that the shift is primarily the result of the increase in fossil-fuel prices. Energy intensity has decreased more noticeably for liquid fuels than for electricity sales (see Section 1 of the Statistical Annex); this would suggest that the government interventions to subsidize electricity to a greater extent that (mostly imported) hydrocarbon fuels, which are noted above, have diminished the extent to which end-users have received a clear price signal that has in turn influenced consumption trends.

[29] Consejo de Electrificación para América Central (CEAC), "Plan Indicativo Regional de Expansión de la Generación 2007-2020," 2007, p. 34, http://cdm.unfccc.int/UserManagement/FileStorage/8VJ12WE0ITD7CUSNA3HRKM9PZQF4B5.
[30] International Energy Agency, "Electricity Access in 2008: Latin America," http://www.iea.org/weo/database_electricity/electricity_access_database.htm.



Note: Liquid fuels consumption includes those used for electricity generation.
Source: Calculated by author using CEPAL 2009 energy data and World Bank GDP data.

In addition, electric grids in the region tend to display structural weaknesses. As of 2008, Costa Rica has the lowest line losses, at 10.6%; Nicaragua has by far the highest at 27.3%. Line losses decreased from 2005 to 2008 in every country except Costa Rica, which saw a 0.9% increase.

For a more in-depth assessment of energy efficiency trends and opportunities, see Section 4.

2.5 REGIONAL POWER MARKET

A regional electricity market has existed in Central America since 2002, but it has seen a negative evolution in the last six years. The amount of electricity exchanged between countries steadily decreased from 8% of electricity sales in 2005 to an average of 2% in 2008. This drop is attributed to decreases in power surplus available on each national grid; some reports also suggest that "structural and regulatory predicaments" in certain countries (namely Costa Rica and Honduras) are impeding the development of a sound electricity market.[31]

In 2009, the main electricity exporters were Guatemala and Panama (124 GWh and 116 GWh, respectively), and the main electricity importers were Costa Rica and Nicaragua (164 GWh and 64 GWh, respectively). Although electricity is traded between countries, the quantities traded remain limited (under 10% in 2005 and under 3% in 2008) compared to the countries' total electricity consumption. For regional electricity trade data, see Section 1 of the Statistical Annex.

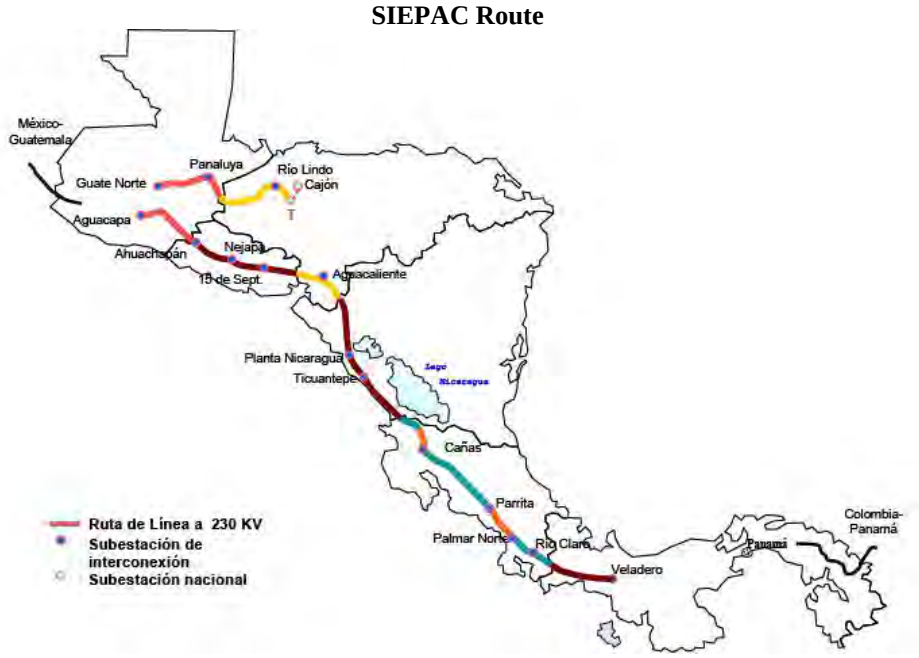
Beginning in 1987, the region began to discuss a project to link all countries through regional transmission lines. The project has two goals: to create the physical infrastructure to transmit electricity from Panama to Guatemala and to create the regulatory environment required for the creation of the Mercado de Energía Regional (MER). SIEPAC broke ground in 2006. Most of the financing was secured through the Inter-American Bank for Development (IDB) and SICA.

[31] PA Government Services, "Expansion of the Power Sector in Central America," September 2006, p. 2-4.

The infrastructure consists in a 1,800 km, 230 kV power line running from Panama to Guatemala. As of the summer of 2010, the SIEPAC line is 60% complete; it is scheduled to be complete and operational by the end of 2011. When fully operational, the line will be able to handle 300 MW of power. A secondary line will be commissioned in 2015–2016. Benefits should include increased competition in electricity production, better resources optimization, and reduced electricity prices. For instance, SIEPAC has been helpful in facilitating wind integration in Nicaragua, where the Amayo project has been implemented. In addition to SIEPAC, the Mexico-Guatemala interconnection project started in 2006 and was finalized in 2009; a Panama-Colombia interconnection project is scheduled for 2014. The commissioning of SIEPAC should create the adequate conditions to increase energy sales across the region by increasing the size of the potential market and making possible the commissioning of large power plants.

The exact route of the SIEPAC power line is detailed below. For more detail on SIEPAC's market and regulatory structure, see Section 3 of this report.

SIEPAC Route



Source: CEAC, "Plan Indicativo Regional de Expansión de la Generación, Período 2009-2023," p. 55.

2.6 LIQUID FUELS: SUPPLY, DEMAND, AND FORECAST

2.6.1 Petroleum Supply

Only Belize and Guatemala have domestic petroleum production, but they export most of their output due to a lack of refining capacity. As such, the region is almost totally dependent on the rest of the world for its petroleum supply. The purchase of petroleum products abroad cost Central America 8% of its GDP in 2007, up from an average of about 4% from 1990 to 2000.[32] The figure reached 12% of GDP for Honduras and 15% of GDP for Nicaragua; these numbers more than doubled from their 2000 levels. This dependence proved an issue in 2008 when the

[32] ESMAP study, 2010, p. 29.

price of petroleum reached record heights. Petroleum price increases had a direct impact on inflation, and most governments reacted by increasing (already high) subsidies for products.

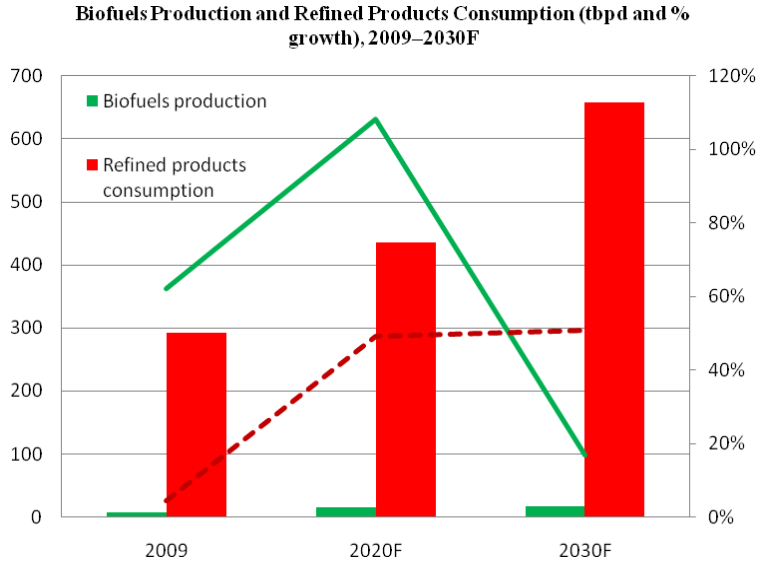
The region's total refining capacity is 35 million barrels per year (96,900 barrels per day). Only three countries in the region have refining capacity[33]: Costa Rica (14 million barrels per year), Nicaragua (11 million barrels per year), and El Salvador (10 million barrels per year).

Petroleum infrastructure in Central America is inadequate, with most domestic petroleum products ships by truck (less so in Costa Rica). The entire region would benefit from the construction of pipelines, which would reduce transportation costs. It would also benefit from the construction of more terminals, which would allow the opening of the sector to wider competition.

2.6.2 Biofuels Supply

Following the increase in petroleum prices in 2008, various initiatives have been launched, such as the use of liquefied petroleum gas (LPG) for transportation (until recent LPG was used mostly for cooking applications) and the exploration of bioethanol production from sugar cane. Currently Costa Rica is the only country with a mandatory ethanol blending program (7%), but it has yet to expand to the national level. Although other countries in the region have plans for similar legislation, there is not a near term target date for them yet.

Biofuels production will see 143% growth from 2009 to 2030.[34] In comparison, refined products consumption will grow 125% over this entire period. Despite this higher growth rate, biofuels production is starting from a base of 7,150 barrels per day, which is less than 2.5% of current refined products consumption. Moreover, its growth rate is expected to slow relative to refined products consumption between 2020 and 2030.



Costa Rica's national production of ethanol in 2003–2006 was estimated at 40–42 million liters per year. Due in great part to the Caribbean Basin Initiative (CBI), a U.S. program that extends tariff and trade benefits to the region, the development of installed capacity in Costa Rica as well as nearly all the region has emphasized exports over national consumption.

[33] CEPAL, "Istmo Centroamericano: Estadísticas Hidrocárburos," 2007, http://www.cepal.org/cgi-bin/getProd.asp?xml=%20/publicaciones/xml/4/34314/P34314.xml&xsl=/mexico/tpl/p9f.xsl%20&base=/tpl/top-bottom.xslt (hereinafter CEPAL hydrocarbons report, 2007).
[34] Nexant projections.

El Salvador has a CAFTA-DR ethanol quota for re-export (mainly from Brazil) into the United States of 5.2 million gallons during 2007 and a 1.3 million gallon annual increase. CAFTA-DR requires that this ethanol be distilled in El Salvador but not necessarily from ethanol derived from local sugarcane; under CAFTA-DR, El Salvador enjoys unlimited access for ethanol produced with local raw materials. A U.S.-Brazilian-Salvadoran venture has constructed a USD 10.5 million alcohol dehydration plant near the port of Acajutla with an annual 60 million gallon capacity that started in 2005.

Guatemala currently produces more than 40% of Central America's sugarcane-based ethanol and has eight processing plants, representing around one-half of the region's total sugarcane processing capacity. Ingenio Monte Rosa, belonging to the Guatemalan Pantaleón group, has said it plans to enter the ethanol industry. Only two companies nationwide are dedicated exclusively to biodiesel production from oil palm, Palcasa and Kukra Hill.

Honduras has ten African palm oil extracting plants. Five of those plants produce biodiesel at 10% of their capacity, and the biodiesel is used mostly for local consumption. These five plants have the capacity to produce 70,000 gallons or about 1,700 barrels of biodiesel per day.

Nicaragua has great potential for development of crops that are raw material for ethanol and biodiesel production (sugar cane and oil palm), but at present, only Nicaragua Sugar Estates' Ingenio San Antonio exports some ethanol.

2.6.3 Demand

The region consumed 97.6 million barrels of petroleum in 2006 (more than 267,000 barrels per day), and petroleum products consumption has increased at a rate of 5.8% per year since then. Annual consumption per country[35] along with the percentage of petroleum consumed for electricity generation, is as follows: Belize: 3 million barrels, Costa Rica: 17 million barrels (6%), El Salvador: 15 million barrels (11%), Guatemala: 26 million barrels (16%), Honduras: 14 million barrels (34%), Nicaragua: 9 million barrels (36%), and Panama: 15 million barrels (20%). Given its heavy reliance on thermal generation in Mexico (where 75% of installed capacity is fossil fired[36]), Belize's grid has been indirectly based on about 60% thermal generation capacity. Given that its contact with Mexico will soon end, its petroleum product usage for electricity will change significantly.

According to the Comisión Económica para América Latina (CEPAL), petroleum consumption is forecasted to increase to 131 million barrels in 2020, with the following breakdown: 31.9% gasoline, 42.5% diesel, 11.9% LPG, 5.9% kerosene, 6.3% fuel oil, 0.1% jet fuel, and 1.4% asphalt.[37]

For more detail on liquid fuels markets, see Section 5 of the Statistical Annex.

[35] CEPAL hydrocarbons report, 2007.
[36] Julio Valle, "Energías Renovables en México," Secretaría de Energía (Mexico), November 2009.
[37] CEPAL/SICA, "Estrategia Energética Sustentable Centroamericana 2020," p. 72.

Section 3 Regulatory and Institutional Frameworks

This section presents a country-by-country review of the regulatory framework for the power and liquid fuels sectors, with reference to electricity market reforms, key institutions and their capacity, and recent policies and programs addressing renewables and energy efficiency. It also offers an update on regional energy market development.

3.1 NATIONAL POWER SECTOR FRAMEWORKS

Beginning in the 1990s, most of the countries in the region implemented electricity reforms to foster the participation of the private sector, independent regulation, and competitive markets with the goal of improving quality, reliability, and efficiency as well as improving the fiscal position of the government and increasing access to service at reasonable prices. El Salvador, Nicaragua, and Panama moved away from a vertically integrated monopoly structure, opening the segments of generation, transmission, and distribution to competition. Honduras tried to introduce reforms following the same lines but remains a de facto single buyer owing to the failed privatization of distribution. Costa Rica retained its vertically integrated structure but acts as a single buyer, procuring additional generation from independent power producers. Private sector participation in generation in these two countries is significant. A chart describing each country's key market and regulatory characteristics can be found in Section 1 of the Statistical Annex.

Small market sizes and the consolidation of distributors following privatization limit competition in the distribution segment. In Guatemala and Panama, any consumer with peak demand greater than 100 kW can select its electricity provider and negotiate the conditions and prices of supply. In El Salvador, each consumer, regardless of size, has this right, as do Nicaraguan consumers with peak demand greater than 2 MW. Guatemala has seen the most retail competition, thanks to the 37 large consumers that participate directly in the wholesale market.[38]

The new market model promotes the use of market prices for generation, tariffs that recover costs of service, and transparent subsidies. However, the threat of large tariff increases given high and volatile petroleum prices has compelled governments to intervene in the market and establish subsidies that undermined the credibility of the governments' commitments to market reforms and regulatory frameworks. Actions to control prices and implement large subsidies have also weakened energy companies' financial position and increased investment risks.

The institutional and regulatory frameworks for renewables and energy efficiency are nascent in almost every country in the region. The legal framework for renewables tends to emphasize incentives over requirements; these incentive-based policies (detailed in Section 2 of the Statistical Annex) are not likely to shift Central America's energy matrix significantly away from fossil fuels. While a policy mandate for energy efficiency exists in almost every country, Costa Rica is the only one to have a law in place (Panama is in the process of preparing one). Lacking a strong legal framework and institutional capacity, energy efficiency has also not

[38] ESMAP study, 2010, p. 55.

become a systematic policy objective. Institutional capacity is a major hindrance across the region. Government agencies, utilities, and regulatory bodies alike suffer from frequent turnover and a lack of funding.

The period 2010–2011 is the "moment of truth" for the notion of regional energy integration. A regional plant is needed, and the project needs to be large enough to cover needs in various countries.[39] In addition to investment in infrastructure, efforts at regional electricity integration will need significant political will and resources to overcome the many regulatory hurdles in its path, such as reciprocity among dissimilar market structures and long-term transmission rights.

3.1.1 Belize

Following the reform and consolidation of the power sector in 1992, BEL became the main generator, distributor, and transmitter of electricity in the country. However, BEL is required by law to provide transmission facilities to any generator capable of paying its fees; it purchases power from Mexico's CFE, BELCOGEN (bagasse), Belize Electric Company Limited (BECOL) and Hydro Maya Limited (HML) (hydroelectric), and Belize Aquaculture Limited (BAL) (HFO).[40] The Farmers Light Plant Cooperative in Spanish Lookout serves a small local grid of 480 customers.[41] In 2009, CFE cancelled its firm PPA with BEL because it no longer had enough generation capacity to supply Belize in addition to Mexico.[42] CFE continues to supply BEL with power as available; because Belize has sufficient in-country generation to meet demand, BEL only purchases power from Mexico when it is more economical than in-country generation.

Electricity pricing is regulated and codified in a number of laws including the Amended 1992 Electricity Act, the Public Utilities Commission (PUC) Act of 1999, and the Electricity Tariffs, Charges and Quality of Service Standards By-Laws of 2001.[43] As required by electricity regulations, PUC regulates tariffs. In addition, the PUC is responsible for the award of licenses and for monitoring and enforcing compliance with license conditions.

BEL is currently awaiting the outcome of its appeal of the PUC's 2008 Final Tariff Decision, in which the PUC imposed a USD 36.2 million charge against the company, disallowing pass-through costs and effectively forcing the company to absorb USD 38 million of excess cost of power as a result of record high oil prices in 2008.[44] The 2008 tariff decision caused BEL to be in breach of its loan covenants, preventing the company from borrowing and paying dividends.

3.1.1.1 Renewable Energy

In 2004, the national energy plan for Belize was presented; it included analysis of the energy sector and made policy recommendations to promote several forms of sustainable energy, such

[39] Interview with Claudio Artavia, Executive Secretary, CEAC, May 19, 2010.
[40] BEL annual report, 2009, p. 16.
[41] Launchpad Consulting and Dr. Ivan Azurdia-Bravo, "Energy for Sustainable Development: Toward a National Energy Strategy for Belize Energy Sector Diagnostic," November 5, 2003, p. 32 (hereinafter Launchpad Belize diagnostic, 2003).
[42] BEL annual report, 2009, p. 14.
[43] Launchpad Belize diagnostic, 2003, p. 50.
[44] BEL annual report, 2009, p. 3.

as a renewable energy portfolio standard[45] and minimum local generation standard.[46] However, the country has no renewables-specific policies, either as a part of a comprehensive energy strategy or specific to the electricity sub-sector.

Short of policies, Belize has taken some actions to encourage renewables investment, including developing an investor's information packet.[47] A national renewable energy education and awareness program aims to communicate the overall goals of the government, and several initiatives to encourage solar water heaters and small PV and wind systems have been developed. A comprehensive renewable energy training initiative with the purpose of increasing utility staff and project developers' capacity to develop and utilize these resources has been established.

Belize, along with twelve other Caribbean states, is a participant in the Caribbean Community's Renewable Energy Development Project (CREDP), which aims to remove barriers to renewable energy use in the region in terms of policy, finance, capacity and awareness. Since 2009, Belize has also been participating in the Caribbean Information Platform on Renewable Energy (CIPORE) in order to share information on renewable energy projects and learn from other countries.

3.1.1.2 Energy Efficiency

Belize does not currently have an energy efficiency law or an entity specifically responsible for related policies and programs. The government would like to implement a comprehensive energy-efficiency training program for utility personnel, hotel developers and engineers, potential entrepreneurs, and other relevant stakeholders.[48] It is planning to revise building codes to include potential energy saving design features and may conduct a study of energy end-use practices in all sectors in collaboration with BEL and an organization experienced in conducting surveys.

3.1.1.3 Institutional Capacity

BEL is quite critical of PUC, citing regulatory uncertainty as a major inhibitor to investment, as "regulatory approvals cannot be relied on and sovereign agreements are not respected."[49] Its 2009 Annual Report cites the government's need to "implement workable and stable regulations, managed by a competent commission." These remarks indicate dissatisfaction with PUC's regulatory capabilities and, regardless of the veracity of BEL's claims, they highlight a tense environment that makes institutional cooperation rather unlikely at this juncture.

In general, Belize's energy institutions have few staff to cover a range of international coordination activities.

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[45] A renewable energy portfolio standard is a target for the percentage of electricity that must be generated using renewable sources.
[46] Interview with Dennis Gonguez, Chief Meteorologist, National Meteorological Service (Belize), February 8, 2010.
[47] Ibid.
[48] Ibid.
[49] BEL annual report, 2009.

3.1.2 Costa Rica

Costa Rica has maintained a vertically integrated utility model with the participation of small cooperatives in rural areas and private investment in small-scale renewables generation. ICE and Compañía Nacional de Fuerza y Luz (CNFL) are the two state-owned vertically integrated utilities, contributing 75% and 3% of installed capacity, respectively. (From a corporate point of view, CNFL is a subsidiary of the ICE Group; it distributes power in the San José greater metropolitan area.) Thirty-two private generators contribute 17% of electricity, and five cooperatives (two of which are distribution utilities only) supply 2%. Two municipal utilities supply 2%. ICE is solely responsible for transmission.

Law 7200 (1990) allows private generators to sell up to 20 MW to the state; Law 7508 (1995) allows for larger facilities with eventual asset transfer to ICE. ICE is limited to purchasing 30% of total capacity from private producers. Other companies (such as CNFL and cooperatives) may purchase additional amounts of renewable energy.

The Autoridad Reguladora de Servicios Públicos (ARESEP) acts as regulator, and the Ministerio de Ambiente, Energía, y Telecomunicaciones (MINAET) establishes the relevant law. Within MINAET, the Dirección Sectorial de Energía (DSE) is the leading organization for comprehensive energy planning. It prepares the national energy plan, conducts and coordinates studies, develops energy pricing policy, and evaluates and enforces relevant policies and goals.

ICE is in charge of developing the expansion plan in accordance with the guidelines of energy policy included in the national development plan approved by the government. As a result, when the government changes every four years, the country's national development plan and energy policy change as well. The new administration of President Laura Chinchilla has clearly instructed ICE to move to increase the penetration of wind in the system and to take the steps necessary to manage system stability. It is also pursuing legislative reforms for the power sector. The draft legislation would remove the limits on the size of privately owned projects, create a market for bilateral contracts alongside a wholesale market, facilitate distributed resources, and separate the system operator from ICE.[50]

Some analysts argue that the conditions for passage of this legislation, which will arouse stiff opposition from the ICE union, are more favorable than in the past; with the ratification of Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR) and the successful liberalization of telecommunications, insurance and banking, it will be easier to fend off political challenges.[51] Opponents of the proposed legislation will, among other things, argue that private investment in a more open market will only be interested in serving export clients, potentially leaving Costa Rica with a supply deficit.[52]

The Chinchilla administration will also seek ratification of the second protocol to the SIEPAC treaty, which has been approved by all of the other SIEPAC parties, and there is confidence

[50] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[51] Ibid.
[52] Interview with Jorge Dengo G., Country Manager, GDF-Suez Central America (Costa Rica), May 21, 2010.

within the government that the ratification bill will pass.[53] The explanation given by Gloria Villa, Director of Energy at MINAET, is that the previous administration's attempt to get the second protocol through the legislature met with failure because of other provisions in the legislative vehicle not related to SIEPAC. By removing these controversial provisions, the Chinchilla administration hopes to win approval for the measure. Furthermore, the current Minister of Energy and Environment, Teofilo de la Torre, who is a former head of ICE, is generally regarded as the godfather of SIEPAC and also directed the Unidad de Implementación (UI) for the project; given his long involvement in the project, he has staked his personal credibility on ensuring passage of the measure.[54]

3.1.2.1 Renewable Energy

Costa Rica has enjoyed success in attracting investment in wind facilities and has made wind a key part of its overall system expansion plan, in which renewables play a central role. ICE provides all load following and complementary services as well as balancing power for wind facilities. The government has employed various procurement strategies, including value-based tariffs, turn-key acquisition by the state utility, and competitively bid build-own-operate-transfer projects, and it now appears to be moving toward a cost-plus tariff model.

ARESEP is developing a new tariff model for future projects (and new contracts for projects whose contracts will soon expire). It will use model projects from a technical study in each technology (wind, biomass, and small hydro) to calculate a tariff for each project type annually for ICE to use as a price ceiling in negotiations. ARESEP's plan is to eventually make the calculated tariff a fixed price. There is uncertainty about the duration for which the new tariff would be applied, given the administration's proposal for a new electric sector law,[55] and private investors express reservations about the considerable variation in approach.[56]

Costa Rica's most recent national expansion plan, written before the Chinchilla administration came into office, views hydropower as the most viable option for increasing generation from renewables and decreasing imports, followed by geothermal, wind, and to a lesser extent energy biomass, primarily from sugarcane bagasse.

Some 1,700 MW of identified hydroelectric potential partially or totally affects indigenous reserves. No legal impediments exist to the eventual execution of these projects, but additional complexities imposed by negotiations and agreements imply that some of these projects may not be executed. Another 780 MW of geothermal potential are located in national parks, where the law does not allow any kind of exploitation.

3.1.2.2 Energy Efficiency

DSE, an entity within MINAET, is charged with promoting the rational use of energy by creating the mechanisms needed to execute action in this area. Recent programs include the Programa

[53] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010; interview with Jorge Dengo G., Country Manager, GDF-Suez Central America (Costa Rica), May 21, 2010.
[54] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[55] Interview with Álvaro Barrantes, ARESEP (Costa Rica), May 20, 2010.
[56] Nexant, "Windpower Procurement and Policy Framework in Costa Rica: Case Study," prepared for USAID Africa Infrastructure Program, 2010.

Nacional de Conservación de la Energía (PRONACE), initiated in 1994, which launched subprograms on education, equipment, demand-side management, legislation, and other issues.[57] Costa Rica has also issued plans to save electricity in the public sector.

Costa Rica is the only country in the region with an efficiency law. In 1996, it passed Law 7447 regulating the Uso Racional de Energía (URE), which charges MINAET with the coordination and supervision of the URE program of increasing energy efficiency and promoting energy conservation, including establishing energy efficiency standards and labels. It also authorizes public enterprises and institutions to execute the URE program, either through their own means or through third parties. Law 7447 included a number of provisions such as tax exemption for purchases of energy efficiency and renewable equipment, but these were removed during the process of tax simplification under previous administration; the current administration is working to reinstate the incentives.[58]

The Instituto de Normas Técnicas de Costa Rica (INTECO), recognized as the nation's standards agency in 1995, develops and conducts certification activities and collaborates with the public sector to implement standards procedures. In the area of energy efficiency, INTECO is developing a methodology to implement energy efficiency labeling for critical products.[59]

ICE has been a leader in the country on energy efficiency, and signs and advertisements are evident in San José. ICE provides energy-saving tips for consumers on its website, targeting the residential and commercial sectors. ICE Electric provides similar advice for the commercial and industrial sectors. In February 2008, ICE implemented a "pay for two, get three" campaign with importers and distributors to distribute compact fluorescent lamps (CFLs) and foster awareness. ICE paid for the free lamp; almost 1.5 million units were sold, amounting to almost 12,000 MWh of energy saved and 1,500 tons of CO_2 emissions prevented.[60]

ICE's Departamento de Ahorro de Energía provides three types of service as value added in its business and/or strategies to ensure adequacy of supply: (1) the Energy Efficiency Laboratory (supported by IDB loan 796); (2) the energy efficiency services program, which provides advisory services to large clients and/or ones with problems that complicate ICE's operations and its public information campaign; and (3) rural electrification based on renewable energy.[61]

ICE's laboratory in Pavas is the only operational one in the region for testing the energy efficiency performance of energy-consuming equipment, but it is only accredited for illumination products.[62] Accreditation by the Ente Costarricense de Accreditación for refrigeration and

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[57] Comisión Nacional de Conservación de Energía, Ministerio del Ambiente y Energía, Costa Rica, "Programa Nacional de Conservación de Energía 2001–2006," 2001, http://www.dse.go.cr/en/05UsoRacEnerg/02CONACE/pronace.pdf.
[58] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010; Interview with Alejandra Arias, ICE (Costa Rica), May 19, 2010.
[59] Claudio Carpio, "Energy Efficiency in Latin America and Caribbean: Situation and Outlook," April 2010, p. 95, http://www.eclac.cl/publicaciones/xml/2/39412/lcw280i.pdf (hereinafter CEPAL energy efficiency outlook, 2010).
[60] CEPAL energy efficiency outlook, 2010, p. 89.
[61] Interview with Alejandra Arias, ICE (Costa Rica), May 19, 2010.
[62] Interview with Gabriela Córdoba, CCAD (El Salvador), May 17 and 31, 2010.

motors is expected in 2010 and 2012, respectively.[63] The laboratory provides the means for verifying efficiency claims on products and checking compliance with standards that have been developed with INTECO's involvement. For now the standards are voluntary and would require the issuance by MINAET of a regulation to make them obligatory.[64]

CNFL is also very active on energy efficiency. Its Innovation and Electrical Efficiency Department provides services including educational and training programs and technical studies, including energy audits for firms and industries. The department's Energy Efficiency Section offers power factor studies, energy quality assessments, grounding systems, and thermography.

In addition, CNFL is working on the development of energy efficiency software for each sector that it services and provides personalized customer service systems for large consumers to improve efficiency. It purchases and installs efficient lighting systems through public-sector buildings; the investment is charged to the institution through its electrical bills.

ICE and CNFL's efforts appear to be having some impact. ICE data show that residential demand has decreased 1% on the basis of consumption per account (unitary consumption), even as overall consumption has increased via population growth and additional lines.[65] One ICE official suggests that cost, energy efficiency concerns, and public awareness have had an impact. However, this decline in consumption could also be attributed to the recent economic downturn.

3.1.2.3 Institutional Capacity

Costa Rica is generally thought to be the best prepared and organized country in the region, but some gaping holes remain. DSE does not have efficiency specialists, which makes it difficult to expand specific energy efficiency projects and activities.[66] Moreover, Costa Rica has no systematic monitoring of the results of energy efficiency efforts.[67] ARESEP has been at odds with ICE over tariffs, with the result that revenues have fallen short of requirements, leading to consequences such as power outages; ESMAP argues that it is necessary to redefine the regulator's functions to ensure more fluid operations.[68]

The Oficina Costarricense de Implementación Conjunta (OCIC) was appointed the Designated National Authority (DNA) to approve Costa Rica's participation in emission reduction or removal projects via the Kyoto Protocol's Clean Development Mechanism (CDM). The body once had a staff of 25; now there is only one person. According to officials, there has been a lack of support for OCIC since 1998.[69]

3.1.3 El Salvador

El Salvador's electricity sector includes competition at the retail level among five distribution companies; privatization of the distribution network began with the sale of four regional

[63] Interview with Alejandra Arias, ICE (Costa Rica), May 19, 2010.
[64] Ibid.
[65] Interview with Javier Orozco, Director, Integrated Expansion Planning, ICE (Costa Rica), May 19, 2010.
[66] CEPAL energy efficiency outlook, 2010, p. 84.
[67] Ibid., p. 95.
[68] ESMAP study, 2010, p. 73.
[69] Interview with William Alpízar, OCIC (Costa Rica), May 21, 2010.

distribution companies in February 1998. AES Group controls four distribution companies, accounting for about 75% of the market.[70]

Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL) is the only public company with a stake in generation, with 97% of hydroelectric capacity. Three of CEL's thermal generating plants were privatized in late 1999.[71]

The Unidad de Transacciones (UT) is the private company in charge of administering the wholesale electricity market and the transmission system. Empresa Transmisora de El Salvador (ETESAL), which was constituted in 1999 after the restructuring of CEL, is responsible for the maintenance and expansion of the transmission system. The Superintendencia General de Electricidad y Telecomunicaciones (SIGET) is the regulatory body for the electricity and telecommunications sectors.

In 2006, the president created the Consejo Nacional de Energía (CNE), which has the role of analyzing El Salvador's energy situation and recommending new strategies. The CNE seeks to contribute to a shift in generation towards renewable energy and to modify consumption patterns toward the efficient use of energy.

3.1.3.1 Renewable Energy

El Salvador's 2007 National Energy Strategy supports the diversification of energy sources. Besides hydroelectricity and geothermal energy, the government foresees the addition of 50 MW of renewable generation in the next 10 years in the form of wind power, solar power, biomass and mini-hydroelectric plants.

In November 2007, El Salvador approved the Fiscal Incentives Law for the Promotion of Renewable Energy (Decree 462). This act provides a package of tax benefits to individuals or corporations to invest in sources of renewable energy generation, including exemption from import tariffs for capital goods and other inputs associated with the first 10 years for up to 20 MW plants and exemption from income tax the first five years for plants between 10 and 20 MW and 10 years for those under 10 MW. Projects above 20 MW can deduct the cost of all studies related to the project from income tax.[72]

Another initiative is the Sistema de Fomento de Energías Renovables (SIFER), which is creating the Fondo de Fomento de Energías Renovables (FOFER). FOFER will provide soft loans and guarantees and assist in the financing of feasibility studies for new renewables projects.[73] FOFER will act as a hedging mechanism for price variation, guaranteeing the generator a more stable revenue stream via a fixed-price contract.

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[70] ESMAP study, 2010, p. 55.
[71] Economist Intelligence Unit (EIU), "Country Profile: El Salvador," 2008.
[72] CEPAL, "Istmo Centroamericano: Las Fuentes Renovables de Energía y el Cumplimiento de la Estrategia 2020," December 22, 2009, p. 37, http://www.cepal.org/cgi-bin/getProd.asp?xml=%20/publicaciones/xml/6/38216/P38216.xml&xsl=/mexico/tpl/p9f.xsl%20&base=/tpl/top-bottom.xslt (hereinafter CEPAL renewables report, 2009).
[73] CEPAL renewables report, 2009, p. 37.

UT is leading the implementation of the regulation for the wholesale market based on production costs, which contemplates specific arrangements for renewables. The objective is to launch this bid-based system in the early fall of 2010, with renewables accounting for a projected 50% of contracted capacity in 2013 and expanding to 80% in 2015.[74] The challenge for making these bids a platform for contracting renewable capacity is that the regulations for this type of bidding do not allow for specification of technology. CNE has talked about setting aside 30% for renewables out of the share of demand allocated to contracted supplies, which would involve a modification of Decree 11/2006. The Superintendencia de Competencia (SC) would have to issue an opinion on any limitation regarding technology, and there is the question of the requirement to provide firm capacity.[75]

3.1.3.2 Energy Efficiency

The Dirección de Energía Eléctrica (DEE), created in 2001, was the principal institution responsible for the electricity sector until the creation of the CNE. DEE has been involved in preparing technical cooperation projects related to energy efficiency; it completed the preliminary preparations for the county's energy efficiency program and presented them to the IDB. DEE played a significant role given the scarcity of resources devoted to the subject, but the CNE will have a major influence on the development of initiatives going forward.[76] CNE recently created the Dirección de Energías Renovables y Eficiencia Energética, which will benefit from IDB assistance.[77]

El Salvador does not currently have a specific energy efficiency law, but the CNE is considering creating one, and it is preparing a national energy efficiency plan.[78] In the short term, the government is looking to implement savings practices in the government, industry, commerce, and residential sectors and replace incandescent lamps with CFLs in the rural residential sectors. The government is developing energy efficiency campaigns that include national-level events and seminars, the preparation of technical manuals, and the dissemination of lessons learned. It is also developing norms and minimum standards for efficient electrical equipment.[79] One example is performance and labeling requirements for fluorescent lights, managed by the Ministerio de Economía (MINEC). In 2006, SIGET launched an energy efficiency program to promote energy savings through helping people to identify the energy consumption of their electrical equipment.[80]

In the medium term, El Salvador hopes to strengthen institutional actions and incentives to promote the use of efficient electrical equipment in the industrial and commercial sectors and

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[74] Interview with Napoleón Alfaro, Head of Wholesale Markets, and Carmen Elena Torres, Head of Concessions, SIGET (El Salvador), May 31, 2010.
[75] Ibid.
[76] CEPAL energy efficiency outlook, 2010, p. 125.
[77] Ibid., p. 124.
[78] Jorge Asturias, "Avances en Eficiencia Energética en la Región" (presentation, WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26) (hereinafter Asturias presentation, 2010).
[79] Yolanda Gavidia, "Política Energética en El Salvador," Dirección de Energía Eléctrica (El Salvador).
[80] Collaborative Labeling and Standards Program, "Summary of S&L Information for El Salvador," http://www.clasponline.org/clasp.online.worldwide.php?countryinfo=332#Related Links.

increase the capacity of credit analysis for energy efficiency projects in financial institutions through training.[81]

3.1.3.3 Institutional Capacity

Since its inception in 1997, SIGET has been struggling with a heavy work load and limited resources.[82] This regulator is well organized but, according to ESMAP, is subject to political influence that has resulted in costly and unsustainable subsidies.[83]

In the energy efficiency space, CEPAL notes that El Salvador needs to strengthen relevant public and private agencies institutionally in order to better direct energy-saving programs and projects to all socioeconomic levels; improve access to financing, expand efforts to disseminate information; boost training and educational activities; and gradually reduce dependence on foreign cooperation by replacing them with local entities that can design, finance, and implement projects.[84]

3.1.4 Guatemala

Guatemala's electricity markets reforms, beginning in the mid 1990s, provided for a general unbundling of generation, transmission, and distribution and gave private companies unrestricted access to the power grid, distributors, and wholesale customers. Privatization of state-owned electric companies began with the selling off of the state distribution company, Empresa Eléctrica de Guatemala (EEGSA), and the primary generating company, Instituto Nacional de Electrificación (INDE). INDE was divided into three subsidiaries: Empresa de Generación de Energía Eléctrica (EGEE), the remaining public generation company; Empresa de Transporte y Control de Energía Eléctrica (ETCEE), a transmission company (one of the country's three) that controls 95% of the network[85]; and the Empresa de Comercialización de Energía (ECOE), which buys and sells electric capacity on the domestic and international markets.

The country has 42 private generation companies, which account for 75% of generation. The government has also privatized the entire distribution network.[86] Three companies comprise the distribution market, two of which are owned by Unión Fenosa.[87]

The Administrador del Mercado Mayorista (AMM) is a private non-profit responsible for managing the wholesale market. The Ministerio de Energía y Minas (MEM) is the entity responsible for formulating and coordinating policies, state plans, and programs for the electric sub-sector and applying regulations. The Comisión Nacional de Energía Eléctrica (CNEE) is a technical and independent body of the MEM in charge of the regulatory and normative functions.

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[81] Gavidia, "Política Energética en El Salvador."
[82] Renewable Energy and Energy Efficiency Partnership (REEEP), "Policy DB Details: El Salvador (2009)," http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=20.
[83] ESMAP study, 2010, p. 73.
[84] CEPAL energy efficiency outlook, 2010, p. 128.
[85] ESMAP study, 2010, p. 55.
[86] EIU, "Country Profile: Guatemala," 2008.
[87] ESMAP study, 2010, p. 55.

3.1.4.1 Renewable Energy

In November 2003, the Congress approved by Decree No. 52-2003 the Incentives Law for the Development of Renewable Energy Projects. This law instructs MEM to assess renewable energy resources and projects, study their investment requirements, and award incentives. These incentives include exemption from customs duties for imports, including value-added tax and consular fees on imports of machinery and equipment exclusively used for renewable power generation during the pre-investment and construction period (no more than 10 years), and exemption from income tax during the first ten years of the plant's commercial operation. However, some policymakers argue that these incentives are not sufficient to compel the rate of change needed to shift the national energy matrix significantly toward renewables.[88]

Guatemala has taken special measures to encourage the development of co-generation, which consisted of favoring long-term electric power purchases within a dual generation scheme (using both bagasse and petroleum derivatives) that also permitted production outside of the sugarcane season.[89]

In October 2008, CNEE approved the technical standard for the connection, operation, and control of distributed renewable generation and marketing and self-producers with excess energy. This resolution is intended to regulate the access of renewable energy projects or distributed renewable generation and self-generation to the distribution networks. The rules state that installation costs between the plant and network are the responsibility of the generator, while the distributors are required to make extensions or changes authorized by the CNEE but will be reimbursed by the generator. Distributed renewable generation was already exempt (under Article 70 of the Electricity Law) from payment of distribution tolls that are under consideration and must only pay fees for firm capacity if they have signed supply contracts.[90]

3.1.4.2 Energy Efficiency

No agencies or units have direct responsibility for energy saving in Guatemala, but CNEE has taken up the mantle, as discussed below. To fill this gap, a national energy efficiency council has been proposed, with technical assistance from the Organización Latinoamericana de Energía (OLADE) and financial support from the Canadian Agency for International Development. This commission will have the mandate of creating energy efficiency policy in the country, including technical and regulatory aspects as well as sectoral programs, and be similar to the Comisión Nacional para el Uso Eficiente de la Energía (CONUEE) in Mexico.

MEM's national energy policy includes five objectives within the theme of energy efficiency: education, public lighting, residential lighting, industrial efficiency, and a labeling program.[91]

In 2004, MEM launched an energy-saving information campaign across the country, including training, press releases, radio and television spots, bumper stickers, and flyers. The effort was

[88] Interview with Carlos Echeverría, Director General de Energía, Ministerio de Energía y Minas (MEM) (Guatemala), May 28, 2010.
[89] REEEP, "Policy DB Details: Guatemala (2009)," http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=22.
[90] CEPAL renewables report, 2009, p. 38.
[91] Asturias presentation, 2010.

carried out jointly with power utilities and the Secretariat of Social Communication of the Office of the President of the Republic. MEM and INDE carried out a pilot project to replace 75W incandescent bulbs with 15W energy-saving bulbs in 660 residences in Estor Municipality, Department of Izabal. MEM also collaborated with the Ministry of Education to develop a curriculum for primary school teachers in nine departments.

Other short-term plans include an energy-efficient lighting program in municipal and residential sectors, energy efficiency in public buildings (a pilot project in MEM and CNEE), and training courses for specialists.[92] Legislation has been proposed to prohibit the sale of incandescent bulbs and set up a trust to finance electricity-saving measures.[93]An attempt to use daylight savings time was suspended due to logistical and safety concerns.

CNEE has staked out a role for itself as the national leader on energy efficiency until such time as the National Energy Efficiency Council is established. IDB has provided a technical assistance to CNEE to carry out a comprehensive plan for energy efficiency that will determine where energy efficiency efforts should be focused, potential legislation to develop a stronger regulatory and institutional framework, and the role of the proposed national commission. A national scale workshop on energy efficiency was organized in May 2009 and a business consulting firm called Estrategias de Inversión, S.A. is in charge of structuring the national energy efficiency plan and helping CNEE map all of the actions that must be taken in order to integrate previously isolated efforts and scale them up.

IDB and CNEE are also designing a pilot project that will include standards for engines and refrigerators. CNEE signed an agreement of bilateral cooperation with Mexico's Fideicomiso para el Ahorro de Energía Eléctrica (FIDE) in order to advise CNEE on energy efficiency.

3.1.4.3 Institutional Capacity

The Guatemalan government and MEM specifically demonstrate weaknesses in the area of technical capabilities. MEM also suffers from high turnover and has only 11 staff to handle all technical aspects of fulfilling with what the electricity law mandates.[94] ESMAP argues that CNEE monitors the market effectively but has not successfully attracted investment for the development of energy resources.[95]

3.1.5 Honduras

In the early 1990s, the electricity sector in Honduras experienced a severe financial crisis when electricity tariffs were not adjusted to cover the debt service of the El Cajón hydroelectric project, and ENEE suffered from high losses, overstaffing, and poor plant maintenance.[96] In 1993, this financial crisis was accompanied by severe drought and lack of generation reserve capacity, resulting in an urgent need to mobilize private financing to expand generation capacity

[92] Comisión Nacional de Energía Eléctrica (Guatemala), "Programa Nacional de Eficiencia Energética," August 2009, p. 8.
[93] CEPAL energy efficiency outlook, 2010, p. 134.
[94] Interview with Carlos Echeverría, Director General de Energía, Ministerio de Energía y Minas (MEM) (Guatemala), May 28, 2010.
[95] ESMAP study, 2010, p. 73.
[96] World Bank, "Honduras: Power Sector Issues and Options," July 10, 2007, p. iv.

and improve ENEE's performance. Thus, in 1994 Honduras attempted to establish a competitive power market. However, the market envisioned in the law was not implemented because the distribution networks were not unbundled and privatized, and ENEE continues to operate as a de facto single buyer. ENEE procures about one-half of electricity generation through power purchase agreements with 26 private companies. Although according to law transmission networks can be built and owned by public, private, or mixed ownership operating enterprises, in practice ENEE is responsible for transmission and system operations.

The Electricity Law of 1994 assigns the policymaking function to an Energy Cabinet chaired by the President of the Republic with the Secretaria de Recursos Naturales y Ambiente (SERNA) as its Secretary and Coordinator. SERNA is in charge of licenses, concessions and operation contracts as well as compliance with the General Environmental Act. The Comisión Nacional de Energía (CNE) serves are the regulatory agency.

3.1.5.1 Renewable Energy

Decreto 70 (2007) promotes the development of renewable energy-generating plants through sales tax and import duties exemption for all equipment through the construction phase; tax exemption for the first 10 years of commercial operation for plants up to 50 MW; tariff benefits for temporary imports necessary for construction and maintenance; and income tax exemption for wages and contract honoraria for necessary workers. Generation from projects less than 50 MW will be purchased at a 10% premium above the short-term marginal cost for 15 years.

In April 2009, ENEE awarded 49 contracts for generation and sale of 250 MW of renewable energy. Companies who received these contracts are part of the Asociación Hondureña de Pequeños Productores de Energía Renovable (AHPPER). Contract terms mandate that each company will be required to generate power within 24 months, during which they must have completed construction of their projects, mostly mini-hydroelectric, and promote reforestation activities in the basins of the rivers where they will operate.

3.1.5.2 Energy Efficiency

SERNA is responsible for energy efficiency via the Dirección General de Energía (DGE). The country has limited policies and standards on the issue. Honduras does not have a specific energy efficiency law, but SERNA and ENEE are working on one; a draft bill is in the Legislative Assembly.[97]

Energy efficiency standards are under the direction of the Organismo Hondureño de Normalización (OHN). Among others, a standard for CFLs is being developed. It is oriented toward restricting the import, manufacture, and marketing of incandescent bulbs. In the future, standards for electric motors, refrigerators, and household appliances will also be developed.[98]

ENEE has directed important projects, including the Generación Autónoma y Uso Racional de Energía Eléctrica (GAUREE) project, financed by the European Union between 2000 and 2007. The GAUREE II project is aimed at increasing the use of energy-efficient CFLs, lowering

[97] Asturias presentation, 2010.
[98] CEPAL energy efficiency outlook, 2010, p. 150.

energy consumption by 50 million kWh per year. The plan of action includes giving away, in a three-phased operation, a free 20 W CFL bulb to 800,000 households.[99] It also includes an educational campaign in at least 250 primary and secondary schools and training for more than 300 teachers.[100]

The Grupo Interinstitucional para el Uso Racional de la Energía (GIURE), created in August 2007, set out a plan with the objective of reducing national electricity demand by 100 MW in 2008.[101] This would entail an 8% reduction of the maximum demand forecasted by ENEE. Some of the main activities included in GIURE's program are promotion of gas stove use, use of clean development mechanisms, educational campaigns, and efficiency in the industrial and commercial sectors.

The government has been running the Programa de Eficiencia Energética en el Sector Industrial y Comercial (PESIC) in the Sula Valley since 2005. This pioneer project, one of the largest in Honduras, includes energy efficiency assessments in these two sectors and provides recommendations that will help with equipment upgrades. The Fondo de Inversión de Desarrollo Empresarial (FIDE), located in San Pedro Sula, is implementing this project. The Centro Nacional de Producción Más Limpia (CNP+L), part of FIDE, is another organization that is active on energy efficiency activities in Honduras.

3.1.5.3 Institutional Capacity

Honduras's expansion has been characterized by investments under emergency conditions, with debatable outcomes. The government has not been able to meet the financial conditions that are necessary to invest in large-scale projects, which has resulted in the signing of last-minute contracts with private investors to provide small capacity increments.[102] The heavily indebted ENEE has postponed some renewable energy projects, including the construction of several new dams.[103] ENEE's poor corporate governance and outmoded technology, know-how, commercial practices, and information and management systems contribute to poor performance.[104] According to ESMAP, CNEE is "weak and ineffective," with little influence on ENEE.[105]

Particularly with regard to the advancement of renewable energy, promotion and planning have been split between ENEE and SERNA. For example, the know-how for project application for CDM credits is in the hands of SERNA, while ENEE approves and follows technical development.[106]

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[99] REEEP, "Policy DB Details: Honduras (2009)," http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=24.
[100] CEPAL energy efficiency outlook, 2009, p. 153.
[101] REEEP, "Policy DB Details: Honduras (2009)."
[102] Ibid.
[103] EIU, "Country Profile: Honduras," 2008.
[104] Timothy Irwin and Chiaki Yamamoto, "Some Options for Improving the Governance of State-owned Electricity Utilities," World Bank, Energy and Mining Sector Board Paper No. 11, 2004, http://www.regulationbodyofknowledge.org/externalDocument/irwinSome/.
[105] ESMAP study, 2010, p. 73.
[106] REEEP, "Policy DB Details: Honduras (2009)."

Similarly, the penetration of renewable energy technologies into rural electrification programs is still lagging behind due to a lack of clear and consistent policy framework in the field.[107] As a result, most of the rural electrification activities are still grid extensions.

SERNA is in a weak position due, among other reasons, to limited budgets and to the weakness of the civil service system. Also, the ministry staff faces a total turnover whenever a new government takes over (every four years), which slows down its operations. The Energy Cabinet has met less than once a year since its creation. CNE has had a marginal role due to lack of political support and resources. As a result of this void at the cabinet level, ENEE has become the default source for energy expertise, which contributes to a weak separation of roles among utility, regulatory agency and the ministry.[108]

3.1.6 Nicaragua

Private suppliers generate the majority of Nicaragua's electricity, with ENEL playing a diminishing role after undergoing partial privatization in 1998–2002. Plants run by ALBA de Nicaragua SA (ALBANISA) produce more than one-half of the country's energy.[109] This company, which imports Venezuelan petroleum,[110] is 49% owned by the state-run Petróleos de Nicaragua and 51% owned by Petróleos de Venezuela (PDVSA). It was created in 2007 as a result of Nicaragua's entry to the Alianza Bolivariana para los Pueblos de Nuestra América (ALBA). For more on ALBANISA's expanding role in Nicaragua's energy sector, see Section 3.2.6.

All transmission is handled by Empresa Nacional de Transmisión Eléctrica (ENATREL), which is also in charge of the system's dispatch. Unión Fenosa controls two distribution companies with 93% of the market.[111] The Centro Nacional de Despacho de Carga (CNDC) is the operational body in charge of administering the wholesale electricity market and the Sistema Interconectado Nacional (SIN).

The Ministerio de Energía y Minas (MEM), created in January 2007, replaced the Comisión Nacional de Energía (CNE) and is in charge of producing development strategies for the national electricity sector. The Instituto Nicaragüense de Electricidad (INE) applies the policies defined by the government and is in charge of regulation and taxation.

3.1.6.1 Renewable Energy

In April 2005, the government approved Law No. 532, the Law on Promotion of Electricity Generation with Renewable Resources. This law and the Hydroelectric Promotion Law (amended 2005/531) provide incentives to invest in electricity generation, such as import tariff and value-added tax exemption for equipment during pre-investment and construction, sales tax exemption for up to the first seven years of commercial operation (including taxes from carbon

[107] Ibid.
[108] World Bank, "Honduras: Power Sector Issues and Options," p. 9.
[109] Roberto Morales, "Albanisa Concentra Generación Eléctrica," *La Prensa* (Nicaragua), July 8, 2010, http://www.laprensa.com.ni/2010/07/08/nacionales/30752.
[110] Luis Galiano, "Albanisa Es Un Pulpo," *El Nuevo Diario* (Nicaragua), September 28, 2009, http://www.elnuevodiario.com.ni/nacionales/58180.
[111] ESMAP study, 2010, p. 55.

credit sales), municipal tax exemption for the first ten years, and natural resource exploitation tax exemption for up to five years.

Additionally, Nicaragua's renewable energy law stipulates that renewable projects that have excess energy relative to their contracted amounts can sell that energy on the spot market, provided that the sales price is between USD 0.055 and USD 0.065 per kWh.[112] This arrangement is unlikely to be very profitable, if at all, for projects that bring new renewable generation capacity to the market, with the exception of hydropower from relatively large facilities. Smaller-scale hydropower, wind, and biomass-fired generation will likely require sales prices in a range between USD 0.065/kWh and USD 0.095/kWh.

MEM is very interested in the issue of wind integration. ENATREL is preparing for a series of investments in the grid to improve its ability to handle the added wind resources, with IDB support. MEM is conducting a review of renewable development to determine the near-term target. Licensees are also required to provide grid studies to demonstrate that the impact is manageable. However, MEM believes that the system does not have enough regulating capacity from thermal or hydro facilities to manage the intermittence, and it is therefore necessary to contemplate the possibility that the PPAs will provide for curtailment of the wind facilities when required to ensure grid stability.[113]

3.1.6.2 Energy Efficiency

In 2007, MEM, acting through its Dirección General de Electricidad y Recursos Renovables, formed the Departamento de Eficiencia Energética, with new staff committed to contributing to energy saving. The department undertakes activities such as promoting energy audits and demonstration projects, advising institutions on how to reduce consumption, promoting improvements in lighting and air conditioning, defining incentives for introducing equipment, promoting training and awareness, and creating private enterprises specializing in energy efficiency, among other initiatives.

MEM has designed a public street lighting program, fuel saving program for the transport sector, demonstration projects in the government sector, information campaigns for the residential sector, and studies to improve energy efficiency. Its Programa de Desarrollo de la Eficiencia Energética en los Sectores Industrial y Comercial is funded by international institutions and governments.

In January 2009, the government published Decree 2-2009, a set of measures to generate energy savings in public institutions.[114] The country has mandatory technical standards for lighting, refrigerators, and motors, but enforcement remains a critical issue, and the country needs a laboratory to support conformity.[115]

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[112] La Asamblea Nacional del la República de Nicaragua, "Ley No. 532," *La Gaceta*, May 27, 2005.
[113] Interview with Martín Yllescas and Elmer Bervis, MEM (Nicaragua), May 27, 2010.
[114] CEPAL energy efficiency outlook, p. 194.
[115] Interview with Martín Yllescas and Elmer Bervis, MEM (Nicaragua), May 27, 2010.

3.1.6.3 Institutional Capacity

MEM's creation was the first move in what has become the increasingly successful process of state empowerment within the energy sector.[116] Yet, Nicaragua lacks funds to continue with many actions, and MEM's new staff needs stronger technical capabilities.

The Ministerio del Ambiente y los Recursos Naturales (MARENA), along with INE and MEM, plays a specific role in the promotion of sustainable energies and environmental protection. Unfortunately, due to budget restraints, MARENA must seek international assistance to develop its sustainable programs.[117]

Similarly, INE needs more resources to resolve a number of issues, including covering the costs of ensuring access to electricity for low-income consumers.[118]

3.1.7 Panama

In 1998, the Panamanian government restructured its electricity sector, separating the generation, distribution, and transmission assets of the state-owned power company, Instituto de Recursos Hidraulicos y Electrificación (IRHE). The government partially privatized four power plants belonging to IRHE and opened the market to private generators. The market now includes 23 private generators and three distribution firms. The government retained control of Panama's transmission company, Empresa de Transmisión Eléctrica (ETESA).

The Autoridad Nacional de los Servicios Públicos (ASEP) regulates electricity as well as water, sewage, telecommunications, radio and television, and natural gas. The Comisión de Politica Energética (COPE), under the MEF, was created in 1997 with the mandate to formulate, plan, and establish the energy sector policies, ensure compliance, advise the executive branch, and propose the necessary legislation for the proper enforcement of energy policies. In 2008, COPE was folded into the newly created Secretaria Nacional de Energía (SNE).

3.1.7.1 Renewable Energy

COPE issued two resolutions in 2004 (4001 and 4002) to promote the construction of hydroelectric and wind generation plants. For stations up to 10 MW, there is no distribution or transmission charge, import tax exemption for equipment and spare parts for construction and operation, and tax exemption of up to 25% on the income tax regarding direct costs of the project during the first ten years of commercial operation. For stations of 10 to 20 MW, there is a transmission charge exemption of transmission for first 10 MW in first 10 years of the operation, no allowance to contract directly with the distribution company, and a fiscal incentive of up to 25% of direct cost based on CO_2 emissions reduction is only applicable to 50% of tax income (not 100%). Above 20 MW, stations benefit from the same incentives as 10–20 MW stations but must pay the transmission charge. Panama also provides subsidies to finance up to 5% of direct costs of all projects foreseen to be of public use, an allowance to sell up to 15% of electricity to

[116] REEEP, "Policy DB Details: Nicaragua (2009)," http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=27.
[117] REEEP, "Policy DB Details: Nicaragua (2009)."
[118] ESMAP study, 2010, p. 73.

any distribution company independently from the location of the plant, and an allowance to sell electricity on the spot market.

Under law, tenders cannot discriminate between generation technologies. It is not clear how the government is going to address this issue in targeted procurements.[119]

3.1.7.2 Energy Efficiency

Panama's National Energy Plan 2009–2023 is the first plan to recognize the possibility of a positive contribution from efficient energy use as an energy-planning alternative.[120] It proposed demand-side energy planning to reduce energy requirements without compromising need or neglecting environmental issues. IDB is supporting work by a consultant on a draft energy efficiency law. A draft is expected in late 2010, and it will address the need to achieve improvements in efficiency in buildings and appliances as well as promote public education.[121]

The Dirección General de Normas y Tecnología Industrial (DGNTI) of the Ministerio de Comercio e Industrias (MICI) has done work on technical standards for CFLs. The Universidad Tecnológica de Panamá has conducted studies and research on energy efficiency issues and serves on various technical committees. Its short-term plans include the creation of a laboratory to undertake trials for equipment certification in lighting, air conditioning, refrigeration, and electric motors, which would require a USD 2 million investment.[122] The Autoridad Nacional del Ambiente (ANAM) undertakes activities to promote energy efficiency measures as a climate change strategy.

Panama's distribution firms, EDEMET, EDECHI, and ELEKTRA-NORESTE run campaigns to educate customers on rational energy use.[123]

3.1.7.3 Institutional Capacity

Institutional strengthening is necessary to increase DGNTI's operational capacity for the creation of standards and convene all entities that should participate in the process.[124]

SNE will need further technical and institutional strengthening to ensure the fulfillment of an energy efficiency policy.[125] While the government has implemented a variety of energy efficiency programs targeting government agencies starting in the early 1980s, some have failed due to a lack of monitoring, control, evaluation, and feedback.[126]

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[119] Interview with Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24, 2010.
[120] CEPAL energy efficiency outlook, 2010, p. 208.
[121] Interview with Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24, 2010.
[122] CEPAL energy efficiency outlook, 2010, p. 213.
[123] Ibid., p. 213.
[124] Ibid., p. 212.
[125] Ibid., p. 217.
[126] Ibid., p. 217.

Regarding regulation, ASEP, which ESMAP assesses as solid and responsible, was recently restructured; this process is ongoing and, according to ESMAP, could have unintended consequences.[127]

3.2 NATIONAL LIQUID FUELS FRAMEWORKS

Costa Rica, El Salvador, and Nicaragua maintain refineries and import crude, whereas Belize, Guatemala, Honduras, and Panama must import refined products. The region's petroleum bill, including crude imports and fuel, grew from USD 3 billion in 2000 to USD 11 billion in 2008—a 280% increase due to an increase in demand and a substantial rise in average West Texas Intermediate (WTI) prices, which is used as an industry benchmark.[128] (See Section 5 of the Statistical Annex for liquid fuels production and consumption data.)

Given these increases, all of the countries except Belize, El Salvador, and Panama have chosen to enter the Acuerdo de Cooperación Energética Petrocaribe, an agreement with Venezuela that offers fixed prices and favorable financing.

El Salvador, Guatemala, and Nicaragua have deregulated fuel prices (with the exception of LPG). Costa Rica and Honduras apply formulas based on import parity to regulate wholesale and retail prices. Panama only regulates wholesale prices based on import parity, but in September 2008 it established maximum prices for gas stations.[129]

The petroleum subsector is functioning well, without significant supply interruptions, thanks to pricing policies that allow for reactions to international prices. Price-level differences between neighboring countries suggest the possibility of contraband, but this does not seem to be a major issue.[130]

3.2.1 Belize

Belize is one of two oil producers in the region, along with Guatemala. In 2006, an Irish-owned company, Belize Natural Energy (BNE), formally announced a commercial oil find at Spanish Lookout, with reserves estimated at 10 million barrels. BNE is Belize's only petroleum-producing company and is pumping 5,000 barrels of oil per day from ten wells.[131]

Belize's wholesale and retail markets are open to multiple importers, but currently only Esso has the authority and the facilities to import oil for commercial consumption. Two other authorities are licensed to import, BEL and a private wholesaler, but for the most part they do not access the general retail market.[132] Esso supplies Texaco Belize Limited and Shell Belize Limited for commercial sales. Fuel is transported over land by small- and large-capacity tank trucks (3,000 to 10,000 gallons).

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[127] ESMAP study, 2010, p. 73.
[128] Ibid., p. 28.
[129] Ibid., p. 30.
[130] Ibid.. p. 32.
[131] Lindsay Fergus, "Baroness of the Belize Oil Fields," *Belfast Telegraph*, January 12, 2010, http://www.belfasttelegraph.co.uk/business/business-news/baroness-of-the-belize-oil-fields-14632106.html#ixzz0trTeJDFe.
[132] Launchpad report, 2003, p. 27.

The Ministry of Natural Resources and the Environment is responsible for petroleum as laid out in the Petroleum Act and the Petroleum Regulations.[133] In March 2006, the government established a Petroleum Advisory Board to oversee oil development policy. Pump prices are regulated by the Ministry of Finance and vary in each district due to transportation costs, the lowest pump prices being in Belize City, where the terminal is located.

3.2.2 Costa Rica

Importation, production, and distribution of petroleum products in Costa Rica is a government monopoly under Refinadora Costarricense de Petróleo (RECOPE), supervised by MINAET. RECOPE processes 42,000–45,000 barrels per day of oil at Moín on the Caribbean coast and buys refined products on the world market (including from Venezuela).[134] Retail fuel sales are handled by domestic and international private companies, including Shell, Texaco, and Elf.

ARESEP adjusts the price of petroleum products once per month based on international spot market prices,[135] and MINAET is reviewing possible strategies to liberalize the fuels market.[136] Government policy maintains a significant difference between retail prices for LPG and gasoline,[137] and several companies import and install devices to convert vehicle engines to dual LPG/gasoline consumption. MINAET issues executive decrees that establish fuel quality specifications.

3.2.2.1 Renewable Energy

According to Costa Rica's national expansion plan, biofuels can become a significant additional source of energy in the coming years. Feedstocks under consideration are sugarcane and sorghum for ethanol, jatropha, and higuerilla, as well as African palm and algae.[138]

MINAET has concluded that the country has available land to produce enough biofuels to cover a blend of 10% alcohol and 20% biodiesel (higher than CEPAL's estimates, which analysts say are conservative).[139] Blends of diesel with 5–20% biodiesel can be used in any of the thermal plants in the country without adjustments or major conversions. However, no infrastructure for large-scale domestic production, storage, or distribution exists. Small amounts are being used experimentally in ICE thermal plants to measure their performance, particularly with regard to emissions. MINAET is examining how to extend to hybrid vehicles the tax exemptions for other energy efficiency and renewable equipment that it is seeking to reinstate.[140]

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[133] Geology & Petroleum Department, Ministry of Natural Resources and the Environment, Government of Belize, "Belize Petroleum Sector," p. 1.
[134] EIU, "Country Profile: Costa Rica," 2008.
[135] Dennis Rogers, "There Really is a Method in Computing Gasoline Prices," A.M. Costa Rica, May 20, 2010, http://www.amcostarica.com/052010.htm.
[136] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[137] Autoridad Reguladora de Servicios Públicos, Costa Rica, "Precios Vigentes de los Combustibles," *La Gaceta* no. 137, http://www.aresep.go.cr/docs/PAGINA%20WEB%20COMBUSTIBLES.xls; Erica Zell et al., "Clean Fuels and Vehicles Recommendations for Central America and the Dominican Republic," Batelle, November 11, 2009, http://www.unep.org/pcfv/PDF/Fuels-vehclesEng.pdf.
[138] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[139] Ibid.
[140] Ibid.

A MINAET pilot project has introduced Plus 91 gasoline in Guanacaste and Puntarenas with the goal of evaluating the logistics and handling of gasoline blended with ethanol in service stations.[141] MINAET wants to expand this pilot to the entire country. The challenge has come from fuel distributors, who are argue that they need an up to USD 0.05/gallon additional margin to pay for the investment in necessary installations.[142] ARESEP is reviewing the pricing methodology to determine what additional revenue would be justified.[143]

At a May 2010 World Bank seminar, Costa Rica signaled that it is aware of the need for a regional standard for biofuels. It has been using the Reglas Técnicas Centroamericanas (RTCAs) for biodiesel, but it has not made the same progress with respect to ethanol, for which a national standard exists.[144]

3.2.2.2 Energy Efficiency

A number of decrees and guidelines on fuel-sector efficiency have been issued in recent years, including Decree 41, an information campaign on fuel saving, and Decree 33.096, a provision to promote the use of hybrid fuel/electric automobiles.[145] INTECO and DSE are working to formulate at least three standards for efficient vehicles.[146]

MINAET/DIGECA has done some studies, supported by the German Agency for Technical Cooperation (GTZ), on the basis for a strategy to reform transportation in San José that would incorporate bus rapid transport, light rail, improved fuel quality, and sectorization of transport.[147]

3.2.2.3 Institutional Capacity

ARESEP regulates fuels prices, with one division responsible for all energy issues. This is an area where a regional entity could provide a great deal of support, but the Comité de Cooperación de Hidrocarburos de América Central (CCHAC), the SICA agency tasked with covering fuels, has no permanent staff and rotates between the agencies that oversee hydrocarbon-based fuels in each country,[148] making the tracking of fuel supply and pricing trends difficult.

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[141] Refinadora Costarricense de Petróleo, "Plan Piloto de la Gasolina Regular con Etanol en Guanacaste y el Pacífico Central," http://www.recope.go.cr/nuestra_actividad/proyectos/etanol/etanol.htm.
[142] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[143] Interview with Álvaro Barrantes, ARESEP (Costa Rica), May 20, 2010.
[144] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[145] CEPAL energy efficiency outlook, 2010, p. 83.
[146] Ibid., p. 85.
[147] Interview with María Guzmán, MINAET/DIGECA (Costa Rica), May 21, 2010.
[148] Currently, the secretary general is Carlos Aquilino Duarte, Director of Hydrocarbons and Mines, Ministry of Energy of El Salvador.

3.2.3 El Salvador

ALBA Petróleos, a joint venture between two dozen municipalities and PDVSA imports and distributes oil lubricants, special and regular gasoline and diesel.[149] Texaco, Esso, and other multinational companies are also active in the market.

El Salvador's fuel sector is overseen by MINEC, the Ministerio de Medio Ambiente y Recursos Naturales (MARN), and the Vice Minister of Transportation.

The Dirección Nacional de Hidrocarburos (DNH) within the Ministerio de Economía y Finanzas (MEF) has developed a new formula for setting reference prices for fuels but has not announced it, in part due to lack of necessary data.[150] The government is studying how to eliminate the LPG subsidy in the country.[151]

3.2.3.1 Renewable Energy

El Salvador had an ethanol program in the 1980s during the Civil War that was discontinued for political reasons.[152] IDB is supporting a consultancy to prepare a draft biofuels law and to suggest related modifications. The study will also look at the environmental and social risks and is scheduled for completion by July 2010.[153]

3.2.4 Guatemala

Guatemala is one of Central America's two oil-producing countries (the other is Belize). France-based Perenco produces the majority of oil in the country. Due to a lack of domestic oil refining capacity, however, almost all of their production is exported to the United States, and the country must import petroleum products from the United States, Trinidad and Tobago, Ecuador, and Chile.

According to the records of the Dirección General de Hidrocarburos (DGH), the country has 1,256 gas stations, of which 62.5% are independent and the rest belong to companies that import and distribute fuels.[154] There is only one gas station that sells LPG for vehicles; LPG is also sold at the main distribution centers. The DGH sets fuel standards.

3.2.4.1 Renewable Energy

In December 2007, the Guatemalan Ministry of Agriculture, Livestock and Foods and the Colombian Ministry of Agriculture and Rural Development signed a Memorandum of Understanding (MoU) for Biofuels Technical Cooperation. The MoU covers: (1) training in the area of biofuels; (2) organization of scientific and technological symposiums, conferences, and

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[149] "Alba Petróleos de El Salvador Busca Duplicar Su Cuota de Mercado," *Noticias de Guatemala*, January 5, 2010, http://noticias.com.gt/internacionales/20100105-alba-petroleos-de-el-salvador-busca-duplicar-su-cuota-de-mercado.html.
[150] Interview with Aquilino Duarte, Director for Hydrocarbons and Mining, MINEC (El Salvador), May 28, 2010.
[151] Ibid.
[152] Ibid.
[153] Interview with Luis Reyes, Executive Secretary, CNE (El Salvador), May 18, 2010.
[154] U. Gamarro, "Ampliarán Red De Estaciones," *Prensa Libre* (Guatemala), July 4, 2010, http://www.prensalibre.com/economia/Ampliaran-red-estaciones_0_239376069.html.

workshops focusing on the subject; and (3) value-added processes, transport, and marketing of biofuels.

Guatemala has been investing in biodiesel production in addition to the four ethanol plants that are already in production. The country's first biodiesel plant is expected to open in 2010. Most of this production is expected to be used domestically, as a substitute for the more than 600 million gallons of diesel consumed annually in Guatemala.[155]

3.2.5 Honduras

In 2006, in response to the increase in oil prices, the Manuel Zelaya administration introduced a controversial international bidding mechanism under which annual oil import licenses are to be awarded to the international supplier submitting the most competitive offer.[156] Honduras imports refined products primarily from the United States, Caribbean, and Venezuela.[157]

The Comisión Administradora del Petróleo (CAP) is the main government agency responsible for the fuel sector. It is overseen by SERNA, the Secretaria de Finanzas (SF), and the Secretaria de Industria y Comercio (SIC). The CAP is in charge of the automatic pricing system for imported fuels, import-export and consumption data collection, and domestic and international fuel prices and market monitoring. It regulates the price of regular and premium gasoline, diesel, and LPG.[158] The prices for fuel oil, jet fuel, and fuel used by irrigation planes have been liberalized.

3.2.5.1 Renewable Energy

In February 2006, the Zelaya administration decided to promote the cultivation of up to 200,000 hectares of African palm, with the objectives of producing more than 200 million gallons of biodiesel, creating 300,000 jobs (100,000 directly plus 200,000 indirectly), improving air quality, reducing dependence from imported fuels and saving USD 370 million while promoting economic growth.[159]

Honduras has established a policy on biofuels, which has resulted in Technical Biodiesel Regulations, Technical Regulations for Anhydrous Ethanol Fuel, and proposed Technical Regulations for Hydrated Ethanol Fuel. In addition, a Biofuels Act has been passed, and the related Decree No. 144-2007 (Biofuels Production and Consumption Act) has been issued.[160]

SIC is charged with the application of the law, which aims to establish a coherent legal framework for the production and use of biofuels, defined as products used for energy purposes and obtained from animal and plant raw materials, as well as from agro-industrial product or organic waste processing. The act established a Unidad Técnica de Biocombustibles that will

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[155] REEEP, "Policy DB Details: Guatemala (2009)."
[156] Econergy, "Clean Air Program for Tegucigalpa – Program for Converting City Buses to Biodiesel and Taxis to LP Gas," July 2007.
[157] Zell, "Clean Fuels and Vehicles Recommendations for Central America and the Dominican Republic."
[158] "Factura Petrolera Superará los $1,250 Millones en 2010," *La Tribuna* (Honduras), http://www.latribuna.hn/web2.0/?p=148531.
[159] "Programa Nacional de Biocombustibles," http://www.biocombustibles.hn/.
[160] Zell, "Clean Fuels and Vehicles Recommendations for Central America and the Dominican Republic."

propose relevant policies, and standards.[161] It also provides incentives for investors, including exemption from income tax and import tariffs during the first 12 years.

3.2.6 Nicaragua

ALBANISA, which imports Venezuelan fuel, is rapidly becoming the dominant player in fuel as well as many other sectors in Nicaragua. It has ties to President Daniel Ortega and his family and is being used to funnel resources and investment into a number of areas, such as construction, power, security equipment, hotels, distribution of natural gas, port management, and other business. It invests in these areas by using profits from petroleum and refined products sales, as the petroleum is provided to ALBANISA on favorable commercial terms (25% payable in cash, 25% repayable in five years, and 50% repayable in 40 years).[162] Nicaragua and Venezuela have also restarted discussions on building a refinery in Nicaragua that would function as a binational company.[163]

INE, in conjunction with MARENA, oversees the fuel sector.

3.2.6.1 Renewable Energy

Nicaragua is conducting a study on biofuels, with particular focus on the social issues associated with such activities, including rehabilitating deforested lands. The study is intended to support the preparation of a draft biofuels law and the establishment of a national standards committee.[164]

3.2.6.2 Energy Efficiency

One action undertaken recently is the prohibition of imports of used vehicles, as part of a strategy to reduce the age and improve technological level of the of the vehicle fleet.[165]

3.2.7 Panama

All fuels are imported, mainly from Argentina, Chile, Colombia, Curacao, the United States, and Venezuela. There are promising developments in petroleum exploration activities in the east, with likelihood of resources shared with Colombia.[166]

Panama designates the maximum prices permitted for retail sale; a new parity formula will be announced in 2010.[167] The agency responsible for fuels regulation and oversight is the Dirección de Hidrocarburos within the SNE. MICI and ANAM also have oversight roles in the sector.

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[161] Secretaría de Industria y Comercio, Honduras, "Decreto No. 144-2007," December 28, 2007, http://www.sic.gob.hn/transparencia/documentos/Leyes/Ley_de_%20biocombustibles.pdf.
[162] Interview with Mario Lezama, ENEL (Nicaragua), May 26, 2010.
[163] "Nicaragua y Venezuela Acuerdan Aumentar Cooperación Bilateral," Agence France Presse, April 15, 2010, http://www.univision.com/contentroot/wirefeeds/world/8188264.shtml.
[164] Fernando Campo, Biofuels Advisor, MEM (Nicaragua), remarks at the WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26, 2010.
[165] Interview with Suyén Pérez, CCU/MARENA (Nicaragua), May 27, 2010.
[166] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24.
[167] Interview with Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24, 2010.

3.2.7.1 Renewable Energy

Panama has an ethanol standard and is working on one for biodiesel.[168] It is also working on a biofuels law, with a draft expected in August 2010.[169] The allowance of fuel blends containing 5% or less of biofuels is under consideration.[170] Production levels of ethanol are sufficient to reach 10% blend, though in the initial phase imports will be required.[171]

3.2.7.2 Energy Efficiency

The Panama City metro (apparently a Transmilenio-type Bus Rapid Transit (BRT) system) is expected to result in reduced fuel consumption and increased energy efficiency in the transportation sector.[172]

3.2.7.3 Institutional Capacity

SNE has limited capacity but is ahead of other countries in the region.

3.3 REGIONAL POWER SECTOR FRAMEWORK

The Central American countries decided to integrate their electrical systems with the intention of making better use of energy resources and infrastructure. Beginning in 1985, they created regional bodies such as CEAC to promote cooperation, infrastructure construction, energy exchanges, and joint planning. The first interconnections date back to 1976, with the Honduras-Nicaragua link, which was followed by Nicaragua-Costa Rica in 1982, Costa Rica-Panama and Guatemala-El Salvador in 1986, and El Salvador-Honduras in 2002.

Efforts to create a Central American electricity market have advanced significantly. The MER was established following the entry into force of the Framework Treaty on the Electricity Market of Central America in January 1999. It is comprised of the system operators from each of the participating markets; the MER is the seventh market "superimposed" over the existing six markets. While the MER is technically functioning, actual exchanges have been impeded by fuel prices, transmission restrictions, regulatory incompatibility, and lack of generation capacity.[173]

The Comisión Regional de Interconexión Eléctrica (CRIE) will serve as regulator for the new regional wholesale market, and its board will be formed by one representative from each country. The Ente Operador Regional (EOR) will act as the system's operator and administrator of regional power transactions, and its board will include two members from each country. CRIE approved the Reglamento Transitorio del Mercado Eléctrico Regional (RTMER),[174] which defines rules and criteria for commercial and technical operation, in September 2002, and the

[168] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24, 2010.
[169] Interview with Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24, 2010.
[170] Zell, "Clean Fuels and Vehicles Recommendations for Central America and the Dominican Republic."
[171] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24, 2010.
[172] Ibid.
[173] Jeremy Martin, "Central America Electric Integration and the SIEPAC Project: From a Fragmented Market Toward a New Reality," Center for Hemispheric Policy, May 6, 2010, p. 8, https://www6.miami.edu/hemispheric-policy/Martin_Central_America_Electric_Int.pdf.
[174] Comisión Regional de Interconexión Eléctrica (CRIE), "Reglamento Transitorio del Mercado Eléctrico Regional (MER)," Resolution CRIE 1-2002, http://www.crie.org.gt/files/rtmer.pdf.

Reglamento del Mercado Eléctrico Regional (RMER),[175] in December 2005; the final version will take effect when SIEPAC is electrified. The Second Protocol, ratified by five countries but still awaiting action from Costa Rica, will strengthen the application of RMER by defining a sanction and penalty regime for noncompliance and clarifying procedures for conflict resolution. In addition, and importantly from an institutional point of view, the Second Protocol provides for the creation of the Consejo Director del Mercado Eléctrico Regional ("the Consejo Director"), which will comprise "representatives of each State, named by the Executive Power, who have authority in the formulation of policy on electric [sector] integration in their countries" and will coordinate the activities of the regional power sector agencies created in the Framework Treaty as well as facilitate the implementation of the MER.[176]

The Framework Treaty also permitted the establishment of a company responsible for a single transmission line stretching from Guatemala to Panama. SIEPAC, which will be 1,800 km long when fully completed, uses 230 kV transmission lines to connect 37 million consumers. The countries of Central America have the following respective segments of the SIEPAC project: Guatemala: 282 km; El Salvador: 287 km; Honduras: 270 km; Nicaragua: 309 km; Costa Rica: 489 km; and Panama: 151 km.

Phase I of the the SIEPAC line is now 60% complete and will be 100% complete and operational by the end of 2011. The second circuit will be completed in 2015 or 2016.[177] The system's capacity will be approximately 300 MW, or about 3% of the region's total installed capacity, with the possibility of doubling this capacity with a second circuit. The line is property of the Empresa Propietaria de la Red (EPR), whose shareholders include the six governments, the Spanish electricity company ENDESA, the interconnection company ISA of Colombia, and the Mexican electricity company CFE.

Current cost estimates for the project are around USD 495 million. Of that amount, the IDB is providing USD 240 million in loans to the six nations comprising the project, while the Central American Bank for Economic Integration (CABEI) is providing USD 100 million and the Corporación Andina de Fomento (CAF) an additional amount. In addition, the Spanish government has provided USD 70 million for the project to be administered through its Trust Fund at the IDB.[178]

Gaps remain with respect to the integration of laws, procedures, and guarantees for the development of regional electricity stations. Without norms and laws that provide for integration and additional capacity, all of the benefits of SIEPAC will not be realized.

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[175] CRIE, "Reglamento del Mercado Eléctrico Regional (MER)," Resolution CRIE 09-2005, http://www.crie.org.gt/files/rmer.pdf.
[176] "Segundo Protocolo al Tratado Marco del Mercado Eléctrico de América Central," http://www.ceaconline.org/pdf/Marco_Legal/II%20PROTOCOLO%20AL%20TRATADO%20MEAC.pdf.
[177] Interview with José Enrique Martínez, General Manager, EPR-SIEPAC (Costa Rica), May 20, 2010.
[178] Inter-American Development Bank (IDB), "IDB Approves $240 Million Financing Plan for Central American Electric Interconnection System," November 28, 2001, http://grupobid.org/news/detail.cfm?language=English&id=959.

Among the issues that must be resolved are:[179]

- Reciprocity among market-based electricity sectors (Guatemala, Nicaragua, and Panama) and integrated sectors (Costa Rica and Honduras)
- Norms for prioritizing domestic demand in the case of generation deficits (Honduras and Panama)
- Prices controls and generalized subsidies (El Salvador and Nicaragua)
- Long-term transmission rights
- Harmonization of national and regional norms
- CRIE's operational capacity
- Resources for infrastructure investments such as transmission improvements and regional generation projects

The period 2010–2011 is the "moment of truth" for the notion of regional energy integration. A regional plant is needed, and the project needs to be large enough to cover needs in various countries.[180] Yet, considerable resistance remains to local costs associated with projects, especially hydropower projects that require some displacement of populations that have benefits accruing at the regional level.[181] Moreover, the authority of governments to restrict power flows is a problem, and the solution will lie in how the contracts are worded and guarantees are provided. The UI is handling contract design issues.[182] Regional plants will have to have a PPA in place and the approval of the regulators in each country and the system operator.

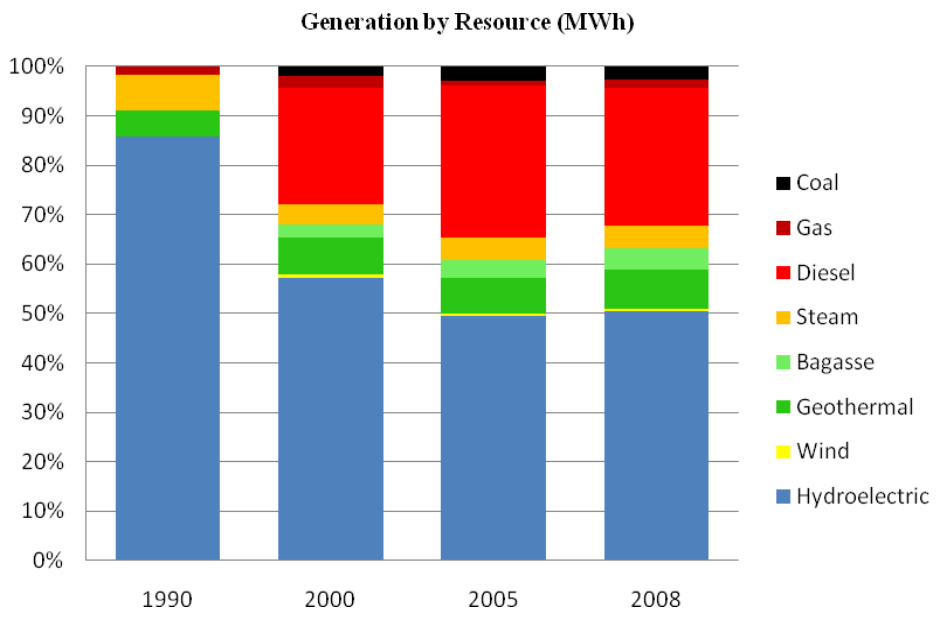
The broader challenge for SIEPAC, and regional energy integration more generally, is to ensure that the policymaker who participates in regional fora on energy integration issues is also the person who makes decisions at the national level in order to streamline decision-making at the regional level and reduce the potential for bottlenecks at the national level.[183] CRIE has responsibility for facilitating the adaptation of national regimes to the regional regulatory framework. It is not clear whether the consultants who have been contracted will identify necessary tasks or have doing them included in their scope of work.[184]

[179] ESMAP study, 2010, pp. 118–119.
[180] Interview with Claudio Artavia, Executive Secretary, CEAC, May 19, 2010.
[181] Ibid.
[182] Interview with José Enrique Martínez, General Manager, EPR-SIEPAC (Costa Rica), May 20, 2010.
[183] Interview with Salvador Rivas, Regional Coordinator, AEA (El Salvador), May 28, 2010.
[184] Interview with Álvaro Barrantes, ARESEP (Costa Rica), May 20, 2010.

This section reviews the experience with renewable energy resources, energy efficiency, biofuels, sustainable transportation and rural electrification programs in Central America and argues that some progress has been made toward achieving the goals set forth in the Strategy 2020. In some cases, the progress has been considerable. In other cases, the slow pace of progress, despite the considerable resources and effort that have been invested, reflects the significance of the barriers and obstacles that exist.

4.1 EXPERIENCE TO DATE WITH RENEWABLE ENERGY RESOURCES

Although a considerable amount of renewable energy generation capacity has come online in Central America in the last two decades, these additions have been dwarfed by the expansion of non-renewable generation capacity, primarily diesel-cycle facilities powered with fuel oil or diesel oil, and the rapid growth in fossil-fired generation as a share of total output. In recent years, however, it appears that the tide has begun to turn, with renewable generation making a small comeback; more coherent policymaking, project development support, and additional sources of financing will be required to expand on these incipient gains.



During the 18-year period beginning in 1990, non-conventional renewable capacity increased by a factor of six, compared to fossil resources, which nearly quadrupled, and hydropower capacity, which increased by just 57%. This growth in non-conventional renewable capacity is notable, even if the pace of growth reflects the very small amount in place at that beginning of the period. Nevertheless, the share of conventional and non-conventional renewable generation capacity decreased to 54%, down from 70% in 1990. When the change is viewed from the perspective of total generation, the scale of the shift toward fossil-fired generation is even more pronounced: whereas in 1990 fossil-fired generation accounted for just 9% of total output, in 2008 it represented 37%. The accompanying graph illustrates the evolution of the region's generation mix resource from 1990 to 2008; this graph is based on data found in Section 1 of the Statistical Annex.

Of course, it is more appropriate to evaluate the diversification of the region's generation resource mix using 2005 as a reference point. Leaving aside the pioneering efforts of Costa Rica in the 1990s, the region's push to foster more renewable energy began in 2004, when the Matriz de Acciones (which sets out steps to achieve the region's energy goals) was first prepared, and gathered momentum with the preparation of the Estrategia Energética Sustentable Centroamericana 2020 (Strategy 2020), which was approved at the Presidential Summit in December 2007. During 2005–2008, some progress was made toward reducing reliance on fossil-based generation: fossil generation decreased from 39% of total output in 2005 to 37% in 2008. Preliminary data for 2009 suggest that the figure moved back up to 39%.[185]

The distribution of the region's hydropower and non-conventional renewable resources has been uneven, but there are also indications that this distribution is shifting in countries where fossil-fired generation has been most prevalent. As illustrated in Section 1 of the Annex, Costa Rica is in a category of its own, with the largest share (on the order of 73%) of installed capacity coming from hydroelectric and non-conventional renewable resources. El Salvador, Guatemala, and Panama form a second category, with 50–55% of installed capacity based on hydropower and other renewable resources. Finally, the systems of Belize, Honduras, and Nicaragua have 35–40% provided by hydropower and other renewables. Belize poses a special case, as it relies on imports from Mexico for a very large portion of its electricity supply. Given its heavy reliance on thermal generation in Mexico (75% of installed capacity is fossil fired[186]), Belize's grid has been indirectly based on about 60% thermal generation capacity until recently.

Developments from 2008 to the present, as well as projects expected to reach completion in the next year or two, provide examples of new generation capacity based on non-conventional and hydroelectric resources, thereby supporting (albeit more anecdotally) the view that the long-term trend toward heavier reliance on fossil generation resources has slowed and begun to reverse itself, even if to a very limited degree so far.

Recent reviews of the national and regional long-term expansion plans (detailed in Sections 1 and 2 of the Statistical Annex), which are based on more systematic assessments of near term and longer-term options, also suggest that the share of fossil-fired resources in new capacity additions will decrease relative to previous periods. Based on the data presented in the 2010 World Bank Energy Sector Management Assistance Program (ESMAP) survey, some 10,800 MW in additions to generation capacity are projected through 2022, nearly half of which (49%) would be hydroelectric facilities, followed by 37% provided by thermal generation facilities. In general, these figures compare favorably with previous periods. Conventional thermal (fossil) resources accounted for 65% of new capacity during the period from 1990 to 2000 and 48% of additions in the following eight years. However, the sector denominated as "other renewable" in the consolidated expansion plans accounts for about 12% of anticipated additions, down from the 20% observed between 2000 and 2008. This suggests that new hydropower resources are expected to provide a dramatically more important part of capacity growth in the next decade and possibly that the potential growth in non-conventional renewable resources is being underestimated.

[185] CEPAL, "Istmo Centroamericano: Estadísticas del Subsector Eléctrico," April 30, 2010, http://www.iadb.org/intal/intalcdi/PE/2009/03351.pdf.
[186] Valle, "Energías Renovables en México."

The presentation in the ESMAP report coincides with those scenarios presented in CEAC's 2009 regional expansion plan that call for relatively unfettered development of hydropower and/or non-conventional renewable energy resources[187] as well as CEPAL's relatively optimistic assessment of progress.[188] All of these scenarios share the expectation that a considerable amount of hydroelectric development will take place in addition to development of non-conventional renewable generation. The list of potential hydropower projects drawn from regional expansion plans in the ESMAP study includes a large amount of projected capacity from a relatively small number of large-scale projects (66% from facilities larger than 150 MW); this increases the vulnerability of the expansion plan to development and construction delays due to local opposition to the projects. As noted in the following section, such opposition has already been a major issue in virtually every country in the region.

While the amount of hydroelectric and non-conventional renewable resources anticipated in the expansion plans is considerable and larger than the amounts added in previous decades, it obviously represents a small part of the estimated potential that could be developed based on the region's renewable energy resources. Clearly, any estimate of the potential resource must consider a range of barriers to development. A more realistic assessment of the potential is obtained after adjusting the theoretical potential downward (1) to reflect the fact that some projects simply cannot be built due to technical and economic limitations, and (2) to account for the Exclusion Factor (EF), which represents the fraction of the total theoretical resource that cannot be developed due to environmental or social considerations. As reported in CEPAL's recent survey,[189] Central America boasts a developable potential of at least 22,000 MW, based on the following assessments:

- *Hydropower* is the most abundant resource, but also the one for which the EF is likely to be the highest; the developable potential is estimated at 18,200 MW, more than four times the current installed capacity. In the region, Costa Rica, El Salvador, and Panama have developed a larger fraction of their respective developable resources (25–50%), while Guatemala, Honduras, and especially Nicaragua have developed little more than 5–15% of the developable potential. CEAC's plan contemplates development of 2,000 to 5,500 MW.

- *Geothermal* is an important resource in the region, but it has a relatively high EF in certain countries, notably Costa Rica. Its developable potential is on the order of 2,500 MW, with Costa Rica and El Salvador furthest along in developing their available potential. Nicaragua and Guatemala offer the greatest untapped potential, while Honduras and Panama have no installed geothermal capacity and limited resource potential compared to their neighbors. CEAC'S 2009 expansion plan contemplates development of 400 to 1,000 MW.

- *Wind and solar* offer considerable theoretical potential, but data on wind are still comparatively limited outside of Costa Rica, so it is difficult to assess the potential throughout the region. However, one SWERA survey estimated that an on-shore area of almost 13,000 km^2 in the region offered good or excellent wind resources. This is an

[187] CEAC, "Plan Indicativo Regional de Expansión de la Generación, Período 2009-2023," May 2009, p. 71, http://www.ceaconline.org/pdf/Doc_Relevantes/PLAN_INDICATIVO_REGIONAL.pdf.
[188] CEPAL renewables report, 2009, pp. 70–71.
[189] CEPAL renewables report, 2009, pp. 26–29.

enormous resource but does not consider the impact of technical and economic limitations or environmental and social considerations. Assessments of the region's solar resources are also still preliminary, and in any case, the economic limitations will likewise be considerable. CEAC's plan contemplates development of wind but does not provide a discrete figure; instead, wind and hydropower development are grouped together. While it is difficult to assign an estimated capacity number based on the available data, because actual capacities will depend on specific characteristics of sites included in the 13,000 km^2, it does not seem unreasonable to assume that a minimum amount in the range of 500 to 1,000 MW could be developed in the years ahead, compared to existing capacity (as of early 2010) on the order of 180 MW.

- *Biomass* likewise offers considerable potential, especially cogeneration schemes implemented at agribusinesses. As noted earlier, the addition of 685 MW of biomass generation and cogeneration capacity to the regional grid over the last two decades represents about 63% of the overall additions of non-conventional renewable generation in the region, a considerable share. The existing capacity and output are based on cogeneration facilities at 23 sugar mills throughout the region; another 27 mills in the region reportedly have the capacity to deliver a roughly equivalent amount of capacity and generation in the future.

4.2 CHALLENGES AND PROSPECTS FOR RENEWABLE ENERGY DEVELOPMENT

While Central America offers considerable commercially exploitable renewable energy resources, notably wind, geothermal, solar and biomass, in addition to hydropower resources, there have been numerous obstacles to achieving rapid expansion in generation capacity, some of which have been addressed recently. While these obstacles are no different from the challenges facing renewable energy project development in other parts of the globe, it is important to identify how these challenges have manifested themselves in the region. The following section discusses some examples from the region and identifies how they are being addressed; the examples are organized by country.

4.2.1 Regional

Several factors that impede the development of renewable energy projects apply to the region as a whole. These include:

- *Small market size*. The limited size of the national power sectors of the seven countries is an important constraint. While clearly this is true in numerous sectors throughout the region and not just in renewable energy, this problem does tend to accentuate the challenges facing renewable energy projects on the basis of their cost relative to other generation technologies. The challenge of small market size is also well understood, and increasing the size of the regional market is an important element of the rationale behind SIEPAC.

- *Resource constraints and lack of consistent public-sector support for project preparation*. The availability of resources to support early-stage development of renewable energy projects, which typically require considerable preliminary resource assessments and feasibility studies, has been a constraint everywhere, and Central America is no exception.

- *Public opposition to large-scale hydropower development*. Major hydropower developments involve considerable local environmental and social impacts, including displacement of populations due to the creation of reservoirs. Communities have been justifiably concerned that the economic impacts (primarily agricultural) associated with the loss of community lands will not (or cannot) be offset by the economic benefits of the project, which tend to be more dispersed. Environmental advocates point to habitat damage and loss (potentially affecting terrestrial, avian, and fish populations as well as local flora), erosion, water quality alterations, and loss of recreational and scenic benefits. Cultural, religious, or historical artifacts and sites may also be damaged or lost. Other types of generation facilities, such as wind farms, thermal generation power plants, and biomass-fired generation facilities also have environmental impacts, but these tend to be more localized and generally easier to manage.

- *Lack of information on project opportunities*. The amount and quality of information available about renewable energy resources in the region is extremely uneven, both across the region geographically as well as from sector to sector. For instance, detailed wind resource assessments were performed at the national level in Costa Rica more than a decade ago, while similar efforts are only just beginning now in El Salvador. To the extent that local utilities have conducted assessments over the last 10–15 years, this information has not necessarily been made available to support project development activities. Indeed, the restructuring processes undertaken in several markets altered the perceived interests of major actors, limiting their willingness to share information about potential projects.[190]

- *Political change*. Given that seven democratic nations are located within a relatively small geographic area such as Central America, it is inevitable that one or more should be undergoing political transition at any given time. At the present time, three countries— Costa Rica, El Salvador, and Honduras—have had a change of administration or other political change in the roughly the last year. Moreover, policymakers in each country are still grappling with the challenges of formulating coherent and effective policies to foster increased use of renewable energy resources, leading to change in policies specific to the renewable energy sector. Investors are less likely to commit capital to new projects in an environment in which policy is evolving rapidly or is simply unclear.

- *Lack of economic incentives*. One characteristic of policymaking on renewable energy in the region to date is that governments have shied away from establishing significant economic incentives for the production of electricity from renewable resources.[191] The measures adopted have tended to feature fiscal incentives such as tax and import-duty exemptions, as opposed to the feed-in tariff arrangements favored in many European countries or the portfolio standards typically adopted in the United States, and these incentives have been insufficient.

- *Lack of recognition of capacity from intermittent resources*. A related consideration is the lack of recognition of capacity from intermittent resources, such as wind. Typically,

[190] ESMAP report, 2010, p. 15.
[191] Interview with Cristhian Escobar, Executive Director, Asociación de Generadores con Energía Renovable (Guatemala), May 28, 2010.

conventional power sector infrastructure projects are compensated for the energy that they deliver to the grid as well as the firm capacity they provide. In the case of wind, and to a lesser degree solar generation, the intermittence of the resource diminishes the firm capacity that such facilities provide to the system, to a considerable degree in the case of wind and to a lesser degree with solar. Most regulatory and market arrangements in Central America preclude the allocation of a capacity credit to wind facilities. When taken together with the failure to offer a preferential price for energy from renewable energy resources, this poses a considerable financial obstacle to projects involving these resources.[192]

- *Financing challenges*. Access to financing is a perennial challenge for renewable energy projects everywhere, and Central America is no exception. In the period since the onset of the global financial crisis in 2008, the financial challenges have worsened. CABEI has observed a sharp drop in project development activity and a corresponding decrease in loan approvals. According to CABEI officer Waldo Moncada, loan approvals for energy infrastructure projects in 2009 were 25% of the level recorded just two years before: the bank issued a total of USD 800 million in loans in 2007, then half that amount in 2008, and half again in 2009.[193] According to Moncada and other observers, access to capital has been a significantly greater obstacle for developers since 2008, compounding the challenges traditionally observed in the sector. Moncada observed that CABEI found that loan applications for smaller renewable energy projects "always are missing something needed to reach closure," including equity or permits, and frequently the projects simply are not well developed enough.[194]

4.2.2 Costa Rica

Costa Rica is unquestionably the leading country in the region in terms of its utilization of hydropower and non-conventional renewable energy resources, and over the last two decades it has managed to maintain a relatively high level of reliance on renewable generation, in contrast to the rest of the region. Ironically, certain national policies impose significant constraints on the development of new renewable energy resources, even as the recently inaugurated administration of President Chinchilla has increased the pressure on the state power and telecommunications utility, ICE, to expand its utilization of these resources. These include:

- *Environmental permitting constraints*. Permitting for new hydropower and geothermal projects, in particular, is complicated by environmental protections that are comparatively stringent in the region. In the case of geothermal energy, the challenge is that geothermal resources are typically easiest to access from sites on the slopes of volcanoes. In Costa Rica, the areas encompassing the slopes have long been designated as national parks, and therefore it is extremely difficult to secure permits for drilling and construction of facilities to extract thermal energy and generate power and the transmission lines to evacuate the power. Public support for protecting the parks is strong.[195] Though clearly not prohibitive, environmental protections have also tended to complicate the development of hydropower projects, particularly larger facilities with storage.

[192] Ibid.
[193] Interview with Waldo Moncada, CABEI (Honduras), May 21 and August 3, 2010.
[194] Ibid.
[195] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.

- *ICE's strength allows it to slow project development*. Costa Rica is one of two countries in the region that have not implemented power-sector restructuring legislation (although, as noted, the Chinchilla administration has indicated that it will present a reform package to the legislature this year). ICE remains a vertically integrated utility controlling 75% of installed capacity and conducts long-term system planning for the country. As a result, ICE has controlled the pace at which non-conventional renewable energy, especially wind, is introduced in Costa Rica. Hydropower resources have been added by ICE as well as smaller electric cooperatives, which own and operate distribution and generation assets. Although Costa Rica was the first country in the region and one of the first developing nations in the world to introduce wind power, it has adopted an extremely conservative stance regarding the overall penetration of wind generation in the grid.[196] While it is not a formally articulated policy, ICE officials familiar with the country's planning process confirm that concerns about the operational impact of larger amounts of wind capacity have led to the establishment of an informal target of approximately 5% of generation.[197] The experience of countries that have expanded wind generation aggressively suggests that this level is relatively conservative.

- *Legal hurdles and complicated project structuring arrangements*. The provisions of Costa Rica's legal and regulatory framework governing private investment are complicated and tend to slow project development activities.[198] From the investor perspective, restrictions on ownership of project assets and project structures slow down development activity, limit investment opportunities to competitively tendered investment opportunities that may not attract some players and may complicate the arrangement of financing. In the case of the country's fleet of wind facilities, projects have been implemented in accordance with two different investment arrangements and multiple tariff arrangements. The prospect of further modifications in the calculation of sales prices for wind power has caused some investors to express concern about the long-term viability of their projects.[199] Still, although the provisions are restrictive, ICE's institutional strength and the government's creativity in establishing frameworks for investment have resulted in the successful implementation of several major hydropower and non-conventional renewable projects.[200]

  Even ICE, its central role in the Costa Rican electric sector notwithstanding, has encountered problems securing government approval for major projects. For instance, the 200 MW Garabito medium-speed diesel facility, which begins operations this year, was initially planned more than five years ago. The government rejected ICE's initial financial structure, delaying the project considerably; the project moved forward after the two sides reached agreement on a contingency plan including a wide range of actions and was eventually financed on a project finance basis with a lease contract with ICE.[201] The contingency plan spurred some progress in the area of energy efficiency and renewable generation. In order to move forward with Garabito, ICE committed to move the first phase of the PEG wind farm

[196] Interview with Jorge Dengo G., Country Manager, GDF-Suez Central America (Costa Rica), May 21, 2010.
[197] Interview with Claudio Artavia, Executive Secretary, Central American Electrification Council (CEAC), May 19, 2010; interview with Javier Orozco, Director, Integrated Expansion Planning, ICE (Costa Rica), May 19, 2010.
[198] Interview with Jorge Dengo G., Country Manager, GDF-Suez Central America (Costa Rica), May 21, 2010.
[199] Ibid.
[200] ESMAP report, 2010, p. 112.
[201] Ibid., p. 81.

to early 2009 and launch a more widespread publicity campaign for energy efficiency, among other actions.[202]

- *Financial sustainability*. In 2007–2008, ICE's financial sustainability was compromised by the combination of relatively low generation tariffs for ICE's sales to the distribution companies and higher-than-average fuel prices.[203] ICE and ARESEP, the regulatory body overseeing the electric sector, were embroiled in bitter dispute over the latter's refusal to allow for the pass-through of real costs (a realistic return on assets and timely pass-through of fuel costs) to the end user. This situation reached crisis levels in early 2008, when ARESEP requested that ICE secure debt financing for a significant percentage of the 30% increase in generation costs to mitigate their impact on electricity tariffs.[204] The financial constraints on ICE have slowed development of new capacity, undermining long-term planning and forcing ICE to implement contingency plans. For similar reasons, the electric cooperatives also have experienced financial difficulties in recent years that have slowed development activities.

4.2.3 Guatemala

Guatemala has enjoyed sufficient electricity supplies since 2000 and has been the region's major electricity exporter. As in the rest of the region (except for Costa Rica), Guatemala saw a sharp decline in the share of renewable generation during the 1990s and 2000s. With respect to renewable energy development, there have been some important obstacles, including:

- *Community opposition to hydropower projects*. As elsewhere in the region, large-scale hydropower projects have encountered considerable local opposition. A recent example is the 181 MW Xalalá hydropower facility, which was overwhelmingly opposed by local communities in a community referendum held in 2007.[205] Six international firms were prequalified to bid on the build-operate-transfer contract with INDE, but none presented a proposal in the international tender held in late 2008.[206] While the financial crisis would inevitably have had a negative impact on the bidders' financial calculations, it has also been suggested that the bidders found the social and political risks associated with the project to be too high.[207]

- *Competitive pressures*. In the Guatemalan market, the electricity products sold on the wholesale market (*mercado mayorista*) are energy and capacity. Intermittent resources such as wind would not receive a capacity payment under the current system, while energy is priced at short-run marginal cost. Hence, in the absence of any specific pricing arrangements for wind power, wind cannot compete economically with other resources. There is also evidence that generators in the country with conventional facilities are lobbying to open

[202] Ibid., pp. 81–82.
[203] Ibid., p. 157.
[204] Ibid., p. 69.
[205] See "Financial Crisis Stops Xalalá Dam – For Now," International Rivers, November 26, 2008, http://www.internationalrivers.org/node/3538.
[206] ESMAP report, 2010, p. 111.
[207] Interview with Juan Miguel Cayo, World Bank (Washington, DC), July 16, 2010.

future tenders, such as one that has been announced for the purchase of 700 MW of renewable energy generation, to the participation of conventional technologies.[208]

- *Inadequate planning and support for geothermal energy and legal hurdles*. Like the rest of the region, Guatemala has considerable geothermal potential. However, this resource has been underutilized in the country because of a combination of legal and administrative problems that compound the intrinsic financial challenges associated with development geothermal resources. Indigenous communities are typically found in areas where geothermal resources are located, and such communities often lack legal documentation to prove title to the land. Moreover, under the Constitution, the state owns resources located beneath the surface; this slows the pace of development because INDE must take the lead in securing land in resource-rich areas.[209]

- *Environmental compliance*. Licensing for geothermal projects, in particular, has been complicated by environmental permitting requirements.[210]

4.2.4 Panama

The share of hydropower and non-conventional renewable generation in Panama's total output has remained at relatively high levels, comparable to El Salvador and Guatemala, due exclusively to the country's significant hydropower capacity. Panama does not yet have non-conventional renewable generation in place, due to some structural biases that have favored fossil generation. However, Panama's ability to continue to expand its hydropower capacity may face greater opposition in the future due to:

- *Community opposition to hydropower projects*. As elsewhere in the region, large-scale hydropower projects have encountered considerable local opposition. There has been considerable opposition to the concentration of hydropower development occurring in the province of Chiriquí in western Panama, where 17 projects (all of which are relatively small run-of-river facilities) are under construction in four watersheds. Opponents of the projects include indigenous communities from the region, which staged a protest in Panama City recently and have been involved in filing a protest before an international human rights tribunal.[211] The significance of this issue was underscored by the remarks made by Minister of Energy Juan Urriola at the May 2010 ministerial meeting on energy in Panama; he argued that local communities needed to become "development partners" through the implementation of community partnership agreements.[212]

- *Competitive pressures*. The spot market in Panama prices transactions involving energy based on variable cost or short-run marginal cost, with the value for hydropower dependent

[208] ESMAP report, 2010, pp. 134–135; interview with Cristhian Escobar, Executive Director, Asociación de Generadores con Energía Renovable (Guatemala), May 28, 2010.
[209] Interview with Cristhian Escobar, Executive Director, Asociación de Generadores con Energía Renovable (Guatemala), May 28, 2010.
[210] Ibid.
[211] Interview with Rita Spadafora, Economic Growth and Environment Specialist, U.S. Embassy (Panama), May 24, 2010.
[212] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24, 2010.

on values calculated by the Centro Nacional de Despacho.[213] In the absence of special provisions for the purchase of energy from intermittent generation from wind, non-conventional renewable generation would not be able to participate effectively in the marketplace. In the context of the proposed tenders for renewable generation capacity, policymakers at SNE admitted they are still not sure whether a tender can be issued that specifies the generation technology to be used.[214]

- *Transmission limitations*. Panama's transmission network is still relatively weak in terms of capacity to deliver power from the western and eastern extremities of the country toward the center. The wholesale market has pitted hydro versus thermal resources in direct competition, and thermal facilities concentrated in central Panama, where the loads in Panama City and the Canal Zone are located, were given an additional credit because of their contribution to grid stability. Absent extensive investment to reinforce the transmission network as well as economic incentives based on their benefits, renewable energy resources located in the more remote parts of the country will continue to be at a disadvantage.[215]

- *Failure of tendering processes*. During the middle part of the decade (2002–2008), the public tenders issued by the distribution companies for new hydropower generation capacity were not well received. The primary reason for the lack of interest was that the contracts were too short to ensure an adequate return, but other conditions, such as maximum prices, were also not acceptable. In 2008, the bid resulted in ten-year contracts with seven projects totaling 350 MW of capacity.[216]

4.2.5 El Salvador

El Salvador is the leader in the region in terms of geothermal capacity, and it has the highest percentage of installed generation capacity provided by geothermal resources.[217] In terms of the current level of penetration of hydropower and non-conventional renewable generation, El Salvador is comparable to Guatemala and Panama. At the same time, despite a restructuring of the electric sector based on strict adherence to market principles, the country has found it difficult to attract investment to increase installed capacity. From 2001 to 2005, installed capacity in the country did not grow, and increasing demand was met through imports, principally from Guatemala.[218] Among the factors limiting the development of new resources in the country are the following:

- *Competitive pressures*. From its inception in the late 1990s, the regulatory framework in El Salvador was characterized by high volatility in wholesale prices because the segment of the market composed of long-term contracts failed to attenuate spot market volatility. At the same time, wholesale prices were frequently too low for generators to recover fixed costs. In this environment, non-conventional renewable resources with high fixed costs were simply

[213] ESMAP report, 2010, p. 142.
[214] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24, 2010; interview with Fernando Diaz, Director of Electricity and Energy Policy SNE, May 24, 2010.
[215] Interview with Juan Urriola, Minister of Energy, SNE (Panama), May 24, 2010.
[216] ESMAP report, 2010, pp. 110–111.
[217] Interview with José Hernández, Planning Manager, William Martínez, and Edgar de Assis, Ente Operador Regional (El Salvador), May 28, 2010.
[218] ESMAP report, 2010, pp. 83, 173.

unable to compete, given the absence of special arrangements that would ensure demand for a specified quantity or established prices for electricity generated by such resources.[219] Further, procurement regulations have typically prohibited specification of a particular technology. CNE is now considering making this change, but this would require the issuance of an opinion by SIGET.[220]

- *Community opposition to hydropower projects*. El Salvador has two major hydropower projects (66 MW El Chaparral and the 261 MW Cimarrón) under construction and one slated for expansion, 6 Noviembre. Cimarrón faces considerable opposition,[221] to the extent that the project may never be implemented. The project does not appear in the national expansion plan reproduced in the recent ESMAP report, [222] but it does appear in CEAC's plan in the context of the modeling exercise conducted to evaluate nine different development scenarios.[223] El Chaparral, which is under construction, has also been the target of opposition that has contributed to construction delays. It is not surprising that development of large-scale hydropower projects with large volumes of storage should pose a particularly acute challenge in El Salvador, because it is the region's most densely populated country, with 338 inhabitants per km^2, more than twice that of the second-place country, Guatemala.

- *Failure of tendering processes*. Between 2000 and 2007, the country had difficulties securing investment in new generation capacity because the regulatory framework did not require contract terms long enough to attract investors. Since 2007, when a change in regulations required that 50% of demand growth be covered by long-term contracts, it appears that there has been increasing interest. A Guatemalan hydropower project, 30 MW Hidroxacbal, was awarded a 15-year contract in 2008.[224]

4.2.6 Honduras

The decrease in the share of renewable energy generation in the Honduran grid in the last two decades has been the sharpest of any country in the region (renewable energy's share decreased to 36% in 2006 from 100% in 1990), and the current level of renewable energy penetration is second lowest; only Nicaragua is lower. The country's supply-demand balance has typically been extremely tight, and this situation worsened in the first half of the last decade because of delays in securing new supplies, prompting emergency measures, and the introduction of diesel facilities. In recent years, Honduras has relied on imports to meet load growth. The national utility, ENEE, continues to dominate the sector by virtue of remaining a vertically integrated company and serving as the single buyer in the country, but it is in difficult financial condition because tariffs do not reflect full cost.

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[219] Ibid., p. 111.
[220] Interview with Napoleón Alfaro, Head of Wholesale Markets and Carmen Elena Torres, Head of Concessions, SIGET (El Salvador), May 31, 2010.
[221] See, for example, Central American Water Tribunal, verdict of September 1, 2000, available at http://www.tragua.com, in which the Government of El Salvador and the World Bank were urged to cease support for the project. While TRAGUA is an NGO, and not a regional body constituted by the governments of Central America, the pronouncement provides clear evidence of significant opposition to the project.
[222] ESMAP report, 2010, p. 153.
[223] Cimarrón is introduced in the scenario based on less restrictive hydropower development and high petroleum prices (Case G). See CEAC, "Plan Indicativo Regional de Expansión de la Generación," pp. 31, 58.
[224] ESMAP report, 2010, p. 111.

- *Insufficient tariffs*. Low tariffs and ENEE's weak financial condition pose a considerable challenge for financing of any new capacity in the country, particularly give ENEE's role as single buyer.[225] This complicates the completion of financing packages for new generation facilities. Low purchase prices to generators for renewable energy resources have dampened investor interest. For instance, President Elsia Paz of AHPPER recently said that "the [purchase] price does not create an incentive for investment in renewables, [and so] to date no company on small-scale projects has signed a contract with the ENEE, except for a wind plant that signed above short-run marginal cost in 2008 (10.6 cents)."[226]

- *Political instability in last two years*. Honduras has experienced a profound political crisis in the last two years, causing considerable disruption to policymaking and program execution. In specific cases, the diplomatic fallout of the country's political situation has interfered with the country's engagement with international organizations and participation in international meetings. The United Nations Framework Convention on Climate Change (UNFCCC) did not recognize the Honduran delegation to the 15th Conference of Parties at Copenhagen (COP 15), for instance.[227] In addition, Dr. Rigoberto Cuéllar, Secretary for Natural Resources and Environment, reported that he was not allowed to participate in a meeting staged in Madrid in the context of the Europe-Latin America and the Caribbean Summit, held in Madrid in May, because of opposition expressed by certain governments that were opposed to the interim government established in Honduras after the removal of Manuel Zelaya.[228]

- *Community opposition to hydropower projects*. As in other countries in the region, development of large-scale hydropower projects, particularly ones with storage such as the 104 MW Piedras Amarillas (Patuca III), require lengthy environmental and social reviews and have encountered local protests and delays in securing the acceptance of indemnification packages by the local inhabitants. In 2009, Power Company Taiwan, which had been conducting studies of the project, announced that it would not proceed with the investment, apparently because of financial problems. The Taiwanese government, meanwhile, has supported the preparation of engineering studies for the project and has stressed its commitment to supporting the development of the project. Discussions of the project in the press consistently refer to the issue of local opposition.[229]

4.2.7 Nicaragua

Nicaragua, like Honduras, has seen dramatic expansion of fossil-fired generation over the last two decades. Nicaragua's electric sector restructuring in the late 1990s did not usher in major investments in new generation capacity, with new capacity of only 50 MW coming online

[225] Ibid., p. 120.
[226] Cited in interview with Rigoberto Cuéllar, Secretary of Natural Resources and Environment, and Darío Cardona, Undersecretary of Natural Resources and Environment (Honduras), May 20, 2010.
[227] Interview with Mirza Castro, Coordinator, National Climate Change Program, SERNA (Honduras), May 20, 2010.
[228] Phone interview with Dr. Rigoberto Cuéllar, Secretary, SERNA (Honduras), May 20, 2010.
[229] "Cancelado Mega-Proyecto Patuca III," *La Prensa* (Honduras), May 7, 2009, http://www.laprensa.hn/País/Ediciones/2009/05/07/Noticias/Cancelado-el-mega-proyecto-Patuca-III; "Taiwan Entrega Estudios para Construcción de Proyecto Hidroeléctrico Patuca III," *La Vanguardia* (Honduras), May 17, 2010, http://lavanguardia.hn/Lv/content/taiwán-entrega-estudios-para-construcción-de-proyecto-hidroeléctrico-patuca-iii.

between 2000 and 2006.[230] This limited growth in new generation led to difficulties in the mid-2000s, when a combination of drought, limitations on the availability of fossil-fired capacity and limited reserve margins led to blackouts and rationing. Measures imposed in 2005 to freeze residential prices in the event of petroleum prices above US$50/barrel; this eventually led to financial difficulties for the distribution companies. The government of President Daniel Ortega, who assumed power in early 2007, resolved the situation through an emergency program involving demand-side management measures, contracting new thermal capacity under special emergency provisions, and a fuel import deal with Venezuela that allowed for petroleum imports at subsidized prices.[231] Some of the factors that constrained development of new capacity have been addressed, while other considerations remain:

- *Lack of adequate studies and data resources*. Various observers have commented that the government had a difficult time mobilizing investment in new capacity because the data resources and quality of feasibility studies were insufficient to conduct successful tenders.[232]

- *Weakness of national grid*. Nicaragua's national grid exhibits numerous limitations due to delays in implementing upgrades and reinforcements in the system. These limitations have implications for the country's ability to accommodate new generation capacity. For example, the recently completed Amayo II wind farm, located in the Rivas isthmus between Lake Nicaragua and the Pacific Ocean (which made Nicaragua the second country after Costa Rica to have wind generation in Central America), has been evacuating its output to the Costa Rican grid and then wheeling it back into Nicaragua through the other interconnection between the two countries because of the limitations of the Nicaraguan grid in the west of the country.[233]

- *Financial limitations of local companies*. ENEL's ability to undertake expansion of new capacity is constrained by its balance sheet and ability to take on debt. Currently, ENEL is developing or is building three hydropower facilities, Larreynaga, Sirena, and El Barro, totaling 34 MW at a cost of approximately USD 200 million, and it is also embarking on a repowering of existing hydropower facilities. With all of these projects and the corresponding loans on its books, it will have reached the borrowing ceiling imposed by major lenders, such as CABEI.[234] The privately owned distribution companies are recovering financially following the 2005 tariff freezes. The concern about Nicaragua's financial condition extends to the household sector, where officials at ProCredit, a microfinance institution, warn that as a result of the financial crisis, Nicaragua has, like other countries around the world, left behind the era of easy credit, and now many in the sector are concerned that the over-indebtedness of the population will lead to significant problems.[235]

[230] ESMAP report, 2010, p. 92.
[231] Ibid., pp. 92–93; interview with Mario Lezama, ENEL (Nicaragua), May 26, 2010.
[232] ESMAP report, 2010, pp. 112.
[233] Interview with Mario Lezama, ENEL (Nicaragua), May 26, 2010.
[234] Ibid.
[235] Interview with Stefan Queck, former Nicaragua director of ProCredit (Nicaragua), May 26, 2010.

4.2.8 Belize

Belize is distinct from the rest of the region at a variety of levels, ranging from linguistic and cultural factors (the country identifies itself and cooperates closely with other Anglophone Caribbean countries) to political factors (Belize gained independence from the United Kingdom only in 1981) to questions of energy integration (the country is not a part of SIEPAC and since 1998 has relied heavily on imported electricity from Mexico). Leaving aside the imported supplies, which are based on thermal generation in southeastern Mexico, Belize's indigenous capacity includes a high percentage of hydroelectric resources together with some recently added some biomass cogeneration capacity. Factors that have impeded the development of renewable energy generation in the country include the following:

- *Limitations of data and feasibility studies*. It appears that the government's efforts to support project development to bring additional generation capacity have gained momentum only recently, with attention to the need to assess available resources and support feasibility studies occurring in earnest in the last decade. These activities have resulted in the addition of new capacity, notably the 31.5 MW BELCOGEN sugarcane bagasse facility located at the Tower Hill sugar refinery near Orange Walk. Belize joined CREDP in 2004 and supported the preparation of various pre-feasibility and feasibility studies in the years following.[236]

- *Contractual restrictions*. Beginning in 1998, Mexico's CFE provided firm power to BEL under a 12-year contract; this PPA was terminated in late 2009.[237] While the details of the contract are confidential, it is possible that the agreement contained provisions obligating BEL to purchase specified amounts of electricity even if it did not require them. This may have limited BEL's ability and/or incentive to secure alternative sources of supply, although the purchase price from CFE was quite expensive (in the range of USD 0.27/kWh until 2009).[238] As the end of the contract approached, this consideration became unimportant, and now it is clear that CFE will not be in a position to renew the contract for a similar amount, irrespective of the pricing.

- *Limitations of transmission system*. Belize's grid, like the systems of other countries in the region, is not well equipped to accommodate power from renewable energy facilities in remote locations without considerable investments.

- *Financial constraints*. Since 2000, BEL has been owned by Fortis of Canada and the Belize Social Security Board, resulting in a considerable improvement of the company's financial condition and performance. However, while BEL's financial condition improved in 2009 after losses associated with the impact of high fuel prices in 2008, BEL's situation is complicated because the losses of 2008 are the result of a PUC ruling that disallowed a pass-through of those costs. These losses caused BEL to breach loan covenants, and by BEL's own account, they undermine its credibility as a counterparty and thereby undermines the

[236] Interview with Dennis Gonguez, Chief Meteorologist, National Meteorological Service (Belize), June 2, 2010.
[237] BEL annual report, 2009, p. 17; "Mexico Cutting Back on Power to BEL," *Ambergris Today*, May 9, 2009, http://www.ambergristoday.com/html/archives.php?p=050709.
[238] BEL annual report, 2009, p. 8.

investment climate in the country. Indeed, the tone of BEL's 2009 Annual Report is quite negative, alluding to regulatory uncertainty and accusing the PUC of "incompetence."[239]

- *Human resource limitations*. There are a limited number of technically trained specialists in the country to support broad-based development of renewable energy resources and or wide-spread adoption of renewable energy technologies for residential applications.

4.3 CLEANER PRODUCTION AND END-USE EFFICIENCY: TRENDS AND POTENTIAL OPTIONS

Considerable opportunities for energy savings exist throughout the energy sector in Central America. The governments of the region have so far done very little to exploit the full scope of these opportunities, despite a considerable amount of activity in recent years, and in some cases, dating back to the 1990s.

Several recent assessments of the region's progress in implementing programs to exploit the potential savings from energy efficiency improvements have concluded that this aspect of the larger Strategy 2020 is limited. To date, each of the countries has undertaken activities to articulate a national policy on energy efficiency, and in several countries studies and audit programs have been executed to assess the scale and scope of the potential savings from energy efficiency improvements on the demand side. Yet, the actual implementation of a coherent regulatory framework has occurred only in Costa Rica, and comprehensive measures to achieve savings have been scattered and limited in scale at best. All but Belize have some experience with implementing programs to swap CFLs for the less efficient incandescent lamps, and there have been some notable efforts to implement industrial and commercial energy efficiency projects, primarily as demonstrations and proofs of principle. Nowhere in the region is there an effective program for monitoring and quantifying the impact of energy efficiency programs. As noted in Section 2.4.1, intensity of energy use (expressed as unit of energy consumed per unit of GDP) has decreased since 2004 as a result of rising fuel prices, more noticeably for liquid fuels than for electricity sales (see Section 1 of the Statistical Annex).

Despite the limited progress, the potential savings, detailed in Section 4 of the Statistical Annex, are considerable. An IDB analysis published in 2008 surveys OLADE data on 24 countries in Latin America, including six in Central America, and expresses the energy efficiency opportunity in terms of the avoided cost of generation capacity (assumed to be 250 MW open-cycle gas turbines, operating with a capacity factor of 20% and an estimated cost (all in) of USD 650/kW, admittedly a conservative figure.[240] For Central America, investments in energy efficiency totaling USD 550 million in the region could avoid the need to invest USD 1.747 billion in new generation facilities (12 open-cycle facilities) over ten years, suggesting a simple rate of return on investment of 25–28%, assuming that the energy efficiency investments are made in one year and that the savings from avoided investments in new plants are evenly distributed over the ten-year period.[241] To test this conclusion, Nexant conducted a high-level analysis of the technical potential for savings based on the data presented in the Statistical Annex, and while it arrived at a more conservative figure, the result confirms that there is

[239] Ibid., p. 3.
[240] IDB, "Cómo Ahorrar US$ 36,000 Millones en Electricidad (Sin Apagar Las Luces)," http://www.iadb.org/news/detail.cfm?lang=es&artid=4750&id=4750.
[241] Asturias presentation, 2010.

considerable potential for energy efficiency savings. Nexant's modeling exercise, which is included in Section 4 of the Annex, concluded that annual savings equivalent to about 25% of average annual growth in generation and 20% of average annual peak demand growth in the region for the 2005–2009 period could be achieved through a relatively small suite of measures in the residential, industrial, and commercial sectors. The incremental cost of these measures would total some USD 118 million; over the lifetime of the energy efficiency measures installed, this investment in energy efficiency would deliver the energy saved at a cost of approximately USD 0.03/kWh, a cost considerably lower than the cost of energy supplied by new facilities.

A recent country-by-country review of energy efficiency policies and programs conducted by CEPAL and OLADE[242] clearly illustrates the extent of the region's unfinished business, and discussions with policymakers confirmed these findings:

- *Belize*. Very little has been done other than to develop concepts for educational programs, training, auditing, and country-wide studies of energy consumption patterns.[243]

- *Costa Rica*. Costa Rica passed Law 7447 (Law for the Rational Use of Energy) in 1995, with rulemaking published the following year. Subsequently, some of the fiscal incentives contained in the law were rescinded in the context of fiscal reforms implemented in the country, but these incentives will be restored by the current administration.[244] However, further implementation of product standards and establishment of the relevant infrastructure —an energy efficiency laboratory—did not begin until 2001. Both ICE and CNLF have established divisions offering a range of services to large customers to reduce energy consumption and public information campaigns to promote efficiency among residential users. However, the focus on ICE's activities for large end-users where ICE has an operational interest[245] (such as improving the facility's load factor) suggests that ICE's commercial interest in selling more electricity continues to influence decision-making regarding energy efficiency programs. Costa Rica is the only country in the region to have a laboratory (ICE-LEE), which has developed 14 standards, but none are mandatory at this stage. There have been initiatives to create energy services companies (ESCOs) in Costa Rica, but they have not met with much success. According to Alejandra Arias of ICE, this is because the firms failed to deliver technically credible services and tended to exploit quick-fix opportunities;[246] however, this assertion must be considered together with the fact that ICE has an economic interest in protecting its primacy in this area.

- *El Salvador*. With the establishment of the CNE in 2007, El Salvador has taken steps to create a stronger policymaking apparatus than had existed previously. The CNE's initial document, issued in 2009, identified several important policy priorities and programmatic actions to promote energy efficiency. However, with the change in administration in 2009, Luis Reyes, the new Executive Director of the CNE, ordered a revision, which is expected out in the third quarter of 2010. As a result, the country does not yet have a clearly articulated

[242] CEPAL energy efficiency outlook, 2010.
[243] Interview with Dennis Gonguez, Chief Meteorologist, National Meteorological Service (Belize), June 2.
[244] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[245] Interview with Alejandra Arias, ICE (Costa Rica), May 19, 2010.
[246] Ibid.

policy on energy efficiency. Efforts to date have been focused to a considerable extent on studies and assessments, such as an evaluation of the potential energy savings that could be achieved through different types of investments in water pumping facilities in the country. Some private companies provide a range of technical services that include energy efficiency audits, installation of more efficient equipment and control systems, and other measures; according to the president of one such company, SETISA, business in the sector has been limited, leading the company to diversify into other areas that have proved to be more lucrative.[247] However, the national agency in charge of standards, Consejo Nacional de Ciencia y Tecnología (CONACYT), developed four draft standards for CFLs, motors, and refrigeration equipment, and they have been approved as mandatory standards.

- *Guatemala*. Guatemala's MEM has identified energy efficiency as an important part of the overall Energy Policy 2008–2015, but efforts undertaken to date have been sporadic and limited to pilot programs (such as a CFL distribution program), studies, and public awareness activities. Legislation has been discussed, but none has been proposed formally, much less approved. Interestingly, MEM instituted daylight savings time in 2006, but suspended the policy the following year because of concerns over its impact on traffic patterns as well as crime patterns.[248] In late 2009, CNEE, the electric sector regulator, began implementation of a technical cooperation funded by the IDB to prepare an integrated energy efficiency plan, including development of a financial mechanism for supporting energy efficiency investments and the design and creation of a national technical agency for energy efficiency, as yet without a formal name. It is expected that the consultancy will continue through the end of 2010.

- *Honduras*. Legislation to promote energy efficiency was reportedly under development in 2008 and 2009[249] but is not yet in place. Nonetheless, there have been several relevant initiatives in the last four years. In 2007, the DGE within SERNA established the GIURE to coordinate efforts by various stakeholders (including government, academia, and the private sector) to implement projects. In addition, ENEE has implemented GAURE, which involved distribution of CFLs on a large scale, and its follow-on program, GAURE II, both of which received substantial funding from the European Commission. Beginning in 2005, an industry association dedicated to sustainable development issues, Consejo Empresarial Hondureño para el Desarrollo Sostenible (CEHDES), implemented an energy efficiency program for commercial and industrial enterprises (PESIC) with support from the Global Environmental Facility (GEF), implemented by the UN Development Program. While the initiatives have met with some success in demonstrating the potential economic savings and building public awareness, they have been implemented without the benefit of coordination by a national agency in the context of a coherent legal and policy framework and with adequate follow-up and evaluation.

- *Nicaragua*. Under the Electricity Industry Act and the corresponding rulemaking in Decree 1304 (2004), the government established policy guidelines for promoting energy efficiency. The government of President Ortega, which took office in early 2007 amid a severe energy

[247] Interview with Rodrigo Guerra, President, SETISA (El Salvador), May 18.
[248] CEPAL energy efficiency outlook, 2010, pp. 137–138.
[249] Ibid., p. 150.

crisis, has intensified efforts to promote efficiency and gave the MEM specific mandates with respect to efficiency.[250] Since then, the government implemented a large-scale CFL distribution program,[251] numerous studies that included audits of industrial and commercial facilities, educational initiatives, and an effort to establish mandatory standards for electrical appliances. MEM is also working to secure funding for a national laboratory to support implementation of the mandatory standards. In early 2010, MEM reached agreement with the IDB and several other donors to support the Programa Nacional de Electrificación Sostenible y Energías Renovables para Nicaragua (PNESER), which includes USD 15 million for energy efficiency activities, including expanded efficient lighting programs for residential users, government offices, and street lighting and solar water heaters for hospitals, hotels and industrial facilities, among other measures.[252]

- *Panama*. The creation of the SNE in 2008 represents a step toward the consolidation of authority to make policy on energy issues, including energy efficiency, and management of programs in the area. Under its predecessor, COPE, which was created at the time of the restructuring of the electric sector in 1997, the government had conducted numerous studies and assessments but did not establish a legal framework for energy efficiency or, as far as the documentary evidence suggests, implement any meaningful demonstration projects, audit programs, or similar initiatives. The interest of the previous administration of Martín Torrijos as well as the current one of President Ricardo Martinelli appears to have been driven by a supply crisis in late 2007 and early 2008. SNE is now overseeing the preparation of a draft energy efficiency law with support from the IDB.[253]

On the supply side, there are two significant potential sources of savings, though their availability is less widespread. Technical and non-technical losses of the national distribution systems throughout the region are high compared to major industrial markets; in the cases of Honduras and Nicaragua, they are extremely high and threaten the long-term financial integrity of the distribution companies involved. This situation is also tied to the higher level of subsidization observed in those two countries. Another important opportunity is the rehabilitation and repowering of existing hydroelectric facilities. According to assessments conducted by the IDB, more than 800 MW of additional capacity could be secured through the repowering and rehabilitation of facilities located throughout the region.[254] The IDB is supporting repowering projects in Costa Rica and Nicaragua.

In the area of vehicles and transportation, even less has been done compared to the electric power sector, although several studies and assessments have been conducted to examine potential strategies for inducing changes in patterns of vehicle use, restructuring public transportation systems, and improving the fuel efficiency and/or altering the fuel consumed by the vehicle fleet. Since fuel consumption by the transportation sector accounts for more than one-half of total consumption of refined products in the region as a whole (see Annex 5), efforts to

[250] Ibid., p. 193.
[251] Interview with Mario Lezama, ENEL (Nicaragua), May 26, 2010.
[252] Germán Cruz, "Visión Energética" (presentation, WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26, 2010) (hereinafter Cruz presentation, 2010).
[253] Interview with Fernando Diaz, Director of Electricity and Energy Policy, SNE (Panama), May 24.
[254] Cruz presentation, 2010.

reduce fuel consumption in this sector could deliver considerable benefits in environmental, macroeconomic and social terms.

The challenges associated with the adoption of more vigorous initiatives to alter vehicle and transportation patterns are considerable, both in terms of the degree of public support that is required as well as the importance of improving planning and coordination between disparate government agencies and institutions, specifically agencies with responsibility over transportation, public finance, international trade, basic infrastructure, land use, and urban planning. Guatemala is clearly the leader in the region, having implemented a BRT system in 2007. Based on the experience of Guatemala City, two other countries in the region, Honduras and Panama, appear to be on a path to develop BRT systems of their own, in Panama City and Tegucigalpa. The following examples of initiatives illustrate the complexity of achieving progress in this area:

- *Costa Rica*. The commitment of the government and general population to sustainable development has traditionally been greater in Costa Rica than elsewhere in the region. In the past, the Dirección de Gestión de Calidad Ambiental (DIGECA) within MINAET, with financial support from GTZ, has overseen studies to provide the basis for transportation strategy reform in San José, possibly including components such as BRT, along the lines of projects implemented in numerous other cities in Latin America; light rail; improved fuel quality; and sectorization of transport, meaning that public transport systems are segmented to reduce the number of longer-haul lines that lead to congestion in key areas and bottlenecks. Work has not proceeded beyond the studies, however, due to limited political will to support transportation initiatives involving changes in public transport services. Political opposition from transportation unions and other interests has been too powerful.[255] Another unexploited opportunity with energy (and carbon emissions) benefits involves a fleet-based efficiency program with taxis in San José.[256] Some recent developments suggest there is new momentum. In 2009, the City of San José expanded its daily restriction on vehicle use in the city center, which is based on license plate numbers, and observed a 12% reduction in traffic.[257] However, experience from Mexico City suggests that, over the longer term, programs of this sort experience some degree of a “snap back” effect, as vehicle owners procure second vehicles in order to be able to drive every day. The Chinchilla administration is moving forward on two other fronts, though it does not appear to be prepared to take on existing public transportation service providers. Rather, the Ministerio de Obras Públicas (MOP) is preparing a concession for light rail service along existing lines along the east-west axis of greater San José, from Pavas to Curridabat. The existing train is diesel, but the project would involve electrification of the line with the participation of CNFL.[258] In addition, MINAET is examining how to include hybrid vehicles on the list of eligible equipment for the tax exemptions under Law 7447, which MINAET is seeking to reinstate. It would also develop a standard for vehicle fuel efficiency and pollution control.[259]

[255] Interview with María Guzmán, MINAET/DIGECA (Costa Rica), May 21, 2010.
[256] Interview with William Alpízar, OCIC (Costa Rica), May 21, 2010.
[257] CEPAL energy efficiency outlook, 2010, p. 87.
[258] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.
[259] Ibid.

- *Guatemala*. In 2007, Guatemala City inaugurated a BRT line dubbed the Southwest Line, operating in the same manner as BRT systems in other countries, such as Mexico City, Quito, Lima, and the city that originated the concept, Curitiba.[260] One of the key components of the project, like any BRT program, is the elimination of multiple bus transport service providers through the issuance of a concession to a single operator, thereby eliminating competition between vehicle drivers and a perennial cause of safety problems for passengers. Based on the experience to date, the transition appears to have been accomplished without major difficulties, although there appears to have been a considerable degree of criticism on the part of motorists because the BRT occupies a dedicated lane which is therefore off limits to other vehicles.[261] In Guatemala and other cities in Latin America, owners of private vehicles who drive to work are unlikely to switch to public transportation, out of concern about safety or maintaining social status; therefore BRT systems are unlikely to reduce the number of private vehicles on the roads. Where BRT systems do have an impact is in the consolidation of multiple buses, usually minibuses or "combis," into a smaller number of larger, articulated buses. Based on the success of the Southwest Line, the municipal government is in the process of planning a second route, to be called the North East Line, with a USD 1 million grant from the IDB.

- *Panama*. A new Secretariat of the Metro has been created under the Office of the President to coordinate the creation of a BRT system, referred to as "Metro" in Panama. The program is in the conceptualization and planning stage, with USD 2 million in grant support provided in two tranches of USD 1 million each by IDB and CAF under an agreement completed in 2009.[262] It does not appear that Panama had previously given serious attention to the transportation sector.

- *Honduras*. The Municipality of Tegucigalpa signed an agreement in early 2010 to receive USD 1 million in grant support for capacity building and a pre-investment study to evaluate the creation of a BRT system in that city.

- *Nicaragua*. The City of Managua and the national government in Nicaragua began studying the possibility of a BRT system in 1999 and signed an agreement with the IDB for a USD 435,000 technical cooperation in 2005 to develop detailed planning for the implementation of the program. This effort has not advanced past that stage, however. Programs implemented to date by the Municipality of Managua have been limited to replacements of 100 buses with more efficient vehicles, a reduction in the taxi fleet, and improvements in street lighting and signaling systems.[263] These measures do not appear to have been very extensive, given the continued presence of a large number of old U.S. school buses operating in Managua that were imported for use in the public transportation system.

- *El Salvador*. The Municipality of El Salvador has studied the possibility since the early part of the decade, but to date no further developments have taken place.

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[260] Project documentation is available on the IDB website, http://www.iadb.org.
[261] See, for instance, "El Transmetro de Guatemala," http://www.creatublog.aquiguatemala.com/2007/02/10/el-transmetro-de-guatemala/.
[262] Project documentation is available on the IDB website, http://www.iadb.org.
[263] CEPAL energy efficiency outlook, 2010, p. 203.

The irony of the limited progress in the area of energy efficiency is that the economic benefits of securing improvements in energy efficiency are more compelling than the benefits of securing electricity from new generation resources, whether they are conventional or non-conventional renewable facilities, which are receiving considerable investment and support from national governments, donors, and financial institutions. The investment required to achieve the modest savings estimated in the Nexant modeling exercise would amount to a fraction of the investment going into new generation facilities in the region and a fraction of the cost associated with providing subsidies to shield low-income rate payers from the impact of higher fuel prices.

4.4 BIOFUELS

In 2005, as petroleum prices began their steady march to the record levels attained in 2008, governments in Central America (as elsewhere in the world) redoubled their attention on biofuels as a strategy for replacing petroleum-based fuels and fostering development of this emerging agribusiness subsector to create jobs, reduce fuel costs, and enhance energy security. Despite the volatility in petroleum prices since late 2008, interest in biofuels remains strong. As in other renewable energy sectors, Costa Rica has arguably advanced the furthest in developing a domestic market with a biofuels mandate, but overall, the progress to date has been limited and slower than anticipated.

- *Belize*. Belize has not passed any legislation or regulations to promote and manage biofuels use, but there is clearly interest in biofuels given the presence of sugar production in the country.[264] The BELCOGEN facility, which was developed by Belize Sugar Industries Limited and started operation in early 2010, has clearly established that the sector can play an expanding role in allowing the country to meet its energy needs through domestic production.

- *Costa Rica*. The government issued two executive decrees establishing technical commissions for the development of ethanol (in 2003) and biodiesel (in 2004) as transportation fuels, in the context of a national biofuels program. The objective of the program was to have established markets for ethanol and biodiesel blends at the national level by 2009. A pilot program managed by Costa Rica's state-owned refiner, RECOPE, was launched in 2006 to test the distribution and utilization of a gasoline/ethanol blend (E7) in Guanacaste Province, in the northwestern part of the country.[265] This program continues, but the national roll-out of the program has not yet taken place. According to MINAET, the immediate challenge is the need to reach agreement with fuel distributors, who argue they require additional margin to cover the cost of investments to handle blended fuel. The distributors' lobby has proposed an increase of USD 0.05/gallon, but ARESEP has not yet made its decision.[266]

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[264] Inter-American Institute for Cooperation on Agriculture (IICA), "Agroenergy and Biofuels Atlas of the Americas," 2007, p. 27, http://www.iica.int/Esp/organizacion/LTGC/agroenergia/Documentos%20Agroenerga%20y%20Biocombustibles/Agroenergy%20and%20Biofuels%20Atlas%20of%20the%20Americas.pdf.

[265] Francisco Figueroa de la Vega, "Diagnóstico Energético del Sector Transporte y Protección del Consumo de Combustibles y Biocombustibles y Emisiones GEI en Centroamérica al Año 2020," CEPAL, February 2009, pp. 29–33, http://www.sica.int/busqueda/busqueda_archivo.aspx?Archivo=odoc_48122_1_08042010.pdf (hereinafter CEPAL transportation outlook, 2009).

[266] Interview with Gloria Villa de la Portilla, Director of Energy, MINAET (Costa Rica), May 20, 2010.

- *El Salvador*. El Salvador does not have a biofuels policy in place at present, but CNE has indicated that it is developing a proposal for a policy.[267] The possibility is not an entirely new one for El Salvador. According to Aquilino Duarte, the government did explore the possibility of a biofuels policy in the1980s during the civil war in the country, but this initiative was discontinued for political reasons.[268] Given the lack of political support for biofuels development in the past, local sugar producers have not emphasized ethanol production, and at least one producer (La Cabaña) has indicated that its costs of production are considerably higher than international references, such as Brazil. It is understood, however, that producers could bring production costs down relatively quickly with the necessary investments, which would be justified in the event that a national policy were established.[269] As of 2009, a 10,000 liter-per-day (LPD) pilot biodiesel facility began operations using various vegetable oils as feedstock, in the context of the Proyecto Mesoamericano.[270]

- *Guatemala*. Although Guatemala does have legislation dating back to 1985 for the promotion of ethanol use (Law 1785), this initiative was not obligatory—although the underlying standards for fuel quality and other aspects of the market are—and an effort in 2006 to update this regulation and make it obligatory failed to secure approval in Congress. In spite of the failure by the government to establish a requirement, Guatemala's agribusiness sector has been producing ethanol for export for many years; there are now five large production facilities that export some 80% of their output. [271] There is also a small amount of biodiesel production capacity in Guatemala, based on feedstocks that include recycled vegetable oil and jatropha.[272]

- *Honduras*. A law for the production and consumption of biofuels was passed in late 2007, establishing that the production and use of biofuels is a national interest, assigning responsibility for application of the law to the SIC for downstream issues and to the Ministry of Agriculture for upstream matters, and mandating a series of incentives for investment in biofuels production. The measure was published in the Official Gazette in February 2009, a few months before the recent political turmoil began, so it appears likely that actual implementation has been delayed. As of 2009, a 10,000 LPD pilot biodiesel facility began operations at a peasant cooperative, in the context of the Proyecto Mesoamericano.[273] Several major producers of palm oil have been producing biodiesel for their internal use as well as for sale for several years and have been using biodiesel in their own vehicle fleets.

- *Nicaragua*. No legislation on biofuels is in place or under development, but the government is actively studying the possibility. According to a MEM official, the study is giving particular emphasis to the social aspects of biofuels production, including the potential advantages of encouraging the development of biofuels production on deforested lands as part of the rehabilitation process. The study is expected to lead to draft legislation and the

[267] Interview with Luis Reyes, Executive Secretary, CNE (El Salvador), May 18, 2010.
[268] Interview with Aquilino Duarte, Director for Hydrocarbons and Mining, MINEC (El Salvador), May 28, 2010.
[269] CEPAL transportation outlook, 2009, pp. 43–44.
[270] CEPAL renewables report, 2009, p. 53.
[271] CEPAL transportation outlook, 2009, p. 55.
[272] CEPAL renewables report, 2009, p. 54.
[273] Ibid., p. 55.

creation of a national standards committee.[274] Several government agencies concerned with agricultural and regional development objectives are especially interested in the potential for biofuels to create new economic development opportunities in the country's more depressed eastern regions along the Caribbean coast.

- *Panama*. While Panama's sugar industry is smaller and less productive in terms of yield per hectare, than other countries in the region, the government is interested in promoting the sector as an opportunity for agribusiness and trading companies. Biofuels development has been contemplated as part of national energy policy dating back as far as 1987, and was included in the context of the 2005 National Policy on Hydrocarbons and Alternative Energy.[275] The current administration is pushing forward with the preparation of a draft Biofuels Law and a biodiesel standard (an ethanol standard is already in place).[276]

While there does appear to be momentum toward more comprehensive policies and programs to promote the production and utilization of biofuels, the broader development of biofuels in the region faces several important limitations. Costa Rica's recent experience in the context of its push to create a national biofuels program provides illustrations of some of these obstacles. These limitations are not unique to the region, but the specific characteristics of Central America's physical environment and marketplace make these limitations particularly relevant.

- *Land availability and concerns about environmental and social impacts*. Limitations on the availability of land for conversion to production of biofuels feedstocks is a critical issue in many countries around the world, and is related to (1) concerns about the destruction of rainforests and other irreplaceable biomes in order to make way for cultivation of oilseeds, African palm, sugarcane, and other feedstocks, as well as (2) the displacement of food cultivation. In some countries in the region, notably El Salvador and Honduras, where a great deal of land is in the hands of small holders, the limitation is economic, in that these farmers ability to produce feedstocks at costs comparable to international standards is constrained by inadequate access to credit, limited experience and managerial capabilities, and increased logistical costs due to small plot sizes. As of 2005, CEPAL and SICA reported that the region had 408,000 ha under sugarcane, almost half of which (185,000 ha) was in Guatemala, with the rest of the countries reporting areas in the range of 54,000 ha (El Salvador) to 31,000 ha in Panama and 24,000 ha in Belize.[277] Meanwhile, African palm plantations in the region covered 162,000 ha, roughly one-half of which are in Honduras, followed by Costa Rica (49,000 ha) and Guatemala (31,000 ha). CEPAL's analyses of the sector have concluded that available land in the region should be enough to produce biofuels in sufficient amounts to meet a 10% ethanol and 5% blend mandate, although they do recognize that new lands will have to be brought into production to achieve this. [278] Likewise, sector officials are confident that these targets are attainable without resorting to imported fuels, as has been the case

[274] Remarks of Fernando Campo, Biofuels Advisor, MEM (Nicaragua), at the WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26.
[275] CEPAL transportation outlook, 2009, p. 86.
[276] Interview with Juan Urriola, Minister of Energy, and Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24.
[277] CEPAL/SICA, "Estrategia Energética Sustentable Centroamericana 2020," p. 60; Belize figure is from IICA, "Agroenergy and Biofuel Atlas," p. 27.
[278] CEPAL/SICA, "Estrategia 2020," p. 61.

during the Costa Rican pilot program. It is not clear, however, that national authorities have carefully inventoried available land that is not precluded from use for environmental, social, or other grounds to determine whether the necessary production levels could be achieved. Officials have not confirmed that such work has been performed, and there is no evidence of it in available sources and analyses.

- *Production volumes*. A question related to the availability of land is that of productivity and competing markets for ethanol production. Rum is an important industry in the region, and efforts to increase output of fuel-grade ethanol based on existing levels of sugarcane production would compete with this higher–value-added product. Variations in productivity are another issue. Productivity in the region as a whole averages about 75 tons cane per ha, comparable to Brazil's 77 tons/ha, but it is considerably below productivity in Colombia (123 tons/ha) and Peru (102 tons/ha); within the region there is considerable variation, from the highest level, in Nicaragua (101 tons/ha) to the lowest, in El Salvador (35 tons/ha). Availability of production is yet another consideration. In the case of Costa Rica's pilot program, Brazilian ethanol is being imported because domestic producers had committed their output to other buyers and could not participate in the tender to supply the program.[279]

- *International markets for biofuels and hydrocarbon-based fuels*. The existence of large international markets for ethanol with preferential access, rules for production from Central America, and attractive prices requires that any effort to promote domestic markets for biofuels be based on price parity with export markets; otherwise, the domestic market would be oversupplied or undersupplied, depending on whether the domestic price is higher or lower than the international market. This will create a challenge for domestic producers whose costs of production exceed those of the main overseas producers. The price of imported refined products poses a separate challenge. In periods when gasoline and diesel prices have been relatively low, ethanol and biodiesel prices have been higher, particularly when adjusted for energy content. With petroleum prices in excess of USD 50/barrel for WTI, however, biofuels tend to be cheaper, although international prices for the biofuels themselves can diminish the price advantage; this appears to have been part of the challenge facing Costa Rica's efforts to introduce biodiesel; limited domestic palm oil production together with high international palm oil prices eroded the price advantage of biodiesel relative to mineral diesel.[280]

- *Quality assurance*. Quality assurance is an essential element of any national program, given the need to avoid damage to the vehicle fleet and facilitate regional and international trade. While efforts are underway to prepare RTCAs and to make these obligatory, at present there are no mandatory biofuels standards; only the United States and the United Kingdom have them.[281] Other observers share the view that product uniformity and mechanisms for ensuring conformity with standards, are essential to the implementation of regional biofuels programs.

[279] Ibid., p. 61.
[280] CEPAL renewables report, 2009, p. 59.
[281] Presentation by Carlos Pastor, biofuels consultant, at the WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26.

- *Technical limitations (vehicles)*. Older vehicles do not incorporate more recent engine technologies that would facilitate the use of biofuel blends, not to mention other pollution control technologies. Central America does not yet closely regulate the importation of vehicles, and therefore the age and quality of its vehicle fleet is extremely diverse. In 2007, Central America's vehicle fleet numbered about 4.5 million vehicles of all types, with Guatemala accounting for approximately one-third of this figure; growth in the fleet's size from 2000 to 2007 averaged about 5.4% annually. Costa Rica has the highest level of vehicle ownership, at 189 vehicles per 1,000 inhabitants, while Nicaragua has the lowest, at 64.5 per 1,000. At the same time, the average age of vehicles in the region varies considerably by country and vehicle type: for instance, automobiles in Costa Rica have an average age of about 13 years, compared to 9.5 years in Guatemala and almost 20 years in Nicaragua. The variation is equally apparent in other (diesel-fueled) vehicle types: the bus fleet in El Salvador has an average age of 6.7 years, compared with 8.7 years in Costa Rica and 21.3 years in Nicaragua.[282] This variation in the vehicle age and technology poses a challenge for the creation of a regional biofuels market because the potential impacts on the vehicle fleet vary so widely.

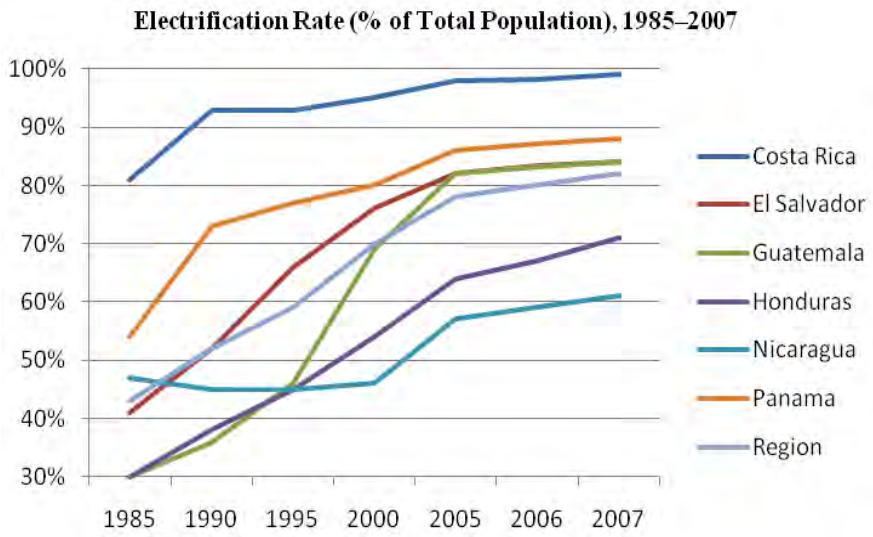
- *Technical requirements (fuel logistics)*. Because of the corrosive properties of biofuels, the infrastructure requirements for managing pure ethanol and biodiesel are considerable. In addition, there are special equipment requirements for preparing biofuel blends. Once the biofuel is introduced into the fossil diesel or gasoline, the modifications required are more limited. The modifications required at RECOPE's installations totaled USD 1 million,[283] and fuel distributors in Costa Rica are arguing that they must be compensated for the modifications (more limited than those required at a RECOPE blending facility, presumably), which will in turn require that these costs are reflected in the price paid by the end user.

- *Political and administrative complexity*. By virtue of the agricultural/industrial nature of biofuels, programs to incorporate them into the transportation fuel supply necessarily include numerous stakeholders that do not coordinate their activities in many other areas. Therefore, some complexity and potential for conflicts between agencies with different perspectives and priorities may be inevitable. However, the Costa Rican experience offers some examples of how the structures created to implement and oversee the programs were perhaps more complicated than they needed to be and involved actors that perhaps did not need to be included, at least not in the core body in charge of implementation and coordination.[284]

- *Public communication*. Communication of the program's goals and structure to the people involved in the program itself (distributors, retailers, and employees of companies in the liquid fuels sector), as well as those involved in the care and maintenance of the vehicle fleet, and, of course, the end users of the fuel, is absolutely essential to its long-term success. This is because there are both misconceptions about the impact of using biofuels blends as well as some real issues that must be addressed. The public's questions regarding the costs of implementing the program as well as the costs of the biofuels and the hydrocarbon-based fuels themselves must also be addressed clearly.

[282] CEPAL transportation outlook, 2009, pp. 15, 22, 28, 50, 67.
[283] CEPAL renewables report, 2009, p. 60.
[284] Ibid., p. 59.

4.5 OPPORTUNITIES FOR GREATER DISTRIBUTION OF POWER RESOURCES: DISTRIBUTED RESOURCES, NET METERING, AND END-USER INCENTIVES FOR PV AND SWH



Electrification in Central America is relatively high compared to other regions of the world, with Costa Rica leading at 98%, followed by Belize, Panama, Guatemala and El Salvador (90%, 87%, 83% and 83%, respectively). Coverage in Honduras and Nicaragua is lower, at 78% and 55%, respectively. Based on a total population in the region on the order of 40 million, this means that some 8 million people in the region do not have access to the grid, and if they use electricity, they are likely to pay considerably more for it than the average end user in the region (average rates in the region are considerably higher than in many other countries in Latin America). Of this population, about 52% live in Nicaragua and Honduras alone, and another 40% live in El Salvador and Guatemala.

What is striking about the current status of electrification in the region, and these four countries in particular, is that a generation ago, in 1985, the situation was rather different: Costa Rica led the region at 81%, followed by Panama at 54% and then Nicaragua, with coverage of 47%; El Salvador, Guatemala, and Honduras stood in the 30–40% range. In the intervening period, El Salvador, Guatemala, and Panama have posted rapid and generally consistent gains, while Honduras and Nicaragua have lagged behind. This suggests that governments in these four countries have pursued the goal of electrification using different strategies and with varying degrees of success.

- *Guatemala*. Guatemala achieved the rapid expansion of electrification between 1995 and 2005 through an aggressive effort to expand the national interconnected system to communities that were not part of the network previously. This was achieved in the context of the privatization of the distribution companies DEORSA and DEOCSA, when the government sold its shares in each to Unión Fenosa in 1998, together with a considerable increase in the resources committed by the government to rural electrification, beginning in 1996 following the Peace Accords that ended 35 years of civil war. Under the Programa de Electrificación Rural (PER), the distribution companies were contracted to achieve 280,000 new connections over a five-year period for a fixed price of USD 650 per connection; resources came from the PER Trust Fund (FIDE PER) created with the proceeds of the sale of shares in the distribution companies leveraged with loans from the IDB and CABEI and managed by a commercial bank. This program was an integral part of the privatization program, which included performance-based incentives in the area of electrification. The

PER focused on those 280,000 households located at least 200 meters from the existing network; the distribution companies were required to connect households located within 200 meters and charge the published tariff, although a connection fee could be charged. Based on an analysis prepared before the end of the five-year contract, it appeared that the distribution companies were not going to reach their goal, although they did add a large number of new users.[285]

- *Nicaragua*. The experience of the PERZA program in Nicaragua offers a recent example of off-grid electrification targeting areas that are not anticipated to be incorporated into the grid in the near or medium term, through the deployment of solar PV technologies. PERZA began in 2006 and consisted of a small subsidy to buy down the initial cost plus support for microfinance lenders. Under the program, a defined system package with a value of about USD 600 qualified for a subsidy, delivered in the form of a rebate to the PV distributor (the amount of which depended on the system size), provided that the installation would be 5 km or more from the grid so as to limit the program to inhabitants of areas not likely to be connected in the medium term. MEM would determine eligibility under this criterion, and could reject reimbursements, in which case the PV distributor absorbed the loss. Loans would be originated by local microfinance banks to pay off the balance of the kit's cost. Loan tenures were typically two to three years, with interest rates in the 18–30% range. The end-users who benefited from the program typically were using kerosene, biomass (*ocote*, a local pine), and to a lesser extent, car batteries or gas generators as their source of electricity for illumination; some 80% used kerosene or ocote. Some potential beneficiaries had difficulties securing credit, sometimes because they did not have legal title to land or property, which did limit the number of end users who participated.

  Technosol, a Nicaraguan solar PV distributor and recipient of financing from E&Co., was a major player in the market created by PERZA; the company has about 80% of the domestic market and installed 90% of the PERZA kits. Technosol's total PERZA-supported business was about 6,000 systems, while its total national business has been on the order of 55,000 systems nationwide. In 2005, Technosol embarked on a national expansion, and the company now has 17 offices around the country. Since the PERZA funds were exhausted, Technosol's business has diminished somewhat, suggesting that end users came to expect the subsidy. Technosol finds itself in the position of having to offer discounts. Other factors played a role: (1) price increases in PV panels (from USD 2/wp to USD 4/wp, the cost is now around USD 8/wp) and (2) more limited access to credit (the credit environment worsened because of the "no pago" movement in 2008–2009.[286] Technosol is actively diversifying into a range of products, some of which involve renewable energy, and other electronics and electrical supply equipment, components, and spare parts. The company is also expanding its business into El Salvador (where there is an Millennium Challenge Corporation (MCC) program component supporting off-grid PC installations), and is monitoring other programs in the

[285] See Economic Consulting Associates/Mercados de Energía, "Emerging Lessons in Private Provision of Rural Infrastructure Services: Final Report – Guatemala," World Bank/PPIAF, August 2002, pp. 1–13, http://rru.worldbank.org/Documents/PapersLinks/RI%20Final%20Guatemalai.pdf.

[286] Interview with Vladimir Delagneau, President, Technosol (Nicaragua), May 26, 2010. Partly because of financial difficulties generated by this movement, which received encouragement from Ortega during his election campaign, there is a perception that the period of "easy" credit has run its course, and there is concern about over-indebtedness in the country. Interview with Stefan Queck, former Nicaragua Director of Pro-Credit (Nicaragua), May 26, 2010.

region as the basis for continuing to expand (including Guatemala, Honduras, and Panama).[287]

Electrification programs are ongoing throughout the region, including a continuation of PER in Guatemala and MCC's electrification activities in El Salvador, ongoing activities in Nicaragua for which MEM is seeking resource for a PERZA II, the programs supported by the Fondo Social de Electrificación (FOSODE) in Honduras, and Panama's Plan Nacional de Electrificación Rural (PLANER).[288] The foregoing experiences in Guatemala and Nicaragua suggest the following observations regarding future actions in this area:

- *Subsidy requirement*. There is nothing new in the experiences illustrated here regarding the need for some subsidization of programs to add new connections to the grid as well as off-grid connections. The question is rather of finding the "right" level of subsidy to create the necessary incentive so that new end users are connected and those that stand little chance of being connected to the grid are included. Here, the experience of PER in Guatemala is instructive, for some observers noted that it was arbitrary to base the delivery of a connection subsidy on whether a particular household was on one side of the 200-meter line from the grid. While it is true that a sliding scale might be adopted to improve the equity of the program, some inequities are inevitable. The analysis conducted also noted a strategy for getting the subsidy "right," through the introduction of more competition in the bidding for contracts to provide connections.

- *Importance of having dedicated resources for subsidies*. Technosol's experience with the decrease in business following the exhaustion of the subsidy fund is similar to that of many other programs that were based on the delivery of one-time subsidies using resources from international funds such as GEF, a charity, or other donor institution. After the program gets underway and word of the program spreads, a constituency is created, and it is difficult to change the public's perception that the subsidized program will return once new resources are secured. This leads to a volatile business environment that can make it difficult for businesses in areas such as distribution of PV systems, solar water heaters, or other technologies to survive.[289] If a given policy objective is a priority, as is the case with rural electrification, the government should allocate resources to achieving it in a consistent and transparent way. This approach is illustrated by Guatemala's PER as well as numerous other electrification programs from other countries.

- *Role for private sector*. There is no reason why the private sector cannot play an instrumental role in adding new connections, as illustrated by the Guatemala PER. In the context of grid expansion, the possibility for creating opportunities for private companies will depend on the policies adopted at the sectoral level. The more challenging question is how to foster the development of small businesses in poor, remote communities based on the provision of renewable energy as well as other technologies in areas that are not served by the grid.

[287] Interview with Vladimir Delagneau, President, Technosol (Nicaragua), May 26, 2010.
[288] Jorge Asturias, "Situación de la Electrificación Rural en Centroamérica," OLADE, June 29, 2010.
[289] The same dynamic is observed with the on-again-off-again deployment of the federal production tax credit for wind power in the United States, which has been the bane of the U.S. industry for years.

- *Community engagement and training*. Experience from numerous programs throughout Latin America as well as in other regions has underscored the importance of engaging communities in advance of the implementation of electrification projects. It is important for end users to be familiarized with the advantages and limitations of household systems to ensure that community expectations do not exceed the capability of the equipment. Unmet expectations have been a perennial problem in off-grid settings, so it is essential to match expectations with performance to ensure that end users honor any commitment to pay part of the cost of the energy provided. Sometimes the community investment is secured through provision of labor or even materials for project implementation. According to OLADE, numerous programs have done this, as a strategy for ensuring that the community is invested in the project and that the project is successful, but on occasion this has slowed down the timetable for project execution.[290]

- *Foster income generation to achieve sustainability*. The experience of numerous electrification programs underscores the importance of ensuring that the introduction of electricity into communities is tied to complementary support to facilitate the activities of "cottage industry" entrepreneurs who use electricity, such as seamstresses, so that they can generate income to pay for, among other things, the electricity that they consume. Institutions with strong experience in community development programs typically have well established approaches to foster the development of income-generating activities. The experience of large companies that manage large-scale programs, as in Guatemala's PER, may not be as well established.

Peri-urban areas and slums offer a separate geographic and socioeconomic area of potential interest to energy and social policymakers for improving standards of electric service and addressing the challenge of losses, especially non-technical losses. Various studies supported by USAID[291] have demonstrated how energy efficiency measures combined with campaigns to regularize end users in slum areas (where illegal and unsafe electric connections are frequent) can deliver improvements in service quality and safety at manageable costs while adding customers to the utilities' lists of paying customers.

Central America's urban population is roughly 22 million, or slightly more than one-half of the total, a rate of urbanization that is in line with the global average. More than 42% of these urban inhabitants are estimated to live in slums,[292] where electric service is likely to be more precarious than elsewhere. This population of approximately 9 million offers a target (of about the same size as the population living in non-electrified areas) for programs intended to improve the quality of electricity distribution service, reduce unserved energy, improve utility collections and improve the efficiency of electricity consumption.

Alternatively, the region's more affluent urban populations, together with commercial and even industrial energy consumers, offer a potential market for the implementation of distributed generation projects based especially on the use of solar PV technology. There are already some

[290] Asturias, "Situación de la Electrificación Rural en Centroamérica."
[291] See, for example, U.S. Agency for International Development, "Innovative Approaches to Slum Electrification," December 2004, http://pdf.usaid.gov/pdf_docs/PNADB219.pdf.
[292] United Nations Human Settlements Programme, *The State of the World's Cities 2004/2005* (2004), p. 112.

examples of this type of project on a pilot basis, such as the PV installation at the German School in San Salvador.[293] There is evidence of increasing interest in this type of project on the part of owners and operators of large retail facilities and malls in Mexico, where there are concerns about reliability of energy supply together with the relatively high cost of electricity for customers in the commercial tariff classes. As this sector develops further in other countries, interest on the part of specific segments of the commercial and industrial sector in Central America will inevitably emerge as well.

4.6 OPPORTUNITY AND CHALLENGES FOR EXPANDED RENEWABLE INVESTMENT FOR THE REGIONAL ENERGY MARKET

With the completion of the first circuit of the SIEPAC transmission line, the regional energy market in Central America will be poised to enter a second phase based on the addition of a separate regional transmission infrastructure to the existing network of border interconnections, which are uneven in terms of the transfer capacity that they offer. The uniformity of the cross-border transfer capacity provided by SIEPAC and the added capacity effectively create a new market for electricity. Moreover, this development comes at a time when cross-border flows have decreased as a result of tighter supply-demand balances throughout the region, which have left countries with limited amounts of excess capacity to sell in the regional market.

Given limited excess capacity, the challenge for SIEPAC will be to ensure that the line's transmission capacity is fully subscribed. While the management of EPR-SIEPAC does not see this as so much of a challenge—indeed, a "build it and they will come" attitude seems to prevail within EPR[294]—many other observers have expressed concern. Overcoming this challenge will require political and regulatory action first and foremost, but investment in actual generation capacity will also be necessary. There are several specific challenges associated with achieving this irrespective of the resources that provide the additional generation to fill the SIEPAC line. When considering the narrower objective of ensuring that renewable energy resources provide the new capacity, some additional challenges arise, including:

- *Modifying laws that prioritize domestic demand over regional demand*. Countries in the region have recently resorted to blocking exports of electricity to ensure that domestic rate-payers are provided electricity. As recently as 2009, Panama's regulatory agency withheld permission for a new project to export power and ordered the project to sell to a domestic off-taker.[295] These provisions in national law and regulations pose an obstacle to the execution of PPAs to sell power to off-takers outside the country through SIEPAC, as off-takers may be unwilling to bear what would likely be considered force majeure risk. Governments, understandably, are concerned that the perception of domestic end-users suffering shortages so that end-users in a neighboring country do not would be politically unpalatable.

- *Ensuring pass-through of SIEPAC costs to end-users*. Once SIEPAC is completed, the project will have to generate revenues to cover the debt service associated with the project. The debt for SIEPAC was contracted by the national companies of the six regional

[293] Klaus Kuhnke and Javier Martínez Mas, "Sistema Fotovoltaico en la Escuela Alemana de San Salvador," 2007.
[294] Interview with José Enrique Martínez, General Manager, EPR-SIEPAC (Costa Rica), May 20, 2010.
[295] Interview with Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24, 2010.

companies, which, together with Mexico's CFE, Colombia's ISA, and Spain's ENDESA, own SIEPAC through their shareholdings in EPR-SIEPAC, and transferred to EPR-SIEPAC through special agreements. The revenue to repay the debt will come from three separate charges: (1) a wheeling fee (CVTR), (2) a transaction fee (CVT), and (3) a complementary charge (*cargo complementario*) that will cover capital costs and will be adjusted downward as revenues increase from the first two. CRIE will have authority over the amounts of all three charges. In any case, EPR is not expected to generate a high return on capital—only 3%.[296] These charges will be paid by the users of the line (the shareholding companies), which in turn will seek to recover them under their respective national regulatory framework. In this regard, statements made at the May 25–26 ministerial meeting suggest that regulatory authorities may not accede easily to the inclusion of these charges. For instance, Minister Juan Manuel Urriola of Panama said that it would be SNE's policy regarding the costs of SIEPAC that the charges paid by the Panamanian shareholder could not be passed through to the end user.[297] This suggests that if throughput on SIEPAC is insufficient to generate revenues to cover debt service, the complementary charge will be used to cover the difference and become an unrecovered cost for the shareholder utilities, with negative financial consequences. Of course, if the pass-through is not subject to sufficient scrutiny, it would be possible to argue that the shareholder companies do not have an incentive to ensure that excess capacity is available to sell over SIEPAC.

- *Completing harmonization of national regulatory system with regional regulatory framework*. Together with the transmission line, the SIEPAC project encompasses a process of regulatory harmonization to establish a regional power market. Since 2002, when the Honduras-El Salvador interconnection was completed, a transitory regional market regulation (the RTMER) has been in effect. Now that the line is close to being energized, attention is turning to the harmonization of the so-called interfaces between the regional regulatory regime (the purview of CRIE) and the national regulatory frameworks (the purview of the national regulatory agencies). This effort is being supported with additional technical cooperation funding from the IDB, which has already overseen the preparation of separate reviews for each country to identify the required changes. Whether or not the necessary changes are made, however, will depend on the national agencies, as CRIE does not have the authority to obligate the national agencies to implement the changes.[298]

- *Extending duration of transmission rights*. Users of SIEPAC will be able to purchase rights to transmission capacity for short periods (for now one year, with longer periods possible with CRIE approval), in keeping with the expectation that SIEPAC would serve as a marketplace for executing transactions to handle surpluses and deficits on a short-term basis. However, some observers have indicated that this orientation would impede growth in line usage based on new investment because new projects would require long-term PPAs in order to secure financing, and long-term PPAs would lack value as such if they were not matched with rights to transmission capacity for a similar period of time. Indeed, Claudio Artavia of CEAC indicated that transactions through SIEPAC that involve regional projects will require

[296] Interview with José Enrique Martínez, General Manager, EPR-SIEPAC (Costa Rica), May 20, 2010.
[297] As reported by Salvador Rivas, Regional Coordinator, AEA (El Salvador), May 28, 2010.
[298] Susana Latrónico, "La Operación del MER en el Contexto del SIEPAC," (presentation, WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26, 2010).

national regulatory approval in both countries, a PPA, and rights to transmission capacity (derechos de transmisión (DTs)) held by either the buyer or the seller.[299] Others have countered that extending the DTs' periods could rapidly lead to a few users "monopolizing" SIEPAC capacity. By auctioning the DTs periodically, users will pay a market-based cost of transmission and will be able to secure DTs over the long term, although the price of the DTs will inevitably vary due to seasonal variations in demand and supply, longer-term trends in resource availability throughout the region and demand growth, among other factors. Based on a preliminary review of the RMER, it would appear that the duration of DTs is not specified in the RMER and that CRIE will specify this once EOR begins preparing the auctions.

- *Establishing a uniform contract for regional projects*. In order to facilitate project development in the marketplace by reducing the complexity of project development activities where possible and to consolidate the formation of a regional market governed by a uniform set of rules, some observers have proposed the development of a uniform PPA for regional projects delivering power into SIEPAC.[300] This standardized contract would complement the other uniform elements of the MER, such as the auctions of DTs, and contribute to the process of forming a vibrant contract market and spot market for electricity in the region. Indeed, elements of this standard contract are already in place and described in the RMER, which was issued in 2005. Specifically, the RMER identifies (1) Firm Energy Contracts and (2) Non-Firm Energy Contracts. Under the heading of the latter, the RMER specifies two special instances: (a) the Non-Firm Financial Contract and (b) the Non-Firm Flexible Physical Contract.[301] Each is described briefly as follows:

  - *Firm Energy Contract*. In this type of contract, one of the parties holds DTs between the nodes where energy is injected and withdrawn; the energy is not committed to a contract in the domestic market, and the firm energy delivered is subject to the amount of firm energy authorized by the national regulatory agency with jurisdiction over the buyer or the seller.

  - *Non-Firm Financial Contract*. In this subset of non-firm contract, there is no associated offer in the regional spot market (mercado de oportunidad regional), there is no impact on regional pre-dispatch. The contracts would be used to hedge for risk exposures involving contracts for physical delivery of electricity.

  - *Non-Firm Flexible Physical Contract*. In this category of non-firm contract, offers may be provided in the regional spot market, must be for amounts equal to or less than the maximum contracted amount for each period, and may include an offer to pay up to the complete amount of the variable transmission charges associated with the energy flows.

[299] Interview with Claudio Artavia, Executive Secretary, Central American Electrification Council (CEAC), May 19, 2010.
[300] For example, Philippe Benoit and Juan Miguel Cayo, World Bank, "Desafíos y Oportunidades del Sector Energético en Centroamérica," (presentation, WB-SICA Ministerial Workshop, "Challenges and Opportunities for the Energy Sector in Central America," Panama City, May 26, 2010).
[301] CRIE, "Reglamento del Mercado Eléctrico Regional (MER)," Resolution CRIE 09-2005, sections 1.3.4, 1.3.6, and 1.3.7, http://www.crie.org.gt/files/rmer.pdf.

According to Edgardo Calderón, Director of the Unidad Ejecutora of SIEPAC,[302] the contract descriptions contained in the RMER do not provide a format for a contract per se but do provide the criteria for the development of the contracts. Clearly, the contract types identified could provide the framework for regional contracts involving generation based on renewable resources, including intermittent resources such as wind as well as resources such as geothermal facilities that can provide firm energy.

- *Supporting development of regional projects*. At the Ministerial Workshop in Panama City, Costa Rica's Minister of Energy and Environment Teofilo de la Torre urged his colleagues to support the development of new generation projects for the region to create surpluses that could feed SIEPAC. The ministers agreed to assign CEAC the responsibility of formulating a framework for the development of regional projects,[303] which would be private-sector initiatives large enough to supply more than one offtaker.[304] An important challenge associated with regional projects, particularly hydroelectric facilities, is that they impose considerable local impacts while dispersing benefits at the regional level. Some observers have also pointed out that the region has attempted to foster implementation of a regional project in the past: during the administration of President Vicente Fox of Mexico, the proposal to build a regional refinery was debated but eventually collapsed because the countries could not agree on where it should be located. There may be conflict over the location of the project among the countries as well as within them.

- *Tailoring procurement processes to limit purchases to renewable energy resources*. Several countries, notably El Salvador, Panama, and conceivably Costa Rica will conduct competitive tenders for new generation capacity in the next year to year and a half. El Salvador has delayed issuance of a tender for 320 MW of long-term PPA as part of the transition to a market based primarily on contracted supplies and could tailor the bid to require a percentage of renewable energy generation, provided SIGET gives its approval. There may be too little time to achieve this, however, as SIGET reported that it intended to issue the tender before the end of 2010.[305] Similarly, Panama's SNE has indicated that it will issue a tender for 150 MW of wind capacity before the end of the year, although there is also the issue of whether it would be legal for the tender to specify a particular technology.[306] Costa Rica, meanwhile, has considerable experience with bids tailored to a specific technology. These procurement processes offer an opportunity for the countries involved, as well as others, to work jointly to establish common principles and regulations for procurement that would include the capacity to specify a particular generation technology.

- *Strengthening bilateral interconnections*. Although SIEPAC provides a substantial increase in transfer capacity between countries, officials at EOR stress that the initiation of operations at SIEPAC does not imply that upgrades at the existing interconnections are no longer

[302] Interview with Edgardo Calderón, Director, Unidad Ejecutora del SIEPAC (Costa Rica), August 20, 2010.
[303] Interview with Jorge Vásquez, Director, Energy Coordination Unity, SICA (El Salvador), June 1, 2010.
[304] Interview with Claudio Artavia, Executive Secretary, Central American Electrification Council (CEAC), May 19, 2010.
[305] Interview with Napoleón Alfaro, Head of Wholesale Markets and Carmen Elena Torres, Head of Concessions, SIGET (El Salvador), May 31, 2010.
[306] Interview with Juan Urriola, Minister of Energy, and Fernando Díaz, Director of Electricity and Energy Policy, SNE (Panama), May 24.

necessary. On the contrary, they note that SIEPAC's ability to operate reliably means that contingencies must be in place to handle power flows when and if parts of SIEPAC have to go off line. To avoid operational difficulties, the existing interconnections will have to be available as alternate pathways for power flows. Of particular concern are the national grids of Honduras and Nicaragua, but other problem areas exist, including El Salvador, where there are circuit limitations for north-to-south flows, as well as the Guatemala-Mexico interconnection, where the existing transformer is insufficient. This will require upgrades at several of the interconnections. The cost of executing the upgrades has emerged as a potential point of contention, says EOR, because some national regulators are reluctant to sanction costs that would be passed along to domestic end users—posing another instance of national resistance to incurring costs locally when the benefits are perceived at the regional level.[307]

- *Accelerating energy efficiency initiatives*. While the acceleration of energy efficiency initiatives in the region is important from the standpoint of economic efficiency at the end user and macroeconomic levels, as noted above, it is also important from the standpoint of speeding up the buildup of surplus capacity from existing plants in order to expand electricity exports in the near term. The challenge, to the extent that there is one, is that of achieving a coherent and comprehensive economic analysis of the costs and benefits of aggressively promoting energy efficiency at the national level in order to justify the necessary outlays of financial resources for the programs, which would ultimately have to be sanctioned by the financial authorities in each country.

[307] Interview with José Hernández, Planning Manager, William Martínez, and Edgar de Assis, Ente Operador Regional (El Salvador), May 28, 2010.

This section reviews region's experience of the region with carbon markets, particularly the CDM but also with reference to the voluntary carbon markets, and notes why some countries have been more successful than others in registering projects. The section also provides an overview of the potential for emission reductions from energy and land-use projects and describes recently articulated policy priorities and emerging ones, including the apparent divide between countries favoring mitigation as opposed to adaptation and the implications of this divide for regional strategies.

5.1 BACKGROUND ON THE CARBON MARKET

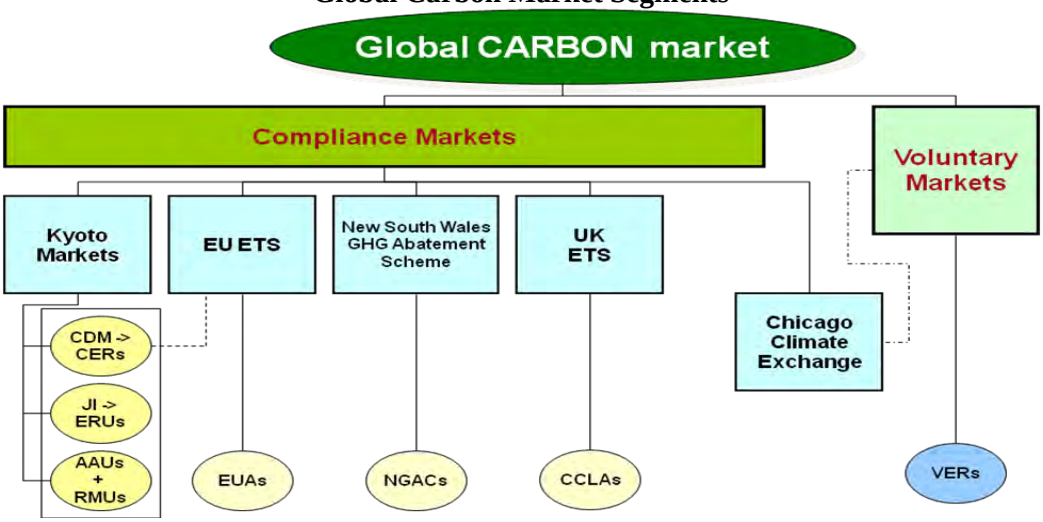
The "carbon market" is a collection of diverse and fragmented markets on which quantities of GHG emission reductions and emission allowances are exchanged. GHG emission reductions are generated and exchanged through projects or activities that reduce or avoid emissions of GHGs, whereas emission allowances represent rights to release emissions of GHGs under a cap-and-trade system. The most commonly traded project-based GHG emissions reductions are Certified Emission Reductions (CERs), Verified Emission Reductions (VERs), and Emission Reduction Units (ERUs); the most commonly seen allowances are EUAs (units traded in the European Union Allowance system).

GHG Emissions Reductions or Carbon Offsets

- One emission reduction or carbon offset represents one metric ton of carbon dioxide equivalent (CO_2e) reduced or avoided through specific project activities.
- CO_2e is the universal unit of measurement used to indicate the global warming potential of each of the six GHGs (CO_2, CH_4, N_2O, SF_6, PFCs, and HFCs) regulated under the Kyoto Protocol.
- To be certified, a carbon offset must be real, measurable, verifiable, and additional to any emission reductions that would occur in the absence of the project activity.
- The most common carbon offset is a Certified Emission Reduction (CER), a unit of Greenhouse Gas emission reductions issued pursuant to the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The trading of emission reductions is driven both by compliance at international, regional, or national levels and by voluntary initiatives. Thus, the global carbon market is composed of compliance and voluntary markets, as seen in the figure below.

Global Carbon Market Segments



Source: http://www.wasteconcern.org.

5.2 MARKET SEGMENTS AND FLEXIBILITY MECHANISMS

5.3 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The UNFCCC, signed in 1992, is an international agreement established to stabilize GHG concentrations in the atmosphere. Parties to the Convention are divided into those countries with mandatory emissions reductions targets, called Annex I countries (all developed countries and countries with economies in transition), and those countries without mandatory targets, called non-Annex I countries (developing countries). To further the goals of the UNFCCC, the Kyoto Protocol was adopted at the third Conference of Parties in 1997. The Kyoto Protocol came into force on February 16, 2005, and covers a basket of six greenhouse gases (CO_2, CH_4, N_2O, SF_6, PFCs, and HFCs) for which Annex I parties have binding emission reduction targets below a 1990 baseline during the period 2008–2012. Each Annex I party has its own reduction target, ranging from an 8% reduction to a 10% increase from the 1990 base year. The average reduction commitment is 5.2% for all Annex I parties.

5.3.1 Flexibility Mechanisms of the Kyoto Protocol

The Kyoto Protocol established three “flexibility mechanisms” to allow industries and countries to have more and lower-cost options for reducing emissions. These mechanisms are:

- Joint Implementation (JI)
- Clean Development Mechanism (CDM)
- International Emissions Trading (IET)

JI and CDM are project-based mechanisms that involve developing and implementing projects that reduce GHG emissions overseas, thereby generating carbon offsets that can be sold on the carbon market. Under JI, Annex I parties can invest in projects that reduce emissions or remove carbon from the atmosphere in other Annex I parties, predominantly countries in transition, in return for ERUs.

The CDM allows for the purchase of CERs by regulated or other entities such as Annex I countries from projects (such as renewable energy, energy efficiency, fuel efficiency, waste management, and forestry activities) in non-Annex I ("host") countries as a means of complying with domestic emission limits in the Annex I country. The objectives of the CDM are to assist Annex I countries in reaching their emissions reduction targets and promote sustainable development objectives in non-Annex I host countries. The main advantages for countries hosting CDM projects are foreign investment, technology transfer, and contribution to sustainable development.

IET, the third flexibility mechanism proposed by Kyoto, allows for direct trading of emission allowances between Annex I countries. Only Annex I governments with emissions limitations and reduction commitments can participate in this market. The units traded by governments are Assigned Amount Units (AAUs). The acquisition and trading of these units is tracked by a registry system under the Protocol.

5.3.2 European Union Emission Trading Scheme (EU ETS)

The European Commission developed EU ETS as a means for European nations to achieve their Kyoto commitments and beyond. Through the EU ETS, which was launched on January 2005, member states target private-sector emissions sources as part of their efforts to reach their Kyoto targets (aside from this market, they may also use energy-efficiency standards and other policy mechanisms to reach their targets). The first phase of the EU ETS began with its inception in 2005 and ran until 2007; the second phase coincides with the first commitment period of the Kyoto Protocol, 2008–2012. Over this period, emissions from mandated installations (about 40% of EU emissions) are capped at 6% below 2005 levels. Participants can meet this target by internally reducing emissions, purchasing EUAs in the market, or acquiring CERs and ERUs (within a 13% average limit of their allocation over 2008–2012). The European Commission has already signed legislation to extend the EU ETS to 2020, and there is clear political commitment to extend the scheme progressively to 2030 and 2050. It is expected that the EU will target a reduction level of 21% below 2005 or higher for 2020, depending on the international community's progress in reaching an agreement on climate change for post-2012.

5.3.3 Other Markets

Japan, Australia, New Zealand, and the United States have also set up or plan to set up market schemes to trade GHG reductions as a means to achieve their voluntary or mandatory reduction targets.

5.3.3.1 Japan

In a major shift in its climate policy, Japan has been considering the implementation of a mandatory emissions trading scheme, introducing a carbon tax, and putting in place a feed-in tariff for all renewable energy sources. This proposed program has faced opposition in Japan, which to date has only worked with voluntary market mechanisms. The most active of these programs has been the Japan-Voluntary Emissions Trading Scheme (JVETS), under which companies receive subsidies to implement mitigation activities in line with voluntary commitments and can also use emissions trading and buy offsets to meet their commitments. Under the Copenhagen Accord (see Section 5.3.1), Japan has pledged the most ambitious target

of all developed countries, a 25% reduction of absolute emissions by 2020 below 1990 levels, despite its low emission intensity per capita. The new program has yet to be passed into law.

5.3.3.2 Australia

Until very recently, Australia had made significant progress towards establishing its Carbon Pollution Reduction Scheme (CPRS), a national economy-wide GHG trading scheme that would have covered approximately 75% of Australia's emissions and allowed the country to stay on track to meet its mid-term target of reducing GHG emissions by at least 5% below 2000 levels by 2020. However, in April 2010 the government announced the postponement of this system until 2012, when it would be re-examined. The reasons behind this decision are domestic political deadlock and the uncertainty on future international climate policy.

5.3.3.3 New Zealand

New Zealand has set up the New Zealand Emissions Trading Scheme (NZ ETS), under which the six GHGs will be progressively regulated in all sectors of the economy by 2015. New Zealand moved early on forestry, which has been covered since 2008, and it plans to phase in stationary energy, industrial process, and liquid fossil fuels in 2012. However, the existence of this market will depend on other developed countries' commitment to establishing similar regulations.

5.3.3.4 China

Although it is not an Annex I country, China has announced that it is set to begin a domestic carbon trading programs during its 12th Five-Year Plan period (2011–2015) to help it meet the 2020 carbon intensity target that it submitted to the Copenhagen Accord. The decision was made at a closed-door meeting chaired by Xie Zhenhua, Deputy Director of the National Development and Reform Commission.[308] According to industry analysts, China considers putting a price on carbon to be a crucial step to employing the market to reduce its carbon emissions and genuinely shifting to a low-carbon economy.

5.3.3.5 United States

In expectation of the passage of federal regulation in the United States and as a result of the growing momentum of regional initiatives such as the Regional Greenhouse Gas Initiative (RGGI), which increased almost ten-fold to USD 2.2 billion, carbon market activity in North America grew almost four-fold in 2009.[309] However, the passage of regulation in the United States appears to be stalled for the time being.

In 2009, the international carbon market received positive signals and demand increased for U.S. offsets when the U.S. House of Representatives passed the Waxman-Markey Bill (June 2009),

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[308] "China to Start Carbon-Trading Program in 2011–2015, Daily Says," Bloomberg News, July 22, 2010, http://www.bloomberg.com/news/2010-07-21/china-to-start-carbon-market-trading-program-in-2011-2015-daily-says.html.

[309] Alexandre Kossoy and Philippe Ambrosi, "State and Trends of the Carbon Market 2010," World Bank, May 2010, http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf.

which would impose a mandatory economy-wide cap-and-trade scheme to reduce GHG emissions to 17% below 2005 levels by 2020 and 83% below by 2050. In contrast to other proposed emissions trading schemes, this bill established the eligibility of Reduced Emissions from Deforestation and Forest Degradation (REDD) offsets for the achievement of reduction goals. Unfortunately, toward the end of 2009 Congress failed to maintain momentum for the passage of climate change legislation. In an effort to reactivate progress toward federal regulation, in 2010 Senators John Kerry (D-Mass.) and Joseph Lieberman (I-Conn.) sponsored a multi-partisan bill that also seeks to reduce U.S. emissions economy-wide by 17 % below 2005 levels by 2020 and creates a cap-and-trade scheme that covers utilities starting in 2013 and expands to manufacturing in 2016. Emitters are allowed to use annually up to 1.5 billion of domestic offsets and 500 million of international offsets, which can include REDD instruments.

On July 24, 2010, the Senate announced that it would delay action on a climate bill until the fall. Hopes that climate change legislation will be approved this year are fading away as the Senate delays decisions, the November mid-term elections approach, and Congress invests its efforts in other legislative priorities. In addition, the divide in Congress between those who prefer to a rules-based approach and those who favor a cap on emissions seems to be strengthening. As columnist Thomas Friedman notes, the greater risk is that if a serious energy bill is not passed by this Congress and Republicans retake the House and Senate, the United States may not have another chance until the next presidential term or "until we get a 'perfect storm'—a climate or energy crisis that is awful enough to finally end our debate on these issues but not so awful as to end the world."[310]

5.4 FUTURE OF THE CLIMATE CHANGE NEGOTIATIONS

5.4.1 Copenhagen Accord

The main outcome of the 15th Conference of the Parties (COP 15) last December at Copenhagen was the Copenhagen Accord, a four-page agreement driven primarily by President Barack Obama and supported by China, India, and South Africa, to establish the initial building blocks for a future international climate change agreement.

The Copenhagen Accord is not a legal document and does not define a post-Kyoto scheme, nor does it establish global emission reduction targets until 2020 or 2050. However, it does outline the main objectives that would characterize a future climate change treaty and establish a "global umbrella" for domestic pledges. Some of the key pillars and goals of the Copenhagen Accord include:

- Target of a maximum temperature increase of two degrees Celsius, held by scientists as the maximum temperature that would avoid disastrous climate change
- Clear mandate for data transparency, accounting, and accountability of global pledges
- Provision of incentives to low-emitting economies so they continue developing on a low-emissions pathway

[310] Thomas L. Friedman, "What 7 Republicans Could Do," *New York Times*, July 20, 2010, http://www.nytimes.com/2010/07/21/opinion/21friedman.html.

- Need for the immediate establishment of a REDD-plus mechanism and the mobilization of financial resources from developed nations to move forward
- Implementation by Non-Annex I countries of mitigation actions, including inventories that will be reported every two years and be subject to domestic measurement, reporting, and verification
- Elaboration by developing countries of nationally appropriate mitigation actions (NAMAs) that will be recorded and subject to international monitoring and verification

The Copenhagen Accord also committed Annex I countries to submitting economy-wide emissions pledges for 2020 by January 31, 2010. To date, most countries have submitted these targets; however, the domestic pledges would not meet the two degree Celsius target of the Copenhagen Accord and at best would limit the temperature increase to 3.7 degrees. Notably, COP 15 prioritized small island states, least-developed countries, and Africa in the financial agreement prepared as part of the Copenhagen Accord, thereby leaving Central American countries far down the priority list for mitigation and adaptation funding.

5.4.2 Post-Kyoto or No-Kyoto?

The hopes of passing U.S. climate change legislation in 2010 seem to be slowly disappearing as certain actions, such as the U.S. Senate's decision to shelve any action on climate change regulation until the fall, take center stage. To make matters worse, other developed countries (such as Australia and Japan) are also facing difficulties passing legislation, or the schemes' entry into force are predicated on the passage of U.S. legislation, as is the case of New Zealand. Western Europe had offered to deepen its target to 30% by 2020 if an international commitment is reached, but it has since returned to its 20% reduction pledge in light of a lack of international commitment to address climate change.

Given this gloomy international scenario, Christiana Figueres of Costa Rica, appointed to the Executive Secretary role of the UNFCCC Secretariat on May 17, 2010, has re-set expectations and expects to deliver a global agreement by COP 17 in South Africa. Figueres will then focus COP 16 (Cancun) to deliver on specific pillars of the Copenhagen Accord, such as international finance, REDD, or CDM reform. The absolute priority for the international community should then be to avoid a gap between the end of first commitment period of the Kyoto Protocol and the next regime post-2012.

5.5 THE CARBON MARKET IN CENTRAL AMERICA: COUNTRY-BY-COUNTRY ANALYSIS

Most of the Central American countries have one GHG inventory, except for Costa Rica, which already has three GHG inventories. El Salvador, Panama and Nicaragua are in the process of elaborating their second GHG inventory. However, as noted by Gabriel Quadri, Regional Manager for Mexico and Central America for EcoSecurities, all of the inventories in the region are "incomplete and obsolete."[311] The newest GHG inventory is Costa Rica's second inventory, which uses 2000 data; the other GHG inventories are based on data that is more than a decade old. As can be seen in the table below, most of the countries' inventories data back to 1990 and 1994.

[311] Interview with Gabriel Quadri, Regional Manager for Mexico and Central America for EcoSecurities, June 7, 2010.

CO_2 Emissions Inventory by Country and Source

	Total	Energy	Industrial Processes	Agriculture	Change in Land Use	Waste	Data
Belize	2,994.10	617.53	1.74	58.81	2,056.37	259.66	1994
Costa Rica	2,321.60	5,688.60	672.50	4,603.90	-3,667.70	1,320.90	2000
El Salvador	8,644.94	4,224.18	490.12	n.a.	3,930.64	n.a.	1994
Guatemala	10,966.54	3,700.40	544.66	2,727.30	3,244.55	638.10	2000
Honduras	10,861.53	3,570.46	514.72	2,740.70	1,348.05	2,687.60	1995
Nicaragua	9,080.98	2,373.54	354.84	4,193.90	1,830.90	327.80	1994
Panama	18,787.96	5,873.12	412.94	1,992.90	8,902.50	1,606.50	1994
Region	63,657.65	26,047.83	2,991.52	16,317.51	17,645.31	6,840.56	

Source: Prepared by author with data from UNFCCC National Communications.

From a regional standpoint, the fact that the data correspond to different base years means that the information is not easily comparable, which complicates the elaboration of regional trends in emissions. According to Quadri, CEPAL in Mexico has already done some work with inventories, and the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) has a good understanding of deforestation trends in the region. The Comisión Centroamericana de Ambiente y Desarrollo (CCAD) could also prove very useful in this endeavor.

One of the barriers encountered by Central American countries in the elaboration of inventories is the lack of or slow flow of funds for the development of such studies. According to Eduardo Reyes, former head of Panama's DNA, the flow of funding from GEF and other institutions is not regular, and therefore countries cannot plan effectively to prepare their national communications, GHG inventories, NAMAs, and National Adaptation Programs of Action (NAPAs). Other obstacles encountered by countries in Central America when developing GHG inventories are a lack of data, lack of effective national data systems, institutional deficiencies, and deficiencies and irregularities in financing.

A review of the sources of emissions covered reveals a common pattern among the different GHG inventories. All of them focus primarily on five sources of emissions: energy, industrial processes, agriculture, land-use change and forestry, and waste. In addition, the highest emissions appear to correspond to land-use change and forestry, energy, and agriculture; within energy, transportation appears to have higher emissions than the electricity sector for some of the countries.

Regarding the Central American countries' progress toward the development of NAPAs and NAMAs, the only country that has taken efforts in this regard is Costa Rica, which has already signed four NAMAs.

As suggested by Quadri, a potential model on how different countries' inventories could be compared using the same base year would include data that is disaggregated by sectors more according to policy regulation.

Potential Model for GHG Inventories Disaggregated by Sector and Using Same Base Year

		BZ	CR	SV	GU	HN	NI	PA
Base Year (same)								
Transport	Emissions from the transportation sector							
Electricity	Emissions from the generation, transmission, and distribution of electricity							
Industry	Direct emissions from industry, excluding use of electricity							
Industrial processes	Direct emissions from industrial processes (cement, steel, beverages, etc.)							
Residential and services	Emissions from households and service industries							
Agriculture and cattle	Agriculture-related emissions (e.g., methane from anaerobic digestion, CO_2 from land clearing, and N_2O for fertilizer applications). Cattle emissions are dominated by enteric emissions							
Waste	Emissions from treatment of urban waste and wastewater and CO_2 release for incineration of waste							
SUBTOTAL								
Deforestation	Gross emissions related to loss of land due to deforestation							

5.5.1 Belize

In 2002, Belize submitted its first (and only to date) National Communication to the UNFCCC, which also contains the country's first national GHG inventory using 1994 as its base year. According to this inventory, the main sources of GHG emissions are land-use change and forestry (69%) and energy (21%).

Land-use change and forestry emissions come primarily from burning during clearance and from the soil during cultivation. Emissions in the energy sector are primarily driven by fossil-fuel combustion in road transportation (53% of sectoral emissions and 11% of total national emissions) followed by energy production (22% of sectoral emissions and 5% of total national emissions). This inventory predates the introduction of the Mollejon hydroelectric facility, which reduced emission from electricity production.[312] Belize has not started efforts to develop NAMAs and NAPAs.

Belize GHG Emissions Inventory (Gg), 1994

Sector	Gg	% of Total
Energy	617.528	21
Industrial processes and solvents	1.735	<0.1
Agriculture	58.807	2
Land-use and forestry	2056.365	69
Waste	259.66	9

Source: UNFCCC National Communication.

[312] Government of Belize, "First National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change," July 2002, http://unfccc.int/resource/docs/natc/blznc1.pdf.

5.5.2 Costa Rica

To date, Costa Rica has three national GHG inventories with 1990, 2000, and 2005 as respective base years. The first GHG inventory was submitted as part of Costa Rica's first National Communication to the UNFCCC. The last two inventories (2000 and 2005) were developed as part of the country's second National Communication to the UNFCCC, which was submitted in October 2009. Costa Rica is the only Central American country that has developed two National Communications and that has an inventory based on data less than five years old.

Costa Rica's second national GHG inventory shows that the three main sources of CO_2 emissions using 2000 data are energy, agriculture, and land-use change.

Costa Rica GHG Emissions Inventory (Gg), 2000

Sector	CO_2	CH_4	N_2O	HFC	CO	NOX	NMV OC	SO_2	Total CO_2e
Energy	5492.7	4.9	0.3	NA	246.4	25.1	37.6	4.5	5688.6
Industrial processes and solvents	496.6	NA	NA	0.121	NA	NA	31.4	0.38	672.5
Agriculture	NA	100.4	8.05	NA	1.07	0.025	NA	NA	4603.9
Land-use and forestry	-3667.7	6.93	0.05	NA	60.6	1.72	NA	NA	-3506.7
Waste	NA	62.9	NA	NA	NA	NA	NA	NA	1320.9
Total	2321.6	112.2	8.4	0.121	308.1	26.8	69	4.9	
Total CO2e	2321.6	2356.8	2604	175.9	ND	ND	ND	ND	8779.2

Source: UNFCCC National Communication.

The energy sector is responsible for net CO_2 emissions of about 5,700 gigagrams (Gg) in 2000. The agricultural sector is responsible for about 4,600 Gg in CO_2 emissions. As shown in the inventory, agriculture accounts for 90% of methane emissions, mainly from enteric fermentation of farm animals, and 96% of nitrous oxide emissions.

The forestry and land-use change sector is responsible for a net CO_2 absorption of approximately 3500 Gg in 2005. This is a result of change in forest biomass (absorption of 1,606.9 Gg CO_2), and abandonment of cropland followed by regeneration of vegetation (absorption of 3,732.3 Gg CO_2). Deforestation activities have decreased in Costa Rica due to a government policy of conservation and forest improvement adopted in the 1980s leading to a 0.4% average annual deforestation rate for 1990–2005.[313] Further, to date Costa Rica has only developed emission reductions projects in the energy sector under the CDM. However, Costa Rica has signed NAMAs in four areas: transport, energy (generation), efficiency, and landfills.

5.5.3 El Salvador

El Salvador has developed two national GHG inventories using 1994 and 2000 data. El Salvador is currently developing a second National Communication that will also contain an updated GHG inventory using 2005 data. According to Jose Francisco Rodriguez of MARN's Office of Climate Change (El Salvador's DNA), the 2005 GHG inventory will include a comparative analysis with respect to the 2000 year inventory. In addition, Rodriguez noted that for future

[313] World Bank, "Costa Rica Country Note on Climate Change Aspects in Agriculture," December 2009.

inventories the National Information System on GHGs (SIN-GEI)[314] will be essential to improving data quality.

According to the country's updated national GHG inventory (2000) , land-use change and forestry represents the second-highest source of GHG emissions in the country (36% of total GHG emissions) in 2000 after the energy sector. The main source of CO_2 emissions from the land-use change sector is the conversion of forest and grasslands due to deforestation (49%); the average annual deforestation rate for 2002 for El Salvador is 4.6%, the second largest in the region after Haiti, driven primarily by land clearing for firewood and cattle grazing. The third-largest source of emissions reductions is agriculture.

El Salvador GHG Inventory (Gg), 1994

Sector	CO_2	CH_4	N_2O	CO	NOX
Energy	4224.18	18.09	0.52	437.48	31.03
Industrial processes and solvents	490.12				
Agriculture		88.14	12.69	70.65	2.86
Land-use and forestry	3930.64	0.52	0.0036	4.53	0.13
Waste		41.75			
Total	9644.94	148.5	13.21	512.66	34.02

Source: UNFCCC National Communication.

According to Rodríguez, the technical and institutional capacities available within MARN to elaborate national communications, GHG inventories, NAMAs, and NAPAs are very limited, and most of the efforts implemented are usually sub-contracted or done in coordination with external groups such as the Universidad Centroamericana (UCA) group, the Bariloche Foundation, and others. Moving forward, the goal of MARN is to institutionalize the work and studies necessary to have this technical capacity available within the MARN. Unfortunately, there is still insufficient funding to move in this direction, and GEF appears to be the only or the main institution that provides financing for this type of initiatives. However, it is not always possible to secure funding from GEF, and delays are possible. As a result, El Salvador has not started efforts to develop NAMAs and NAPAs.

5.5.4 Guatemala

Guatemala has developed only one national GHG inventory corresponding to the first and only National Communication that the country submitted to the UNFCCC in 2001. This first communication also included the results of studies of the vulnerability of forest and water resources to climate change and established options for reducing GHG emissions for the forestry sector.

Guatemala's first national GHG inventory was elaborated based on 1990 data; this is the oldest GHG inventory in the Central American region. The results of the GHG inventory outline the

[314] The Universidad Centroamericana (UCA) signed a contract for the Second Communication and since 2009 has been working on determining GHG emissions. The UCA made the 2000 inventory and is preparing the National Information System on GHGs (SIN-GEI) so that the information-gathering process is easier.

following as the principal sources of emissions: land use change and forestry (43.3%), transportation (28.3%), and manufacturing industry (10.8%).

Guatemala GHG Inventory (Gg), 2000

Sector	CO_2	CH_4	N_2O	CO	NOX
Energy	3,700	34.4	0.52	725.6	36.8
Industrial processes and solvents	544.6	-	-	-	-
Agriculture		129.8	19.7	193.1	5.6
Land-use and forestry	3,244	4.89	0.034	42.8	1.2
Waste		30.4	0.4		
Total	7,489.7	199.5	20.78	961.6	43.79
Absorption (LULUCF)	-42,903				

Source: UNFCCC National Communication.

It is difficult to draw serious conclusions about Guatemala's emission reductions potential today using the data available, which are 20 years old. Nevertheless, according to this first inventory, which is found in Section 3 of the Statistical Annex, land-use change and forestry is by far the largest contributor to GHG emissions in the country. The emission reduction potential of this sector is large but not sufficiently explored. A second important source of emissions in Guatemala is agriculture, where a number of emission reduction activities are already being studied or implemented. A third relevant source of emissions that has also not been explored sufficiently is the transportation sector. The high emissions in this sector result primarily from the country's national vehicle fleet composition, which is composed of second-hand and recycled units. In terms of the electricity sector, this first GHG inventory notes that these emissions are not as significant as emissions from other sectors due to the high participation of hydropower in the Guatemalan grid.

In addition, Guatemala has not started efforts to develop NAMAs and NAPAs.

5.5.5 Honduras

Honduras has developed only one national GHG inventory as part of its first National Communication to the UNFCCC published in 2001. According to this inventory, based on 1995 data, the main sources of emission reductions in Honduras are energy and land-use change and forestry.

Honduras GHG Inventory (Gg), 1995

Sector	CO_2	CH_4	N_2O	NOX	CO	NMVOC
Energy	3570.46	0.57	0.26	29.87	367.3	50.86
Industrial processes and solvents	514.72					32.65
Agriculture		130.51	2.066	2.52	55.034	
Land-use and forestry	1348.05	126.43	2.02	31.41	1106.2	
Waste		127.98	0.83			
Total	5433.23	385.49	5.18	63.8	1528.5	83.51

Source: UNFCCC National Communication.

5.5.6 Nicaragua

Nicaragua submitted its first National Communication to the UNFCCC in 2001, which established its first national GHG inventory with 1994 as its base year. A second national GHG inventory with base year 2000 has already been completed but is not yet publicly available; it will be released as part of its second National Communication.

As can be seen in the table below, the main sources of CO_2e emissions in Nicaragua are land-use change and forestry, agriculture, and the energy sector. For 1990–2000, Panama had an average annual deforestation rate of 1.6%, which is one of the highest in the Latin America and Caribbean region. The main driver for deforestation is agricultural expansion and grazing of livestock.[315] Emissions from the energy sector come primarily from the electricity and transportation sectors.

Nicaragua has not started efforts to develop NAMAs and NAPAs.

Nicaragua GHG Inventory (Gg), 1994

Sector	CO_2	CH_4	N_2O	Total CO_2e Emission	Total CO_2e Absorption
Energy	2373.54	296.45	64	2733.99	
Industrial processes and solvents	354.84			354.84	
Agriculture		4193.91	697.6	4891.51	
CUTS	-14784.09	1830.89	163.2		-12790
Waste		327.81	57.6	385.41	
Total	-12.05571	6649.06	982.4	8365.75	4424.25

Source: UNFCCC National Communication.

5.5.7 Panama

Panama has developed only one national GHG inventory corresponding to the first and only National Communication that the country submitted to the UNFCCC in 2001. Since 2005, Panama has been in the process of updating its first GHG inventory as part of its second National Communication but has not yet completed it because GEF has not yet released all the funds required to finalize it. Panama does not yet have a NAMA or NAPA in place, but according to Rene Lopez of ANAM, the government still needs to determine how best to proceed and will want to see the results of COP 16 in Cancun.

Panama's first national GHG inventory was prepared based on 1994 data. The results of the GHG inventory outline the following as the sources of emissions of CO_2e: land-use change and forestry (58.61%), energy (38.67%), and manufacturing industry (2.6%).

[315] World Bank, "Panama: Country Note on Climate Change Aspects in Agriculture," December 2009, http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&entityID=000333037_20100409032542&cid=3001.

Panama GHG Inventory (Gg), 1994

Sector	CO_2	CH_4	N_2O	NOX	CO	CVDM
Energy	5873.12	0.05		0.07	0.11	3.02
Industrial processes	412.94			0.01	0.31	1.95
Solvents and other products						0.61
Agriculture		94.09	8.87	1.57	22.01	
Land-use change	8902.5	59.69	0.41	14.83	522.31	
Waste		76.54	0.14			
Total	15188.56	230.37	9.42	16.48	544.74	5.58

Source: UNFCCC National Communication.

5.6 DNA CAPACITIES

All of the countries in this study have established DNAs. The majority have housed their DNAs within their ministries or authorities of environment and/or natural resources.

All of the DNAs are responsible for the review and approval of CDM projects and can take from 15 days to 6 months to complete the process. Most DNAs tend to be involved in the process only until registration, but in some cases, such as El Salvador, the DNA also accompanies the developer during the validation and verification process of their project. DNAs can become involved in systematic follow-ups with projects after registration on a case-by-case basis. Some DNAs, such as the Panamanian DNA, have additional requirements such as projects' commitment to investing CER revenues in sustainable development.

Most of the DNAs need additional support and funding to establish national capacity building plans and programs in order to deliver sound CDM training to all sectors and encourage additional activities such as Programmatic CDM (as in the case of El Salvador). Most DNAs are also in charge or have responsibilities associated with the development of National Communications, national climate change plans, inventories, NAMAs, and NAPAs. Funding is needed to create and institutionalize technical capacities within the DNAs for the development of the studies mentioned above.

5.6.1 Belize

Belize's DNA is represented by the National Meteorological and Hydrological Service, which is in charge of screening and approving CDM projects, a process that should take a maximum of four weeks according to DNA regulations. However, Belize has not registered any CDM projects as of yet and does not have any projects in the validation process.

5.6.2 Costa Rica

Costa Rica's DNA is the OCIC, housed in MINAET, which is also the country's environmental authority. MINAET also oversees the country's commitments to the UNFCCC.

Costa Rica's DNA created the country's national climate change plan in coordination with other institutions and is in charge of conducting research related to the GHG inventory, vulnerability studies and analysis of mitigation and adaptation measures, and research studies in preparation for the national communications. William Alpízar, head of the OCIC, noted that the OCIC once

had a staff of 25 people; today, there is only one person in charge due to a lack of support in Costa Rica for the DNA since 1998.[316]

Recently, the Costa Rican government marked the creation of a national strategy for climate change as a top priority for its 2006–2010 agenda. Through this national policy, all public institutions, local governments, and autonomous institutions must produce and execute short-, medium- and long-term action plans containing clear goals around the six main pillars of the strategy: mitigation, vulnerability and adaptation, precise metric system, development of national capacity and technology transfer, education and public awareness, and financing. The mitigation pillar's main goal is to make the country carbon neutral by 2021. The carbon-neutral program has been estimated to cost Costa Rica approximately USD 8 billion, which they expect to raise at a roundtable of developed countries that have been invited to the country for that purpose.

The push to become carbon neutral by 2021 would basically involve having national emissions equal to the sum of certified emissions reductions plus certified offsets, where offsets cannot exceed the amount of emissions reductions. According to Alpízar, the plan would basically involve creating an internal market for offsets. This would mean that Costa Rica would become an Annex I country in everything but name, which is not in the country's interest to do so formally, as it would lose access to resources allocated to non-Annex I countries."[317]

5.6.3 El Salvador

MARN has been the DNA in El Salvador since 2005. The UN Development Program (UNDP) supported the initial processes of the DNA, mainly through a study of deforested lands in El Salvador for the definition of land use change. The current focal point of the DNA is Francisco Rodriguez, who has been at the head of this organization for the last two years.

As the DNA, MARN is in charge of the local approval of CDM projects. The approval process takes approximately 15 working days, and the MARN accompanies the project developer in the whole process, during which a letter of no objection is granted to the developer. MARN also accompanies developers in the validation and verification process and in the elaboration of Project Idea Notes (PIN) before developers proceed to the Project Design Document (PDD) stage.

The MARN has only conducted general training on CDM, for example for the Salvadorian Industrial Association and several universities, and is working with organizations such as the UNDP on CDM capacity building activities and companies such as South Pole to provide CDM training to the industrial, commercial, transport, agricultural, and cattle rancher sectors. However, although all these efforts have been developed the MARN does not have a National Capacity Building Plan (NCBP) designed. They are looking for some additional support in order to design this NCBP in order to encourage Programmatic CDM.

The MARN is also responsible for finalizing the second National Communication and developing the Climate Change Strategic Plan, within which the NAMAs would be included.

[316] Interviews with William Alpízar, OCIC (Costa Rica), May10 and May 26, 2010.
[317] Phone interview with Mauricio Castro, EcoSecurities Costa Rica, Central America, May 10, 2010.

5.6.4 Guatemala

Guatemala's DNA office, the Oficina Nacional de Desarrollo Limpio (ONDL), is located within the Ministerio de Medio Ambiente y Recursos Naturales (MARN) and was created in 2001. During 2005 and 2006, the United Nations Environmental Programme Risø Centre and local NGO Fundación Solar carried out a project to create a fully operational CDM entity with clear and consistent rules and a portfolio of CDM projects in Guatemala. As the DNA, Guatemala's MARN is in charge of the local approval of CDM projects, which can take several weeks.

In terms of the promotion of the CDM, MARN has delegated this role to other organizations previously involved in the sector. For example, the MEM has created an information center and fund for renewable energy. Additional capacity building for CDM is furnished by the Asociación de Generadores de Energía Renovable, a local trade association that supports geothermal and hydro generation in the country. Fundación Solar works with communities to deliver electricity and has taken an active role in promoting CDM by sponsoring studies and giving presentations that explain carbon markets and Guatemalan potential.

5.6.5 Honduras

In Honduras, the DNA was created in 2004 and has always been in the hands of the Deputy Minister of Energy. At its inception, the Honduran DNA received support from UNDP and the Netherlands Development Organization regarding the elaboration of the procedures for review and approval of CDM projects and the issuance of letters of approval. Since its creation in 2004, the leadership of the Honduran DNA has changed three times. However, these changes have not led to setbacks on the work of the DNA.

As the DNA, the Ministerio de Energía is responsible for the local approval of CDM projects. The approval process may take from one to two months; the length of the process will depend on the completeness of the documentation presented by the project developer. The DNA's involvement in projects usually finishes after these have been approved; in some cases, the DNA conducts a systematic follow-up of certain projects.

With regards to CDM capacity-building activities, the Honduran DNA usually works directly with private companies or in bigger training sessions.

5.6.6 Nicaragua

MARENA is the national environment authority and is also the DNA through its Oficina Nacional de Desarrollo Limpio (ONDL).

The ONDL is lead by Suyen Pérez; she has been in this position since the second quarter of 2010. Her appointment generated some criticism in the press, given that she does not have previous experience in the carbon market and has limited experience with climate change generally.

5.6.7 Panama

The Panamanian DNA is represented by the Climate Change Unit (CCU) at ANAM. Since its creation, the CCU/ANAM has had two major changes in its leadership: at the beginning of the previous administration and at the beginning of the current one, which was instituted on July 1, 2009. The current administration has brought a new climate change team to the Panamanian DNA.

Eduardo Reyes, a former ANAM official, argues that Panama is probably ahead of other countries in the region in investing in a low-carbon economy in the region for two main reasons. First, he contends that the country's environmental legislation is already among the most stringent of Latin America, ensuring high levels of requirements and compliance (although follow-up and enforcement could be better). Second, ANAM's budget is one of the largest, with USD 42 million (from USD 12 million only a few years ago). This has reinforced the institution and it could potentially do more. [318] There is a clear need to update the current inventories, and USAID could provide assistance to the region in this respect. According to Reyes, the Centro del Agua del Trópico Húmedo para América Latina y El Caribe (CATHALEC), an association based in Panama, could play a major role in updating inventories and drafting NAMAs for the region.

CCU/ANAM is responsible for the approval of CDM projects, which by law should take a maximum of 180 days. The approval process starts when the developer undertakes the environmental impact study. Most CDM projects in Panama commit 20–30% of revenues from the CERs to sustainable development projects in the community.

In addition to the review of CDM projects, the CCU/ANAM is also responsible for the development and coordination of National Communications and GHG inventories. They are currently working on the second National Communication, which should be ready for COP 16.

Panama's National Climate Change Policy was articulated in 2007–2008 and identifies both adaptation and mitigation as important policy components. According to Lopez of ANAM, adaptation is a priority in Panama but cannot be to the exclusion of mitigation. Mitigation activities contribute resources for adaptation.

A recent Asociación Panameña de Ejecutivos de Empresas meeting gave the private sector and government the opportunity to discuss the current state of climate change negotiations and their relevance for Panama. There is an opportunity for the private sector to engage directly with the government going forward. The government welcomed the support of the private sector in handling the negotiations and drafting climate-friendly policies for the country.

[318] Interview with Eduardo Reyes, former CCU/ANAM, May 28 and June 8, 2010. As noted elsewhere, however, there have been opposite claims made regarding the integrity of the environmental review and permitting process in Panama, especially under the current administration.

5.7 CENTRAL AMERICA'S CLIMATE CHANGE POLICY STANCE

Central American governments have invested a great deal of effort and time in the CDM over the years. They were early movers, particularly Costa Rica, which has been at the forefront of carbon mitigation for 30 years. Except for Belize, all countries in the region have developed a pipeline of projects, which clearly demonstrates a systematic effort to engage and take advantage of the carbon market and its mechanisms. Unfortunately, the rather disappointing results of their participation in the CDM, such as low levels of registration and issuance of CERs (less than 15% on average), have led some governments in the region to question whether market mechanisms are indeed the way forward to curb emissions. Specifically, El Salvador and Nicaragua, which have been seen in international negotiations aligning with Venezuela and Bolivia (the ALBA countries),[319] advocate for the creation of an adaptation fund (financed by developed countries) that can then be administered by governments to combat climate change. While they also dispute the usefulness of market mechanisms going forward, they will probably be not opposed to one that is voluntary. Belize, Guatemala, Honduras, and Panama appear to be in favor of implementing both mitigation and adaptation measures financed by developed-country money that flows either by market mechanisms or otherwise.

Some actors highlight a clear ideological divide between countries on mitigation and adaptation that could represent a barrier for the development of low-carbon technologies in the future. However, the divide is not so much one of ideology as practicality. All governments in Central America recognize that mitigation and adaptation go hand in hand; the real issue for them comes down to what vehicles and instruments to put into practice for mitigation and adaptation strategies. Some interviewees noted that the best adaptation strategy is an effective mitigation strategy, and this view needs to be articulated and discussed openly with El Salvador and Nicaragua. In any case, if the adaptation fund supported by El Salvador, Nicaragua, and the ALBA countries were to be implemented, one would expect that the programs implemented to disburse funds would be similar to those for developing NAMAs, but they could serve both mitigation and adaptation strategies. In order for the region to move forward with discussion on mitigation and adaptation strategies and how to implement both, regional integration and leadership needs to be strengthened.

5.7.1 Copenhagen Pledges

The Central American countries that signed the Copenhagen Accord were Belize, Costa Rica, Panama, and Guatemala (the latter signed, but with a signing statement). El Salvador, Honduras, and Nicaragua abstained from signing the Accord.

Among the countries that signed the Accord, Costa Rica is the only country in Central America that submitted a preliminary pledge, in which it announces its intention to seek carbon neutrality by 2021. To move forward in support of this pledge, Costa Rica is currently in the process of identifying the most relevant sectors for GHG emission reductions and concrete policies and measures that would likely be designed as specific NAMAs. However, the country already has a preliminary list of target sectors, which include transportation, energy, forestry, and waste

[319] Venezuela and Bolivia, the so-called ALBA countries, which appear to retain a "G-77 mentality", by which they wouldn't be in a position to do anything that they are not paid to do, and have an overwhelming preference for adaptation measures

management. This initial list does not preclude additional sectors when more specific and clear data are available.

Costa Rica mentions the need for financing from diverse sources (overseas development assistance, grants, soft loans, private investments, and climate-related market funds) in order to allow immediate and scaled-up action toward carbon neutrality and to support policy and capacity development and implementation. Preliminary estimates indicate that it will cost Costa Rica approximately 1% of their annual national GDP (or USD 8 billion) to implement the package of activities to achieve carbon neutrality.

El Salvador, Honduras, and Nicaragua have not signed the Copenhagen Accord but have expressed their continued support for the Kyoto Protocol in a post-2012 scenario. El Salvador and Honduras are inclined to continue supporting the Kyoto Protocol and to append more countries; for them, a structure is already in place and to start a new initiative would require additional resources and efforts. This raises some questions as to what their position would be if the international community decides to depart from the Kyoto mechanism in Cancun and subsequent COPs. El Salvador did express its disappointment with the COP 15 decision to prioritize small island states, least-developed countries, and Africa in the financial agreement prepared as part of the Copenhagen Accord, thereby leaving Central American countries far down the priority list for mitigation and adaptation funding. MARN in El Salvador has not received further instructions for future negotiations, and they are waiting to define new policies for future climate change within the Copenhagen Agreement framework. Similarly, Honduras is still in the process of preparing their official position for Cancun.

Nicaragua's recently appointed head of climate change, Suyén Pérez, suggested in an interview that Nicaragua's position regarding mitigation and adaptation is more pragmatic than many observers have suggested.[320] Nicaragua is pushing for a climate change policy framework oriented toward adaptation and mitigation activities implemented at the local level, particularly in forestry and fisheries. One of the country's current plans is a Program of Activities to be implemented in the forestry sector with support from the World Bank.

5.8 CDM UPTAKE

The country with the most success in terms of number of registered projects is Honduras, followed by Guatemala. In third place are Panama, Costa Rica, and El Salvador with six registered projects each. At the end of the list is Belize, which does not have any registered projects or projects in validation. The country with the highest rate of issuance (defined as the volume of CERs issued in aggregate for the country's portfolio as a percentage of the country's total volume of CERs expected through 2012) is Nicaragua (13%), followed by El Salvador (12%). Across all countries, the sectors targeted by CDM projects are similar.

[320] Interview with Suyén Pérez, CCU/MARENA (Nicaragua), May 27, 2010.

CDM Projects in Central America

Country	Registered	In Validation	Validation Terminated	Withdrawn	Rejected	Issuance Rate
Belize	0					0%
Costa Rica	6	3				1.5%
El Salvador	6	1		1		12%
Guatemala	11	6	3		1	10.3%
Honduras	16	14			3	6.8%
Nicaragua	4	4	1			13%
Panama	6	12	3		1	0%

Source: Fenhann, UNEP Risø.

5.8.1.1 Costa Rica

Costa Rica has been at the forefront of carbon mitigation for 30 years. Ironically, this pioneering spirit has undermined Costa Rica's involvement in the CDM. Many of the projects that in other countries were not business as usual and therefore qualified for carbon credits had already been implemented or were required by law in Costa Rica. Therefore, proving additionality for renewable energy and energy efficiency projects in Costa Rica has been difficult.[321]

To date, Costa Rica has only registered a total of six GHG emission reduction projects, representing a very small share of projects (1%) in the Latin America and Caribbean region, and has three projects in validation that could be soon approved by the CDM Executive Board (CDM EB). This pipeline of nine CDM projects has a GHG emission reduction potential of close to three million tons of CO_2e until 2012. According to UNEP Risø, this potential could double if one were to consider crediting periods until the year 2020. The portfolio of Costa Rican projects is composed of a diverse mix of clean technologies, including two landfill gas projects (the first one was registered in 2004 and has the highest potential for emissions reductions), three hydropower projects, two wind projects, and two biomass projects. The table in Section 3 of the Statistical Annex provides a detailed list of Costa Rica's current CDM pipeline.

Although Costa Rica has registered projects since 2003, only the Puntarenas biomass project has issued CERs. This project issued 46,000 CERs corresponding to the September 2008–September 2009 period. This issuance represents only 1.5% of the total issuance potential of the Costa Rican CDM pipeline until 2012.

All of the projects registered by Costa Rica are associated to activities in the energy sector. Currently, there are no registered CDM projects in the agricultural sector in Costa Rica, nor are there projects registered under afforestation and reforestation. This is a shortcoming given the sector's impact on GHG emissions in the country.[322]

Costa Rica's experience in getting projects registered has been difficult, costly, lengthy, and often unsuccessful. According an ICE representative, one of the main challenges for projects to

[321] Phone interview with Mauricio Castro, EcoSecurities Costa Rica, Central America, May 10, 2010.
[322] World Bank. "Costa Rica: Country Note on Climate Change Aspects in Agriculture," December 2009, http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&entityID=000334955_20100408022152&cid=3001.

access the CDM has been the high percentage of renewable energy already in the generation mix.[323] This has required considerable effort to reach registration, and ICE has not been willing to make the effort. This is illustrated by the fact that two similar hydropower projects in Costa Rica, La Joya and Carizblanco, were built, but only La Joya, which was developed by a private firm (Unión Fenosa) reached registration. The other project was developed by ICE.[324] Another challenge for Costa Rica in the CDM has been the relatively small size of many of their projects, which has posed a burden in terms of the transaction costs for securing approval and registration.[325]

5.8.1.2 El Salvador

El Salvador has six CDM registered projects, one project at validation, and one project withdrawn. The six CDM projects registered are all in the energy sector, including one landfill, two hydroelectric plants, two geothermal plants, and two biomass energy generation activities..

El Salvador's pipeline of projects has a GHG emission reduction potential of close to 3.5 million tons of CO_2e until 2012. According to UNEP Risø, this potential could grow to 8.5 million tons of CO_2e if one were to consider crediting periods until 2020. In terms of actual carbon credit generation, to date only two of El Salvador's projects have issued CERs. This issuance is equal to 12% of the portfolio's total CER potential until 2012.

El Salvador also has experience in the voluntary market. Its voluntary projects cover a number of technologies, such as geothermal energy, REDD at a coffee plantation, and a landfill, are being developed in El Salvador. The Banco Multisectorial de Inversiones is supporting this process.

El Salvador has chosen to use the voluntary market for various projects due to bureaucratic problems with the CDM process (developers expect to encounter fewer requirements to fulfill the necessary documentation in the voluntary market than in the CDM), the non-application of REDD to the CDM, the lack of skilled firms at the national level for the validation and verification of CDM projects, and higher transaction costs.

5.8.1.3 Guatemala

Guatemala has the second-highest registration of CDM projects, after Honduras. To date, Guatemala has eleven registered CDM projects (only 1% of the project in the LAC region) and six projects in validation. Although Guatemala seems to have been more successful than other countries in the region with regards to project registration, it also has a track record of projects that have been rejected or terminated at validation.

Guatemala also has a higher rate of issuance of CERs compared to other countries in Central America. Six of the projects in its pipeline have issued carbon credits, and this issuance is equal to approximately 10% of the pipeline's total issuance potential until 2012.

[323] Interview with Roberto Jimenez, Director of Environmental Planning, ICE (Costa Rica), May 19, 2010.
[324] World Bank. "Costa Rica: Country Note on Climate Change Aspects in Agriculture."
[325] Interview with Roberto Jimenez, Director of Environmental Planning, ICE (Costa Rica), May 19, 2010.

The sectors targeted by CDM projects in Guatemala include hydropower, methane avoidance, biomass energy, landfill gas, geothermal, and supply-side energy efficiency. None of the CDM projects developed or under development in Guatemala target the land-use change and forestry or the transportation sectors, which are critical sources of emissions in this country. In addition, only one of the registered projects targets emission reductions in the agricultural sector. This is a shortcoming given the impact of these sectors on GHG emissions in the country.

5.8.1.4 Honduras

Honduras has the highest volume of registered CDM projects in Central America. To date, Honduras has 16 registered CDM projects and 14 projects in validation; it also has three projects (all biomass energy) that were rejected by the CDM EB. In total, this pipeline has an emission reduction potential of 5.5 million tCO_2e until 2012 and approximately 14 million tCO_2e until 2020.

To date, only 300,000 CERs have been issued in Honduras' pipeline, representing just 6% of the total portfolio's reduction potential. Many of the hydro projects registered have failed to issue CERs. According to Manuel de Jesus Manzanares, Energy Commissioner in Honduras, the main problems are technology, bureaucratic problems with the CDM, and the financing of pre-feasibility studies required for PDD, PIN, and baseline preparation. Another main reason is Honduras' lengthy process for projects to obtain PPAs, which has delayed the construction of hydropower plants.

The three main sectors targeted by Honduras' CDM pipeline are the hydropower, methane avoidance, and biomass energy sectors (in order of importance). Only two projects consider the implementation of energy efficiency measures, which is a sector that lacks exploration in Honduras.

5.8.1.5 Nicaragua

Nicaragua has registered only four CDM projects and has four other projects in the process of validation. In total, this portfolio of projects has an emission reduction potential of 4.4 million tCO_2e until 2012 and approximately 9.5 million tCO_2e until 2020. To date, only 60,000 CERs have been issued, representing 13% of the total portfolio's potential. A wind power plant was terminated at validation.

Nicaragua's portfolio is quite diverse in terms of technologies promoted. There are two small hydropower plants, two wind plants, one biomass energy project, one methane avoidance project, one geothermal plant, and also one reforestation project (in validation). Nicaragua is the only country in Central America with a forestry project in the CDM pipeline; this project has an emissions reduction potential of 40,000 tCO_2e until 2012.

Perez noted that even though Nicaragua's participation in the carbon markets will continue (there are four CDM projects now and eight are expected to be in place by the end of 2010), they are not looking to raise a great deal of capital through the CDM going forward.

5.8.1.6 Panama

Panama has only registered six projects (all of which hydropower plants) but has 12 projects in validation that could soon be approved by the CDM EB. Also, as shown in the table below, three projects were terminated during validation and one project rejected; all of these projects were hydroelectric plants. In total, this pipeline has an emission reduction potential of 8.6 million tCO_2e until 2012 and approximately 26.6 million tCO_2e until 2020. Approximately 80% of the portfolio is composed of hydroelectricity projects; the rest of the pipeline is composed of two biomass energy projects, one landfill gas project, and one wind power project.

To date, none of the projects registered in Panama have issued CERs. According to Reyes, the lack of success in issuance in Panama could be attributed to the following reasons:

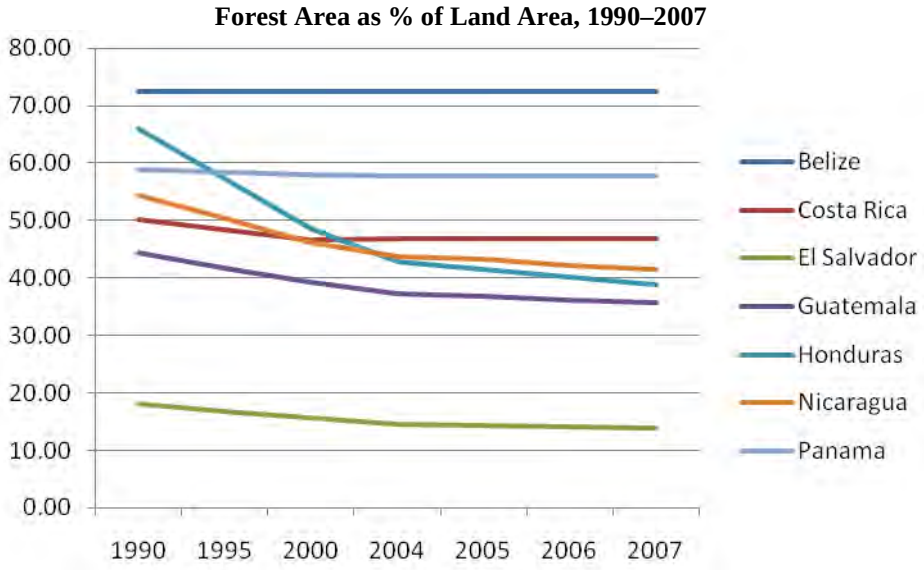
- Delays in project development due to financing. Project developers have only been able to go to the multilaterals for financing because, until recently, PPA negotiations with the transmission company could only be done if all permits and financing was in place.
- Lack of government support to energy investments. This has been the case traditionally. Even though Panama has great hydro potential, only a few projects have actually reached financial closure. About 15 hydro projects are under construction. The government is a supporter of these investments now, but it is not adequately considering their climate change impact.
- Local legal barriers. Law 45 establishes a tax relief scheme for projects that generate less than 10 MW provided that that each project generates less than 50% of electricity. However, if the project generates CERs, the revenue will be discounted from the tax incentives. This has meant that most CDM projects at the point of issuing CERs have preferred not to issue and risk losing the tax relief.
- Delays in validation of projects. Given the relatively new team in charge of the climate change department in the government, host nation approvals are taking longer than before.

5.9 EMISSION REDUCTIONS POTENTIAL, ECONOMIC VIABILITY, AND MAC CURVES

Clear GHG mitigation opportunities in the Central American region exist in the areas of forestry, energy generation through the promotion of renewable energy, and transportation.

5.9.1 Reduced Emissions from Deforestation and Degradation (REDD)

Deforestation is a problem across the region (although it is more critical in some countries than in others). Belize, Costa Rica, and Panama present less pressure for deforestation, while in El Salvador, Honduras, and Nicaragua, deforestation already represents a real and critical threat. The table below clearly shows how deforestation has increased or remained the same in this region since 1990.



Source: World Bank, World Development Indicators, http://data.worldbank.org.

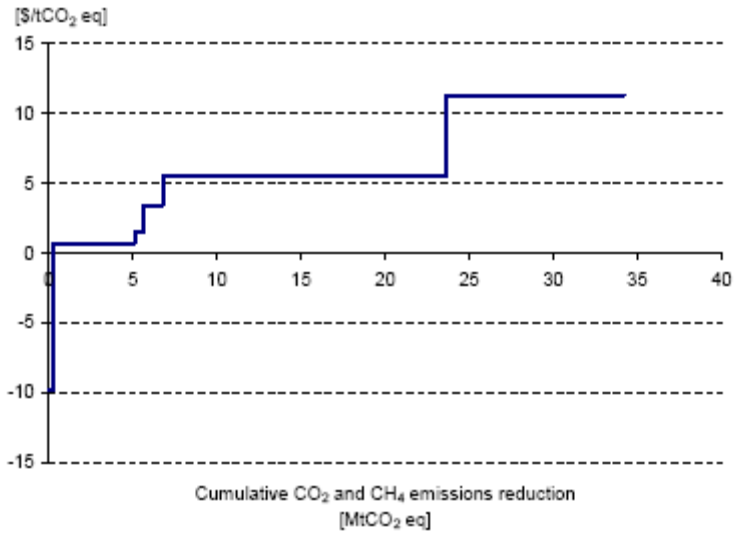
According to a recent World Bank report, a very large mitigation potential exists in forestry, which could be tapped at a relatively low cost and with significant benefits to other sustainable development objectives. The economically feasible potential of forestry activities in Latin America and the Caribbean region by 2040 ranges from 500 to 1,750 $MtCO_2$ per year assuming a price of USD 20/tCO_2 sequestered.

The marginal abatement cost (MAC) curve elaborated by the Energy Research Center (ECN) of the Netherlands for the agricultural and forestry sector in the rest of Central and South America[326] (which includes all the countries of this present study) can also give a very broad idea of the economic cost of implementing forestry reduction options in the region. This MAC curve has been extrapolated to all countries in the region using the data corresponding to Argentina, Bolivia, Ecuador, Colombia, Mexico, and Venezuela, which account for about 72% of the total GHG emissions in the rest of Central and South America.

The figure below is derived from eight reduction options in agriculture and 23 forestry reduction alternatives, including, for example, restoration plantations and afforestation. Approximately 20% of the GHG abatement potential in these sectors can be achieved at negative net costs, and the cost appears to reach a maximum level of USD 10/tCO2e. Nonetheless, this should be considered a very rough estimate for forestry options, as in this case, abatement costs are extremely site dependent. Therefore, the cost values provided below for the identified 23 options could be much higher or lower for concrete CDM projects.[327]

[326] Argentina, Belize, Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay and Venezuela.
[327] B.J.H.W. Wetzelaer et al., "GHG Marginal Abatement Cost Curves for the Non-Annex I Region," Energy Research Centre of the Netherlands (ECN), February 2007, http://www.ecn.nl/docs/library/report/2006/e06060.pdf.

Extrapolated MAC Curve for the Agricultural and Forestry Sector in the Rest of Central and South America



Source: B.J.H.W. Wetzelaer et al., "GHG Marginal Abatement Cost Curves for the Non-Annex I Region," ECN, February 2007.

5.9.2 Country Perspectives

A series of interviews were conducted with representatives of various countries in Central America to gain an understanding of country-specific views on deforestation and potential avenues to move forward. Deforestation is a concern shared across the region, but the actual needs and next steps differ from one country to the next.

5.9.2.1 Guatemala

Guatemala needs capacity building to better align private and government efforts on REDD. The Asociación de Comunidades Forestales de Petén (ACOFOP) is an association of 22 organizations in the north of Guatemala that are running the only large-scale REDD project in the region, which could also be used as a pilot project for the region. ACOFOP has 10 communities under their management that account for 450,000 hectares that are threatened by nomad agriculture and cattle range and more recently by drug trafficking. ACOFOP hopes for a REDD mechanism to take off, but according to Hector Julio Arce, Director of Costa Rica's Fondo Nacional de Financiamiento Forestal (FONAFIFO), ACOFOP is concerned that there is limited knowledge at the government level with regard to the REDD work that ACOFOP has done until now and the policies that must be supported at an international level.[328] ACOFOP is concerned that the government will push for a national approach, whose supporters argue is the only way to deal with leakage[329] by restricting the trading of REDD credits to the government level (thus cutting out the private sector), instead of a hybrid approach, which would open the

[328] Interview with Hector Julio Arce, Director of Fondo Nacional de Financiamiento Forestal (FONAFIFO) (Costa Rica), May 27, 2010.

[329] Leakage implies that the GHG impacts of a project may not begin and end with the immediate project boundary. For example, protecting a forest from logging may simply displace the logging to another area, partially or completely negating the project's benefits. A hybrid approach would require projects to use baselines bigger than their project boundaries to deal with leakage.

private sector's access to international markets (as in the case of the CDM, where private-sector projects can sell CERs directly to a company in Europe or Japan). In this regard, Arce mentions that ACOFOP believes that it would be highly beneficial to run a capacity building program for decisionmakers in Guatemala on issues related to REDD, such as the one described above. In addition, he believes that it would be appropriate to align efforts so that private and government efforts are complementary.

Guatemala's efforts need funding at earlier stages. The Guatemalan government recognizes the country's huge REDD potential, as 50% of their GHG emissions are associated with deforestation activities.[330] Like other countries in Central America, Guatemala is waiting for World Bank funding to finance the REDD-readiness of the country. Guatemala is in the second round of financing, following Costa Rica, Nicaragua, and Panama, which were in the first round. However, according to Mario Escobedo, the Regional Officer for Mesoamerica for Climate Change for the International Union for Conservation of Nature who is based in Guatemala, "it would be better to receive the funding earlier rather than later, especially given the work that ACOFOP has done in the country with regards to proving the REDD concept domestically."[331]

Guatemala's efforts also need recognition of carbon as a commodity at the regulatory level. Guatemala has not legally recognized environmental services or carbon as a commodity that can be owned. Honduras has recently promulgated a new environmental law, but it does not recognize environmental services either.

5.9.2.2 El Salvador

El Salvador sees a need for increased funding and interaction with development agencies. According to Rodriguez of MARN, one of the most important needs in El Salvador with respect to REDD is the creation of comparable deforestation maps and the updating of their GHG inventories in order to elaborate appropriate sequences of deforestation and land degradation.

El Salvador has already been seeking support in this regard. In 2009, they presented a proposal to the World Bank that was approved for a total amount of USD 3 million. The GTZ is also ready to support this program. The program consists of defining El Salvador's baseline, as there is no information on this topic, mainly for forests and some specific protected areas.

5.9.2.3 Costa Rica

In Costa Rica, the largest potential for emissions reduction projects is in the REDD sector, provided that conservation of carbon stocks (regardless of threats) is considered as part of REDD. If not, Costa Rica will be disadvantaged for its pioneering conservation spirit, having already protected 25% of its landmass.[332] FONAFIFO, the government agency in charge of assisting 900,000 hectares of private land in fighting deforestation in Costa Rica through payment of ecosystem services[333] and training, "needs a budget of about USD 40 million in order

[330] Interview with Mario Escobedo, Regional Officer for Mesoamerica for Climate Change, IUCN, May 27, 2010.
[331] Ibid.
[332] Phone interview with Mauricio Castro, EcoSecurities Costa Rica, Central America, May 10, 2010.
[333] The payment for ecosystem services (PES) in Costa Rica works by payment a fee per tree, provided that FONAFIFO establishes that the landowners have done the following: effective conservation of forest, reforestation activities are undertaken, and an agroforestry system is in place (according to a specific list of species).

to effectively assist private landowners in Costa Rica to be ready for a REDD mechanism, provided that the mechanism does not penalize early movers."[334] Currently, the Costa Rican government has also a program, Avancemos, to expand FONAFIFO's program to rural areas. According to Arce, this program would also require more resources to be effective.

5.9.3 Energy Generation

Another relevant source of emission reductions in Central America is the energy sector. Preliminary data for 2009 suggest that 39% of Central America's installed generation capacity comes from fossil fuels (see Section 1 of the Statistical Annex).[335] Even though the use of renewable energies is higher than thermal energy, thermal is still significant in the region and signifies that there is still room for developing more renewable energies that can displace the use of thermal electricity and thus generate emission reductions.

All of the countries except Costa Rica have Carbon Emissions Factors (CEFs) in the range of 0.6 –0.8 tCO_2e/MWh, which means that each additional MW of electricity generated with renewable energy sources displaces 0.6–0.8 tons of CO_2 in the grid and can therefore generate 0.6–0.8 carbon offsets that can be sold into the market.

Emissions Factors by Country (tCO_2/MWh)

Country	CEF (tCO_2/MWh)
Belize	0.759 (no CDM project)
Costa Rica	0.128 (0.298 at La Joya Hydroelectric Project)
El Salvador	0.609 (0.737 LFG Nejapa)
Guatemala	0.715 (0.778 Amatitlan geothermal)
Honduras	0.662 (0.670 at Tres valles cogeneration)
Nicaragua	0.754 (0.857 San Jacinto Geothermal)
Panama	0.688 (0.713 Santa Fe Wind farm)

Source: J.W. Martens et al., "Standardised Baselines for Small-Scale CDM Activities," ECN, December 2001.

The region has hydroelectric and geothermal potential of 22,000 MW and 2,928 MW, respectively[336]; to date, the region only takes advantage of 17% of its hydrological resources and 15% of its geothermal potential. Solar and wind resources are also plentiful in the region and remain largely unexploited. Another renewable energy source that could be better explored in the region is cogeneration at sugar mills. The 25 sugar mills that already cogenerate in the region do not take full advantage of their potential, particularly in the case of Costa Rica and El Salvador, and there are 27 other sugar mills operating in Central America that have not yet integrated cogeneration technologies at their plants. If all of the region's cogeneration potential were used, the energy supply from this source could double.

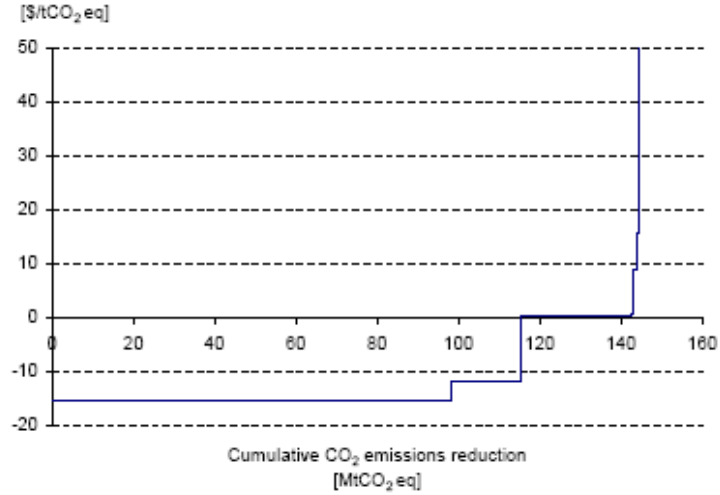
Renewable energy and zero emissions technologies are costly, given the high initial investments that usually characterize these types of projects. Nonetheless, these clean technologies can be competitive with thermal energy technologies assuming certain oil price scenarios and if carbon finance is integrated to the equation. According to the World Bank, in Central America

[334] Interview with Hector Julio Arce, Director of Fondo Nacional de Financiamiento Forestal (FONAFIFO) (Costa Rica), May 27, 2010.
[335] CEPAL, "Istmo Centroamericano: Estadísticas del Subsector Eléctrico," April 30, 2010.
[336] CEPAL/SICA, "Estrategia Energética Sustentable Centroamericana 2020."

hydropower projects with investment costs in the range of USD 2,000/kW and average levelized costs of about USD 59/MWh can compete with liquid natural gas–fired, combined-cycle gas turbine plants, and diesel engines assuming oil price scenarios of USD 60/barrel and USD 100/barrel. The situation changes if one considers the use of a less costly fossil fuel such as coal. While hydroelectric plants would not be able to compete with coal-fired generation plants, carbon prices as low as USD 9/tCO_2 could equalize the costs of both alternatives, thus allowing a switch to the cleaner one at no additional cost.[337] Much higher carbon prices (USD 25/tCO_2) would be needed for developers to prefer natural gas–fired power plants over coal-fired plants given the higher price of gas in these countries. This suggests that if hydropower and other renewable energies are not exploited in this region, some countries will tend to increase the carbon intensity of their fossil fuel-based power generation capacity, thus leading to higher rates of GHG emissions.[338]

The MAC curve elaborated by ECN for the electricity sector in the rest of Central and South America can also give an indication of the economic cost of implementing mitigation options in Central America's electricity sector. The figure below demonstrates that in the rest of Central America and South America approximately 140 MtCO_2e of reductions can be achieved in the electricity sector at negative or zero costs. Above 140 MtCO_2e, the cost of reduction in the electricity sector spikes up to USD 50 per tCO_2e. Reduction options considered in this analysis include combined cycle, wind power, hydropower, and sanitary landfill gas.

Extrapolated MAC Curve for the Electricity Sector in the Rest of Central and South America



Source: B.J.H.W. Wetzelaer et al., "GHG Marginal Abatement Cost Curves for the Non-Annex I Region," ECN, February 2007.

5.9.3.1 Regional Perspective

At a regional level, efforts are moving forward to create SIEPAC, which could have economic and other impacts on the addition of renewable energy capacity in the countries considered. For example, the SIEPAC has been helpful in facilitating wind integration in Nicaragua, where the Amayo project has been implemented. According to José Enrique Martínez of EPR/SIEPAC, SIEPAC adds additional pathways for energy to flow and thereby helps stabilize the system.

[337] World Bank, "Low Carbon High Growth," 2009.
[338] Ibid.

SIEPAC may be an enabler for further investment in renewable energy capacity in the region, but it will not likely generate CERs by itself.[339] ENDESA, one of SIEPAC's shareholders, devoted significant financial resources to developing a CDM methodology for interconnected grid systems that was finally rejected by the CDM EB in 2007.

There are also concerns regarding SIEPAC's impact on renewable energy implementation at the country level. Luis Reyes of El Salvador's CNE noted that new thermal capacity based on fossil fuels is going to be added precisely because no new renewable energy capacity is on official plans to use the regional transmission platform under SIEPAC. Therefore, the challenge for the Central American governments will be to make consistent local and regional energy planning policies in order to provide greater support to expand renewable energy capacity.

5.9.3.2 Costa Rica

Costa Rica is a country rich in renewable energy; in fact, it gets about 73% of all its electricity from clean sources including hydroelectricity, geothermal energy, the burning of sugarcane waste and other biomass, and solar and wind energy. However, Costa Rica could have a better performance in certain clean technologies. For example, the country does not have a well established picture of its wind generation potential (this also applies to the region); the most recent study dates back to the 1980s and provides a theoretical potential of 600 MW.[340] With this in mind, Costa Rica could easily become a net exporter of clean energy to the region through the SIEPAC.

5.9.3.3 El Salvador

El Salvador's national energy policy is planning to strongly increase renewable energy participation in the energy matrix. However, development of renewable projects will take at least five years due to lack of financing, internal bureaucratic processes, and institutional barriers.

5.9.3.4 Guatemala

In addition to the construction of the 94 MW Hidroxacbal hydropower plant, which will be the largest hydropower plant in the last 20 years, Guatemala initiated the construction of a new 300 MW coal plant near to Escuintla. This plant is planned to start operations in 2013 and is a joint partnership between AEI, DELSUR, and Jaguar Energy with a USD 350 million loan from CABEI and Bancolombia. This plant will have some surplus of generation that might help El Salvador to cover power generation deficits.

5.9.3.5 Honduras

Honduras's grid has a current capacity of 1,200 MW, and the demand grows 7% annually. Sixty-five percent of the country's electricity production is thermal using bunker fuel, which points to a significant window for achieving emission reductions with the development of renewable energies. In November 2009, the Honduran government launched a bid process for new long-term generation capacity based on renewable energy, mainly hydropower. The country has an estimated 6,000 MW potential for hydro production that remains largely untapped due to a

[339] Interview with José Enrique Martínez, General Manager, EPR-SIEPAC (Costa Rica), May 20, 2010.
[340] Interview with Javier Orozco, Director, Integrated Expansion Planning, ICE (Costa Rica), May 19, 2010.

number of barriers in the market, including a lack of transmission lines and the costs associated with building new ones and a lack of financing during the early stages of projects, such as feasibility studies.

With regard to energy efficiency, Honduras expressed interest in studying the Mexican model of an energy savings commission that involves the private sector and government.

5.9.3.6 Nicaragua

Nicaragua is one of the countries with the highest dependence on thermal energy in Central America, and it is making efforts to increase its renewable energy capacity through government subsidies. SIEPAC also offers a promising way for Nicaragua to incorporate larger amounts of wind generation in the system and promote geothermal energy, which is key for dramatically altering the generation matrix in the country.

Nicaragua needs support in developing its geothermal resources, which to date have been limited. Solar energy is another clean source with great potential in Nicaragua, but to date few projects have moved forward due to concerns about up-front investment costs and difficulties securing financing.[341] Nicaragua's main operator, ENEL, which has about one-quarter of Nicaragua's installed capacity, has plans to expand renewable energy development, but its ability to expand is constrained by its borrowing ceiling.

5.9.3.7 Panama

Panama also has significant renewable energy potential, but it has not been very successful at developing it to date due to government bottlenecks. Investment in hydropower projects still remains controversial. Nonetheless, the new government in place seems to be friendlier to these investments and has generation expansion plans that include hydro and wind in addition to LNG and coal.

5.9.4 Transportation

At a regional and national level, transportation has not been exploited significantly for GHG emissions reductions. This sector should clearly be targeted for emissions reductions for a number of reasons.

First, within the energy sector, transportation represents the first- or second-largest source of emissions in most Central American countries. CEPAL notes that in that same year the two sectors with the highest energy consumption in Central America were the residential area (43%) and transportation (30%), derived mainly from the use of oil derivatives.[342] Also, with respect to total consumption of petroleum only, the transportation sector surpassed the residential sector with 66%.[343]

Second, GHG emissions from this sector will continue to increase in the absence of policy interventions because of the rapid economic growth and the associated rise in car ownership and

[341] Interview with Vladimir Delagneau, President, Technosol (Nicaragua), May 26, 2010.
[342] CEPAL/SICA, "Estrategia 2020."
[343] Ibid.

use, a modal shift away from public transportation to private vehicles, and the rising length and number of trips per vehicle as cities sprawl. With an average of 90 vehicles per 1,000 people, the motorization rate in LAC exceeds those of Africa, Asia, and the Middle East.[344]

Third, targeting GHG in transportation can bring significant co-benefits. Improving public transport can reduce congestion and local pollution with impacts on health, productivity and welfare.

Fourth, GHG mitigation in transportation can be a by-product of actions that the region would be interested in pursuing in order to promote sustainable growth and reduce poverty, regardless of climate change.

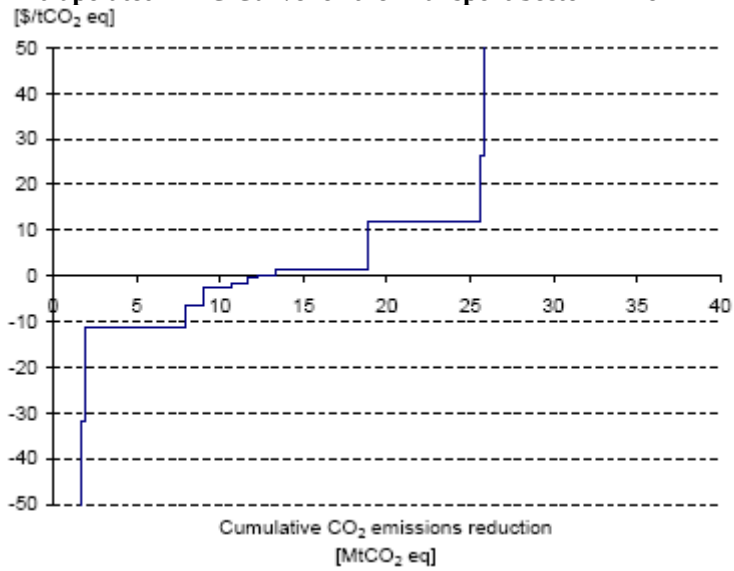
Fifth, increasing the efficiency of transportation reduces GHG emissions and can be achieved at very low or zero costs. In the Latin American and Caribbean, time savings, improved fuel efficiency, and health benefits from better transportation systems can offset a substantial fraction of mitigation costs.[345]

Sixth, the lower cost of mitigation in the transport sector can be observed in the MAC curve elaborated by ECN for transportation in the whole non-Annex I region for 2010. This MAC curve was derived from 19 GHG emission reduction options in the transportation sector, including energy-efficient engine designs and equipping of the existing cars with gas-fueled engines (fuel switch to biofuels were not taken into consideration, as they were not analyzed in the country abatement costing studies used by the ECN report).

The curve on the following page clearly shows that 35% of the emissions reduction potential from the transport sector in the non-Annex I region can be achieved at negative net costs.[346] An additional 35% of emissions can be reduced at low costs of USD 0–10/tCO_2e. If one adds to this equation the benefits of carbon finance, costs of mitigation can go down to zero or becoming negative as well.

[344] World Bank, "Low Carbon High Growth," 2009.
[345] Ibid.
[346] Wetzelaer et al., "GHG Marginal Abatement Cost Curves for the Non-Annex I Region."

Extrapolated MAC Curve for the Transport Sector in Non-Annex I



Source: B.J.H.W. Wetzelaer et al., "GHG Marginal Abatement Cost Curves for the Non-Annex I Region," ECN, February 2007.

5.10 OPPORTUNITIES FOR FURTHER EMISSIONS REDUCTIONS

In addition to the opportunities in the REDD, energy generation, and transportation sectors described in detail above, the emissions reductions identified below for Mexico and the other countries in South America help draw conclusions on other types of emissions reduction options that could be viable in Central America.

Another sector with a high potential for emissions reductions in Central America is industry, which is characterized by high emissions from the sugarcane-based industry and other industries such as cement production. Mitigation options such as industrial cogeneration and energy efficiency measures are viable for these sectors and have a considerable emissions reduction potential.

Potential GHG Emission Reductions in the Rest of Central & South America Region in 2010

Mitigation option	Potential [Mt CO_2 eq/yr]	Costs [\$/tCO_2 eq]
Agricultural products and forestry		
- Methane from landfills (Colombia) [d]	3.5	0.7
- Restoration plantations (Mexico) [a]	12.0	5.5
- Afforestation (Colombia) [d]	1.1	19.2
Electricity		
- Combined cycle (Mexico) [a]	70	-15.6
- Wind power (Mexico) [a]	12.2	-11.7
- Hydro power (Argentina) [b]	13.9	0.2
- Sanitary landfill gas (Argentina) [b]	5.4	0.5
Households		
- Residential Lighting (Mexico) [a]	2.5	-45.2
- Efficient water pumps (Mexico) [a]	1.2	-35.7
- Efficient biomass cook stoves (Bolivia) [c]	1.2	-15.3
Rest of Industry		
- Commercial Lighting (Mexico) [a]	4.7	-30.8
- Industrial cogeneration (Mexico) [a]	35.4	-33.4
- Industrial boilers (Mexico) [a]	2.7	-27.1
- Industrial boilers (Colombia) [d]	2.1	-2.2
- Energy efficiency measures in cement industry (Argentina) [b]	1.5	0.2
- Energy efficient industrial motors (Equador) [b]	1.3	14.4
- Wet to dry switch in cement industry (Colombia) [d]	1.1	19.2
Paper product		
- Energy efficiency measures in paper industry (Argentina) [b]	1.6	0.3
Crude Oil		
- Energy efficiency measures in oil industry (Argentina) b	1.7	0.3
TOTAL IDENTIFIED POTENTIAL for six countries in the Rest of Central & South America region including options with an emission reduction potential less than 1 MtCO_2 in 2010)	*195.6*	

Source: (a) Sheinbaum and Masera (2000)
(b) UNDP/GEF (1999)
(c) World Bank (2000a)
(d) World Bank (2000b)

Note: includes options with a non-extrapolated emission reduction potential larger than 1 Mt CO_2.
Source: ECN.

Section 6 Donor and Government Programs

This section provides an overview of available information on donor programs, including grant-based programs in support of renewables and energy efficiency as well as lending for programs and projects. The discussion gives particular attention to the IDB, CABEI, World Bank, and programs supported by the governments of Finland and Germany. It discusses the balance between funding channeled through regional initiatives and institutions and those managed at the bilateral level as well as the rationales and pros and cons of each.

6.1 OVERVIEW

Over the last two decades, Central America has received considerable donor assistance and financial support from various multilateral financial institutions. Given the scale and regional scope of these donor programs and the often overlapping arrangements for their implementation, it is difficult to determine the amounts involved with precision. No central repository of information about the various programs exists in the region or elsewhere. Indeed, it has even proven difficult for one of the leading donors in the region, IDB, to generate a summary of grant and lending programs dedicated to renewable energy and energy efficiency. Given these difficulties, the review of donor activities in the renewable energy sector presented here is inevitably incomplete and should be taken as a conservative estimate of the level of grant-based and development finance support provided to the countries and regional institutions to support renewable energy, energy efficiency and carbon-reduction investment, capacity building, and market development.

Based on a review of publicly available information from major bilateral and financial institutions, a minimum of about USD 600–650 million in grants and USD 1.9 billion in lending has been mobilized to support energy sector development in the last decade, with the real numbers certain to be higher. Of that amount, some USD 567 million in loans and 1.3 billion in loans have gone to renewable energy, energy efficiency, and climate change. The top agencies by approximate amount of involvement and type of support (grant versus loan) for renewable energy and energy efficiency are presented in Section 6 of the Statistical Annex.

6.2 MAJOR DONOR INSTITUTIONS

6.2.1 Inter-American Development Bank (IDB)

The IDB's latest energy strategy defines the institution's main energy-related objectives: supporting the consolidation of reforms, strengthening new energy markets emerging as a result of the reforms and meeting their credit needs, offering assistance to tackle problems of energy supply and demand, and encouraging the use of new energy markets on an experimental basis.[347]

[347] IDB, "Energy Sector Strategy: Report to Board of Directors," 2000, http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=351777.

The IDB uses four windows to finance energy projects. The Public Sector Group finances energy projects that have the participation of the public sector and count with government guarantees, the Private Sector Department provides long-term direct financing and guarantees for private-sector participation in large infrastructure and public-service projects without government guarantees, the Corporación de Inversiones Interamericanas (CII or IIC in English) finances small- and medium-scale private-sector infrastructure projects and undertakes direct equity participation, and the Multilateral Investment Fund (MIF) encourages private participation in infrastructure through grants and operations to support the legal and regulatory environment, utility privatization, sector restructuring, and institutional strengthening.[348]

Among multilateral lending agencies, IDB has been a leading investor in the energy sector (including conventional as well as non-conventional subsectors) in Central America, with at least USD 1.175 billion in loans and grants channeled toward Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama in the last decade. However, of this amount, only USD 96.65 million corresponds to lending and grants for renewable energy (including hydropower) and energy efficiency.

When all energy investments and programs (conventional and non-conventional) are considered, IDB's total loan portfolio in the region totals about USD 1.15 billion; total non-reimbursable grants are about USD 23 million, or about 2% of total commitments (equivalent to a loan-to-grant ratio of 50:1). Aside from SIEPAC loans, IDB's other major projects are national transmission infrastructure and a utility refinancing provided to Costa Rica; relatively little could be considered lending for conventional power projects (petroleum and natural gas).[349]

The IDB's involvement in basic energy infrastructure begins with the centerpiece of the emerging regional energy market, SIEPAC. With the SIEPAC loan, originally approved in 1997, the IDB established itself as the leading player in supporting the creation and consolidation of the regional power market through the construction of interconnection infrastructure.[350] IDB's loan for SIEPAC was initially approved at USD 240 million and grew to USD 253.5 million through the redirection of several other loan programs.

Since about 2005, the IDB has accelerated support for rural energy, renewable energy, and energy efficiency. Since 2007, largely through the Sustainable Energy and Climate Change Initiative (SECCI), which has been funded by various donor governments, including Canada and Germany, the IDB has allocated about USD 10 million in non-reimbursable technical cooperation for activities in the renewable energy and energy efficiency areas[351]; the volume of grants for the last decade is slightly less than double that amount, at around USD 18 million. In contrast to the more rapid pace of grant-making in the last five years, lending for renewable energy and energy efficiency is considerably more modest in relation to the grants made in the sector: in the last decade, lending for renewable energy and energy efficiency activities has

[348] ESMAP, "Latin America and the Caribbean Region Energy Sector: Retrospective Review and Challenges." Technical Paper 123/09, January 1, 2009, http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&entityID=000333038_20091211035730&cid=3001.
[349] Based on unpublished IDB data.
[350] Data are from an unpublished staff assessment.
[351] Interview with Arnaldo Vieira de Carvalho, IDB (Washington, DC), May 10 and July 21, 2010.

totaled almost USD 78 million, suggesting a loan-to-grant ratio of 4:1. Based on available data from the IDB, which are certainly incomplete, it appears that a considerably larger share of grant resources has been dedicated to activities in support of renewable energy development than energy efficiency, while the reverse is the case in the loan portfolio.

According to two IDB officials familiar with the bank's portfolio in the energy sector, it is likely that the pace of grant-making in the near term will slow as senior management seek to increase this ratio by limiting grants to project preparation activities that are clearly associated with a proposed loan.[352] This appears to be due at least in part to the fact that SECCI resources have been exhausted. For the next two to three years, the IDB will maintain its focus on ensuring that SIEPAC begins operations successfully and broadens and deepens regional energy integration. This will entail a considerable amount of capacity building and related support for the regulatory agencies responsible for implementing the regional market. One specific activity involves ensuring the harmonization of national energy sector regulatory frameworks with those of the regional energy market. A complementary area involves a process of updating and strengthening key regional energy sector institutions to support the process of regional energy integration. According to Carlos Trujillo, who has supported the SIEPAC process since its early stages in the late 1990s, it is especially important to ensure that short- and long-term planning functions undertaken by CEAC and EOR are implemented in a manner congruent with the characteristics of the region's power sector; in particular, this requires a process of institutional reform at CEAC, which was created in the 1980s and as such predates the SIEPAC project and the restructuring programs undertaken in the region.[353]

In parallel, the IDB is pushing forward with various initiatives similar to programs implemented in recent years throughout the region to foster improvements in energy efficiency, both at the level of policymaking as well as at the enterprise level. One initiative at the enterprise level is the GreenPyME Initiative of the CII, which is intended to help SMEs identify and exploit potential economic savings through investments in energy efficiency. Recently, CII concluded an agreement with the Nordic Development Fund to create a trust fund to support GreenPyME programs in Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.[354]

In a separate vein, IDB resources and programs are also helping set the stage for regional cooperation to further integration of energy, transportation, and other infrastructure. For instance, all of the activities identified by the Proyecto Mesoamericano, which constitutes a regional forum for exchanging information and experiences on a range of issues related to regional integration, including in the energy sector, are being supported with IDB resources.

6.2.2 Central American Bank for Economic Integration (CABEI)

CABEI's mission is to promote the progress and integration of the Central American region and to encourage equitable economic growth while respecting environmental concerns. It supports

[352] Interviews with Arnaldo Vieira de Carvalho, IDB (Washington, DC), July 21, and Carlos Trujillo, IDB (Washington, DC), July 27, 2010.
[353] Interview with Carlos Trujillo, IDB (Washington, DC), July 27, 2010.
[354] Cruz presentation, 2010.

public and private projects that generate jobs, raise human development indicators, and contribute to the productivity and competitiveness of beneficiary countries. CABEI has invested in renewable energy and energy efficiency projects (electricity generation and interconnection, hydro, geothermal, solar, and biomass) primarily with the funding channeled from KfW, IDB, European Investment Bank, Japan Bank for International Cooperation, Nordic Investment Bank, and the World Bank Group. Its current committed renewable energy and energy efficiency loan portfolio amounts to least USD 541 million for Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua, with minor involvement in Belize and Panama.[355] Currently, according to Moncada, about 70 to 80% of CABEI's energy sector portfolio is made up of hydropower projects.[356]

Private-sector participation in renewable energy and energy efficiency in the region has increased rapidly during the last two decades, facilitated by the reforms in national energy sectors that have opened up opportunities for investment. CABEI has financed several renewable energy projects, including some large-scale ventures as well as a few medium- and small-size, but as described by CABEI officials, the pace of approvals is slower than it could be because projects frequently exhibit limitations in terms of documentation, presentation quality, or basic requirements. So far, CABEI has not been directly engaged in the financing of micro projects, which tend to be the most difficult and costly to finance, but it is increasing its involvement. CABEI is now working with GEF funds and UNDP support to finance micro renewable energy projects. Although CABEI previously only acted as a financier, under the CABEI/UNDP/GEF project the bank will take a more proactive role in project identification, formulation, appraisal, and preparation and offer tailor-made financial products to accelerate future investment in smaller projects. Small-scale renewable energy lending strategies will be introduced at the bank, including a proactive small-scale renewable energy pipeline in its lending portfolio.

More recently, CABEI became the first regional partner to work with the Latin America Investment Facility (LAIF). (More on LAIF appears below in the context of European cooperation.)

6.2.3 World Bank Group

In the early 1990s, the World Bank Group's policies and strategies for the energy sector in Central America focused on support for energy sector reform. The Group also emphasized private-sector development in the electric power sector and began to put greater emphasis on the integration of sustainable development issues in the process of reform and expansion of private-sector involvement. Policy has always been guided by the principle that any strategy for sustainable reform should address the fundamental issue that electricity revenues are sufficient to cover the costs of supply, that the speed and course of the reform will vary from country to country, and that a full range of options should be considered—from pure public interventions to pure private—but that public-private approaches are appropriate for most countries.

[355] CABEI, "Independent Auditor's Report," 2006, http://www.bcie.org/english/publicaciones/memorias/2006/14.pdf.; Nexant projections.
[356] Interview with Waldo Moncada, energy specialist, CABEI (Honduras), August 3, 2010.

With respect to lending instruments, the Group's guidelines establish a flexible approach to financing. An analysis of the World Bank's lending programs in energy in LAC over the past decade shows a shift away from large infrastructure investment projects in favor of development policy loans to support sector reform and small loans to support carbon finance, rural energy, renewable energy, and energy efficiency programs.[357] The World Bank's pipeline for energy projects in LAC, including Central America, is responsive to demand, and in 2006–2008, it maintained the participation of policy loans and increased the participation of carbon offset and GEF projects to about 60% of the total, an indication of the emphasis on clean energy, efficiency, and rural energy projects, while operations in oil and gas showed a substantial decrease.[358] Now, the largest operations are typically development policy loans. The structure of the lending program in the energy sector has also changed substantially during the past 15 years,[359] with electric power maintaining about 60% participation. Loans for renewable energy and energy efficiency have rather small participation in terms of size but show a steady increase, amounting to at least USD 271 million for Central America.

A recent ESMAP technical paper underscores the need to shift the composition of the Bank's energy portfolio in LAC, and specifically Central America, to help the countries face new challenges in the context of the global financial crisis and the expectation that petroleum prices will remain much higher in the future. [360] In particular, the paper urges development of Central America's hydropower, wind, solar, geothermal, and biomass resource potential. Moreover, it stresses that the region should take the steps necessary to realize the potential benefits of the SIEPAC interconnection and a regional plant. Countries in the region should also be prepared to handle the inevitable consequences of climate change and to take steps to avoid the unmanageable impacts that it could cause. Accordingly, the Group intends to strengthen existing carbon finance and leverage GEF programs to support the development of renewable energy, energy efficiency, and rural energy while recognizing that the financing of traditional investment projects (mainly power generation and regional energy trade) is a high priority. Specifically, the World Bank intends to:

- Focus on financing of large infrastructure projects, including private financing models, PPPs, and guarantees
- Expand energy interconnections and promote regional energy trade, with loans for further implementation of SIEPAC, as well as the expansion of regional interconnections, particularly between Colombia and Central America
- Support harmonization of regional regulatory instruments, including strengthening of competition and improved use of economic instruments in regulation
- Support a regional generation project that would sell energy into the regional market, diversify energy supplies, and promote cross-border firm energy supply contracts

[357] This discussion on the World Bank Group's involvement in the region is drawn from materials retrieved from the WB projects database and ESMAP Technical Paper 123/09, pp. 133–147.
[358] Per ESMAP and World Bank LAC data. See Section 6 of the Statistical Annex.
[359] ESMAP Technical Paper 123/09.
[360] Ibid.

- Support institutional strengthening in the areas of energy and environmental monitoring

- Increase support for renewable energy and energy efficiency, with particular attention to hydropower and geothermal, through assessments of resource potential, development of resource information systems and information dissemination, long-term financing at preferential rates, technical assistance to revise legal and regulatory frameworks and reduce barriers to renewables development, and support for carbon finance for renewable energy projects

- Increase support for high-priority rural energy programs, focusing on countries with medium and low electricity coverage (Honduras and Nicaragua), with activities to assist the transfer of knowledge and development of rural electrification policies, financing mechanisms, and appropriate construction and service standards and tariffs; support the development of renewable energy options for rural electrification, especially by sharing knowledge and best practices in developing countries; and help finance the requirements for investment subsidy to be borne by the public sector

Recently, the World Bank's Energy Division for Latin America and the Caribbean staged a seminar for national directors of energy organized in Panama City, with the participation of SICA/Unidad de Coordinación Energética and numerous stakeholder agencies (including the IDB, OLADE, and the International Energy Agency), in an effort to re-engage regional policymakers. According to the Bank officials involved, in the last decade the World Bank's engagement in the region on clean energy and sustainable development issues has diminished; it is widely recognized that the IDB has been the leading development finance institution working on these issues in the region, as the data presented here confirm. In their presentation at the seminar, Philippe Benoit and Juan Miguel Cayo provided an advance copy of part of a multi-volume study on the region, "Estudio Programático Regional para el Sector Energético,"[361] the formal publication of which is expected later in 2010, and they noted the following examples of programs implemented by the Bank: [362]

- Energy efficiency improvement in the energy sector, Honduras: USD 31.5 million
- Rural electrification project, Honduras: USD 12.6 million
- Rural electrification project, Nicaragua: USD 17.0 million

6.2.4 Global Environment Facility (GEF)

GEF has been a major source of grant support to renewable and energy efficiency projects in Central America. Grants are usually a part of the loan or guarantee facility that is administered and executed by one or more of the major international and regional development organizations ("implementing agencies"), including the World Bank (International Bank for Reconstruction and Development/International Development Association), IDB, UNDP, UNEP, or CABEI. GEF grants to regional renewable energy and energy efficiency initiatives total at least USD 175

[361] The study consists of five modules: (1) general panorama of the sector; (2) regulatory barriers to integration; (3) short-term management power supply crises; (4) identification of hydropower projects at the regional level; and (5) geothermal energy in Central America. Only the first module was released, in draft form, at the conference.
[362] Benoit and Cayo, 2010.

million over the last decade. These grants are helping to leverage considerably more than this amount in co-financing for the projects in the form of debt and equity capital.

One of regional GEF grant projects, Accelerating Renewable Energy Investments through CABEI in Central America, mentioned in the previous section on CABEI, successfully leveraged more than ten times the GEF grant in co-financing. The program was designed to support renewable energy demonstration projects encompassing a range of different renewable energy technologies (including mini-hydroelectric and biomass) suited to the region in every country. GEF has also supported country-specific programs. For example, the GEF funded Nicaragua's Off-Grid Rural Electrification for Development (PERZA) project with IBRD and UNDP involvement, and it supported the Promotion of Environmentally Sustainable Transport in Metropolitan Managua project, in which UNDP was implementing agency; these programs leveraged financing 3 and 15 times, respectively, the grant amounts and successfully promoted renewable energy technology dissemination, energy efficiency, and market development in Nicaragua.

GEF was established in a pilot phase in the context of preparations for the Earth Summit held in Rio de Janeiro, Brazil, in 1992, at which several international environmental agreements, including the UNFCCC were completed. Following the 1992 summit, the GEF provided resources to support programs to advance the objectives of five major international environmental agreements, including the UNFCCC. More recently, in the context of the Gleneagles Summit of the leading industrialized countries, the major donor countries agreed to create two new vehicles, known together as the Climate Investment Funds (CIF), with a total initial capitalization of USD 6.3 billion. The Clean Technology Fund (CTF), with an initial capitalization of about USD 4.3 billion, will support demonstration, deployment, and transfer of low-carbon technologies, while the Strategic Climate Fund (SCF), capitalized initially at about USD 2 billion, will support a broader range of activities, including actions facilitating adaptation and avoiding deforestation.[363]

It is certainly possible that GEF resources will be provided to support programs in Central America. It is less clear to what extent resources from the CTF and CIF will be available for programs in the region because a large share of these resources are being allocated to programs and investments in much larger emerging market countries around the world. The relative absence of these donors from Central America reflects what some observers have characterized as a steady erosion of the region's ability to command attention on sustainable development and climate change issues. This trend underscores the imperative for the countries to pursue further integration and coordinate policies at the regional level so as to command the international community's attention. Central America was a leader on climate change and carbon finance issues in the 1990s, but now it must compete with a large number of successful and much larger economies. Therefore, it is imperative that the region present a unified bloc to the world and avoid the divisions on key policy issues that have slowed progress in the past.[364]

[363] See http://www.climateinvestmentfunds.org/cif/.
[364] Interview with Eduardo Dopazo, Carbon Finance Business Unit, World Bank (Washington, DC), July 28, 2010.

6.2.5 United Nations Development Program (UNDP)

UNDP has implemented at least 33 programs in Central America in the last decade with a total investment of USD 46 million, including at least 22 with some USD 16 million in support from GEF. The programs have encompassed activities under the headings of energy efficiency, rural electrification, support for the preparation of national communications, promotion of renewable energy development, and support for policymaking on energy efficiency and renewable energy. The distribution of resources in these categories has been relatively uneven, with the largest share of the total, some USD 36 million or 78%, going to rural electrification activities, primarily in Costa Rica, El Salvador, and Nicaragua. The table found at the end of this section only includes the amounts reported by UNDP in addition to the support from GEF, since the GEF funds are reflected separately.

6.2.6 European Donors

Numerous European donors have been involved in programs for Central America, directly as well as indirectly through agencies of the European Union as well as multilateral financial institutions. This presentation is by no means exhaustive and focuses on a handful of leading agencies.

- *Latin America Investment Facility (LAIF)*. LAIF is one result of the Europe-LAC dialogue established at the level of heads of state in 2001, the specific priorities of which have been articulated at various times in the last several years. The European Commission regional programming document for Latin America (issued in 2007) identified three strategic focal sectors: social cohesion, reduction of poverty, inequalities and exclusion; regional integration; and investing in people and increasing mutual understanding.[365] In May 2010, the European Community announced the creation of the LAIF at the sixth Europe-LAC summit in Madrid with a commitment of €125 million (USD 152 million) for 2010–2013, about one-third of which (€34.95 million) was committed for 2010 alone. The announcement also included a description of the first three projects of 17 identified for support totaling €16 million, all three of which involve renewable energy and energy efficiency in Central America: a €3 million commitment to the Energy Efficiency and Renewable Energy for SMEs Program, which will be managed by CABEI with a lead investment by KfW (€30 million); rehabilitation and repowering of the 5 de Noviembre hydroelectric facility in El Salvador; and participation in the PNESR rural electrification and renewable energy development program in Nicaragua (which also has support from the IDB, the Agencia Española de Cooperación Internacional para el Desarrollo, and several other donor agencies).[366]

[365] European Commission, "Regional Planning Document: Latin America, 2007–2012," July 2007, http://europa.eu/legislation_summaries/external_relations/relations_with_third_countries/latin_america/r12012_en.htm.

[366] The LAIF commitments for the El Salvador and Nicaragua programs have provisional approval only, and amounts do not appear to have been announced officially. See press releases for the Sixth EU-LAC Summit, http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/10/196&format=HTML&aged=0&language=EN&guiLanguage=en.

- *Germany (KfW)*. The KfW banking group has been very active in the region during the last decade and continues to fund loans for a number of renewable energy and energy efficiency initiatives, mostly in cooperation with other development organizations. KfW's financial cooperation takes the form of loans, which for the renewable energy and energy efficiency sector carry a concessional component. KfW loan commitments in Central America total at least USD 327 million. This German agency has also allocated a substantial amount to loans distributed through CABEI initiatives. KfW support ranges from the multi-million–dollar loans under the umbrella of EIB's Carbon Fund I and II to support CDM and JI projects globally, which has provided some support in Central America, to a number of smaller stand-alone projects or partnerships with EuropeAid, such as solar energy loans and grants channeled for developments in Costa Rica and El Salvador.

- *Germany (GTZ).* GTZ works on a broad range of topics, but its agenda in the energy sector is focused mainly on energy efficiency and renewable energy. One example is CREDP, a notable small-scale regional donor project that has provided support to Belize, a country much overlooked by the other donor agencies. CREDP is designed to help remove barriers to the use of renewable energy and foster its development and commercialization. With funding from GEF and GTZ, CREDP supported work to help the establishment of an enabling legal and regulatory framework in the Caribbean, provide capacity building, demonstrate innovative financing mechanisms, and create a regional information network for renewables development. With respect to renewable energy and efficiency in Central America, GTZ has not been as active at the level of its bilateral and regional offices as it has been in the context of its relationship with IDB, which is extensive and long-standing and has financed the salaries of specialists who sit within the IDB. This appears to be changing, however; according to Rainer Schröer, who recently took up his post at GTZ/San Salvador after several years in Brazil, GTZ is embarking on the creation of a regional renewable energy and energy efficiency program, beginning with Costa Rica, El Salvador, and Honduras, and spreading to the rest of the region in a second phase. The €5 million program will encompass (1) support for legal and regulatory issues, (2) strengthening institutions, and (3) development of an environment conducive to the development of private-sector activity in the renewable energy and energy efficiency sectors.[367]

- *Finland*. Finland supports a joint program between the public and private sector with the aim of promoting the use of renewable energy in all seven Central American countries. The second phase of the program will continue during 2007–2009, and Finland's contribution is €4 million; Finnish aid in total amounts to €5.8 million. Together with Austria, Finland has been a leading contributor to the Alianza en Energía y Ambiente con Centroamérica (AEA) Initiative, which has been overseen by SICA with support from CABEI. The purpose of the grant program is to provide support for pre-investment research and development and feasibility studies as well as capital investments in the case of small projects. Over a period of about six years, AEA has disbursed grants totaling approximately €10.3 million to 237 projects, in amounts ranging from €200,000 to as little as €4,500, with an average grant size of slightly under €44,000. The program is well advanced, with 59% of the grants by value in execution or completed and only 28% in preparation or under review. It appears that the

[367] Interview with Rainer Schröer, Director of Renewable Energy and Energy Efficiency Program for Central America, GTZ (El Salvador), August 25, 2010.

program is seeking additional resources, as funds are being sought for about 9%, and amounts have not yet been assigned for 21 projects that have been presented.[368] Some of the projects supported by AEA have resulted in investments in new generation capacity in the region, such as the Tilawind facility in Costa Rica, a private venture that is expected to come online in 2011 or 2012, and the Belize Sugar Industries cogeneration facility, which began operations in early 2010.

- *Austria*. As noted, Austria has contributed resources to the AEA program.

6.2.7 North American Donor Involvement

Numerous U.S. and Canadian institutions have a lengthy record of working on energy sector issues in Central America. For the purposes of this review, only the most important agencies are noted.

- *U.S. Agency for International Development (USAID)*. USAID cooperation on energy issues has focused on expanding access to modern energy services in two areas, energy market development (implementation of adequate policy, legal, and regulatory reforms) and energy enterprise development (providing affordable, clean, and reliable energy services to the poor). From 2000 to 2005, USAID provided USD 5.3 million in support of Facilitating Financing for Renewable Energy Program (Financiamiento de Empresas de Energía Renovable, FENERCA). This program was aimed at assisting policy reform, providing enterprise development services and business planning assistance, and facilitating financing to encourage investment in renewable sources of energy. The target countries were El Salvador, Guatemala, Honduras, Nicaragua, and Panama. FENERCA helped to create a USD 15 million fund for investment in clean energy known as the Central American Renewable Energy and Cleaner Production Facility (CAREC), managed by E&Co. Another project, entitled Expansion of the Power Sector in Central America, provided USD 4.8 million in support to El Salvador, Guatemala, Honduras, and Nicaragua between 2002 and 2006 for institutional development among regulators and other power sector institutions in the participating countries with the objective of fostering a robust regional power market. The program achieved considerable success in the area of capacity building and institution building. However, the program coincided with the steady slide in regional power sector transactions, which were attributed to narrowing capacity margins and difficulties associated with the desire of national authorities to give priority to domestic loads before permitting exports. Subsequently, beginning in 2006, USAID established a USD 17.2 million cooperative agreement with CCAD that encompasses a suite of environmental and clean production activities, some 35% of which involve support for energy efficiency specifically.[369] USAID also supports the Efficient Energy for Sustainable Development Partnership, a public-private partnership led by the U.S. Department of Energy (DOE) that aims to improve the productivity and efficiency of energy systems. Through this program, USAID has been active in Brazil, Guatemala, and Mexico, supporting energy efficiency in

[368] Based on analysis of AEA project data accessed at http://appext.sica.int/eepbiWEB/.
[369] Communication from Ricardo Aguilar, Project Manager, USAID-CCAD Cooperative Agreement.

the public sector and providing technical assistance for standards and labeling programs and rehabilitation of small hydropower facilities.

- *U.S. Trade and Development Agency (USTDA).* USTDA provides support for feasibility studies and capacity building and training as well as trade missions and has been active in Central America. In the last five years, USTDA has underwritten some USD 772,000 in studies, including USD 500,000 in support for the preparatory studies for the Diquis hydropower project in Costa Rica and about USD 200,000 in support of various regional programs, including a technical conference staged in the United States. Based on the results of a recently completed definitional mission report,[370] USTDA expects to provide funding for several feasibility studies for renewable energy projects in the region.[371] In addition, as part of the Energy and Climate Partnership for the Americas (ECPA), USTDA committed to conduct a series of six "reverse trade missions" to the United States, each one covering a specific renewable energy technology or policy area; these missions will be completed by the end of 2010.[372]

- *Millennium Challenge Corporation (MCC).* MCC provides grant support for a range of infrastructure and development programs based on program designs developed jointly with the recipient government for selected countries that have qualified for support on the basis of political and economic policy criteria. In El Salvador, MCC is supporting a USD 32 million rural electrification program involving installation of 50,000 solar home systems.

- *Overseas Private Investment Corporation (OPIC).* OPIC provides loans, political risk insurance, and loan guarantees, among other financial products and services, for overseas investments by U.S. companies. These have included:

  - A USD 60 million investment in Latin Power III LP, an investment fund dedicated to mid-sized energy generation facilities, with a focus on renewable energy and a regional commitment of 30–50% to CAFTA-DR countries

  - The 2004 approval of an investment guaranty of up to USD 100 million for a lending facility developed by Citibank to expand its activity in Central America and the Caribbean, including lending to small businesses, with Citibank and OPIC sharing credit risk in loans to eligible countries and OPIC providing clearances on worker rights and environmental issues for each downstream loan

  - The 2008 approval of a USD 150 million loan for the Latin Power IV LP, a USD 750 million vehicle for equity investments in Latin America

[370] Constant Group LLC, "Definitional Mission for Latin America and the Caribbean: Regional – Renewable Energy Projects in Central America (Costa Rica, El Salvador, Guatemala, Honduras and Panama)," March 2010, http://www.devex.com/projects/definitional-mission-for-the-renewable-energy-projects-in-central-america.
[371] Personal communication with Keith Eischeid, Manager for Central America, USTDA (Washington, DC), July 17, 2010.
[372] See Energy and Climate Partnership of the Americas (ECPA), "USTDA Clean Energy Exchange Program of the Americas," http://www.ecpamericas.org/initiatives.php?lan=e&initiative_id=9.

- A series of commitments for credit guarantees and/or loans for investment vehicles supporting renewable energy and sustainable development enterprises globally, with the possibility of investments in Central America.[373] Because of the difficulties of linking specific investment amounts to renewable energy and energy efficiency in Central America, other than the case of Latin Power III, only this investment is reflected in this report's calculations

- *Ex-Im Bank of the United States*. Ex-Im Bank provides loans, credit guarantees, and insurance in support of exports of U.S. goods and services to international markets, including for infrastructure projects. In 2009, Ex-Im Bank made authorizations for USD 219 million in loans and guarantees for transactions involving countries in Central America, but data identifying the specific sectors involved are not available. Ex-Im Bank is expanding its involvement in transactions incorporating renewable energy and sustainable businesses, but it is not clear to what extent these include projects in the region. Because of the difficulties in linking specific investment amounts to Central America, these figures are not reflected in this report's calculations.

- *Energy and Climate Partnership for the Americas (ECPA)*. As an outgrowth of President Barack Obama's call for hemispheric cooperation on energy and climate issues at the April 2009 Summit of the Americas, the U.S. Department of State and DOE, in conjunction with other federal agencies, ministries of energy from the region; multilateral organizations including the IDB, OLADE, and the OAS; research institutes; academic institutions; and NGOs,[374] created ECPA. The ECPA's stated goal is to foster partnerships across the Americas to achieve low-carbon economic growth and development through multi-country or bilateral initiatives to promote clean energy, advance energy security, fight energy poverty, and reduce GHG emissions.[375]

  Two initiatives have already been announced that address energy and climate issues in Central America. First, the Energy and Environmental Security Initiative (EESI) for Central America will support activities to accelerate the deployment of clean energy, promote energy efficiency, advance energy integration and cooperation, and enhance environmental security, including workshops, seminars, and other capacity-building efforts to educate regulators and legislators of the advantages offered by clean energy and smart grid development and to support the implementation of SIEPAC. EESI will also support smart grid pilot projects in Costa Rica. In addition, EESI will support a regional event in 2010 to examine Copenhagen outcomes and their impact on climate change plans undertaken by countries in the region (and the Caribbean). EESI will also mobilize support from Mexico, which has offered to lead

[373] The funds are the Virgin Green Fund, USRG Emerging Markets Fund, FE Global Clean Energy Services Fund IV, and Good Energies – Wolfensohn Renewable Energy Fund. See descriptions at http://www.opic.gov/projects.
[374] The ECPA website lists the ministries of energy and mines of Brazil, Chile, Colombia, Mexico and Venezuela; Natural Resources Canada; Office of the President of Costa Rica; the Government of Dominica; Chile's Comisión Nacional de Energía; U.S. Department of Energy, U.S. Department of State, U.S. Department of Agriculture, U.S. Geological Survey, National Renewable Energy Laboratory, and Peace Corps; IDB; the Instituto Colombiano del Petróleo; Centro de Investigación de la Caña de Azúcar and Centro de Investigación en Palma de Aceite of Colombia; Fundación Chile; and Natural Resources Defense Council. See http://www.ecpamericas.org/resources.php?lan=e.
[375] See ECPA, http://www.ecpamericas.org/.

initiative to provide capacity building on energy efficiency for officials from the region.[376] Second, DOE and the State Department have committed to support a regional energy efficiency training center in Costa Rica. The U.S. agencies signed a memorandum of understanding with MINAET, ICE, the Natural Resources Defense Council, the Universidad de Costa Rica, and RECOPE in January 2010. The center will serve as a training center for auditors and energy managers, producing a cadre of energy specialists able to conduct comprehensive energy audits, identify energy savings opportunities and develop detailed solutions, act as energy managers for businesses with heavy energy consumption, and manage energy technology deployment.[377] The precise scope for the project is still being defined. A State Department official based in San José believes that the scope of activities should be broadened to encompass energy efficiency in transportation and alternative energy resources for transportation (such as hybrid vehicles, electric vehicles, and light rail).[378] No budget figures were readily available, so these do not appear in this report's calculations.

- *Canadian International Development Agency (CIDA)*. The CIDA strategy for the Americas has three main areas: governance, particularly reforms to support social, political and economic inclusion; economic productivity, including economic policy and private sector development; and basic human needs, especially primary education, HIV/AIDS prevention, and basic healthcare. In the energy sector, CIDA supported OLADE's Sustainable Energy Project (USD 4.8 million during 2003–2008), which aims to strengthen energy policymaking capacity and ensure sustainable energy development in South America.

While the foregoing review is by no means exhaustive, it does offer a list of representative bilateral and multilateral programs and initiatives to support the development of renewable energy, energy efficiency, and climate change activities. To conclude this section, it is most important to note that support for these sectors in Central America has tended to be focused on a national or project-specific basis. Even in cases where programs have encompassed the region as a whole, they have tended to engage national institutions and individual companies and projects. In short, efforts to date have tended to be undertaken on a "retail" basis as opposed to at the "wholesale" level. The emerging and existing regional institutions, including SICA itself and the energy sector organizations such as CEAC, CCHAC, CRIE, EOR, and the Unidad Ejecutora, have been the beneficiaries of limited support related to renewable energy, energy efficiency, and carbon; power sector institutions have received considerable support in the context of the most important and transformative regional energy initiative of the last 20 years, SIEPAC itself. A more detailed assessment and analysis of donor activities is presented in Section 9.

[376] See ECPA, "Central American Energy and Environmental Security Initiative (EESI)," http://www.ecpamericas.org/initiatives.php?lan=e&initiative_id=10.
[377] See ECPA, "Low Carbon Communities of the Americas (LCCA): Costa Rican Energy Efficiency Training Center," http://www.ecpamericas.org/initiatives.php?lan=e&initiative_id=4.
[378] Interview with Tim Lattimer, Regional Environmental Officer, U.S. Embassy (Costa Rica), May 19, 2010.

Estimated Programming by Major Donor: Renewable Energy, Energy Efficiency, and Climate Change (USD Millions), 2000–2010

	IDB (1)	GEF (2)	CABEI (3)	WB Group	UNDP (4)	Germany (5)	Japan	Finland	U.S. (6)	Canada	Europe	Total Grants	Total Loans
BZ Loans													0.00
BZ Grants					0.61		9.00					9.61	
CR Loans	1.50		268.00	72.00		235.00							576.50
CR Grants	3.30	152.00			0.14				0.51	0.10		156.04	
SV Loans			59.00			30.00							89.00
SV Grants	1.92						1.00		32.80			35.72	
GU Loans	1.21		84.00	35.00									120.21
GU Grants	1.30	15.00			0.37				0.05			16.72	
HN Loans	35.15		122.00	79.00						0.10			236.25
HN Grants	0.50	24.00			1.86				0.02	1.50		27.88	
NI Loans			9.00	73.00									82.00
NI Grants	2.23	103.00			27.20					21.00		153.43	
PA Loans	30.00			13.00									43.00
PA Grants	0.77	10.00										10.77	
Reg. Loans	10.11			0.20		62.00			6.00		154.00		232.31
Reg. Grants	7.67	65.00			0.14			12.00	16.37	0.80	55.00	156.97	
Total	**95.65**	**369.00**	**542.00**	**272.20**	**30.32**	**327.00**	**10.00**	**12.00**	**55.74**	**23.50**	**209.00**	**567.14**	**1,379.27**

Sources: IDB, GEF, CABEI, World Bank, UNDP, GTZ, KfW, JICA, AEA, USAID, USTDA, MCC, Canada, Europe. Notes: (1) Includes in cooperation with other MFIs and organizations. (2) Includes co-financing. (3) Loans to date, including funds from other organizations. (4) Does not include GEF resources. (5) Includes KfW (loans) and GTZ (grants). (6) Includes USAID (FENERCA/CCAD), USTDA (various), OPIC, MCC (El Salvador) (7) Regional programs may incorporate two or more countries, up to total of seven in the region

Section 7 Relevant Experience in Mexico

This section provides a brief overview of the institutional and policy architecture developed in Mexico over a period of 20 years, beginning with the creation of national programs and institutions to promote energy efficiency, deployment of renewables for rural and off-grid applications (particularly in the agricultural sector), the modification of the regulatory framework to facilitate interconnection of wind generators into the grid, and the implementation of a series of tenders for wind.

7.1 ENERGY EFFICIENCY IN MEXICO

Since their constitution almost 20 years ago, the Comisión Nacional para el Ahorro de la Energía (CONAE, recently converted into the Comisión Nacional para el Uso Eficiente de la Energía, CONUEE) and the Fideicomiso para el Ahorro de Energía Eléctrica (FIDE) have been the guiding lights for energy efficiency in Mexico.

FIDE was created in 1989 as a non-profit organization with mixed participation, capitalized with contributions from the two main state utilities, CFE and Luz y Fuerza del Centro (LyFC, which has since been taken over by CFE), along with the Sindicato Único de Trabajadores Eléctricos de la República Mexicana (SUTERM) and key business organizations in the country, such as the main chambers of industry: the Cámara Nacional de la Industria de la Transformación (CANACINTRA), Cámara Nacional de Manufacturas Eléctricas (CANAME), Confederación Nacional de Cámaras Industriales (CONCAMIN), the Cámara Mexicana de la Industria de la Construcción (CMIC), and the Cámara Nacional de Empresas de Consultoría (CNEC), in order to boost energy savings in industrial, commercial, and service facilities, municipalities, and households and more generally promote a culture of rational energy use in the country.

Since 1990, FIDE projects have evolved substantially. Early on, FIDE supported projects in the industrial sector focusing on energy efficiency assessments in various industrial sectors and regions by developing demonstration projects and financing 100% of energy efficiency diagnostics and implementing recommendations as well as creating energy saving committees. In 2001, FIDE financed up to 60% of investment requirements for energy efficiency measures, focusing on corporate groups and commercial projects and financing short-term actions.

Now, FIDE's programs are focused on fostering social responsibility schemes for industrial companies that have expressed a commitment to protecting the environment by developing carbon emissions reduction programs. Specific energy efficiency programs on automation, power demand control, remote monitoring and controls, and equipment purchasing/ replacement as well as financing for new works are part of the current FIDE support schemes. One of FIDE's latest programs involves the acquisition of advanced energy efficiency equipment at preferential rates for optimizing and modernizing processes in order to increase productivity and competitiveness.

From 1990 to June 2009, FIDE programs achieved cumulative energy savings of 16,778 GWh, equivalent to the total consumption of five Mexican states: Aguascalientes, Colima, Durango,

San Luis Potosí, and Sinaloa. Energy savings for 2010 are an estimated 1,374.2 GWh, which would bring FIDE's total 20-year savings to approximately 18,152 GWh.

FIDE's annual budget was initially low because its activities focused on projects; as programs expanded to cover entire sectors, budgets increased. On average, FIDE's budget receives a substantial increment every five years when programs are reviewed and new goals are set up. The first budget in 1990 was around USD 3 million, and in 2001 it was 3.6 times greater (more than USD 10 million). For 2010, FIDE's Technical Committee approved a budget of MXN 4.6 billion (USD 358 million), which reflects the interest in and cost-effectiveness of energy-efficiency programs in Mexico.

This evolution of the annual FIDE budget has been central for its success. Strong commitment from all parties of its Technical Committee has been reinforced with the entrance of new members, mostly from private sector, and collaboration agreements with multilateral financial institutions. FIDE has developed five key partnerships with international institutions such as CAF, IDB, KfW, and the World Bank. Key strategic partners on technical issues have been developed with the Alliance to Save Energy (ASE) and the IEA. All of these alliances have helped FIDE's programs become a reference point in Latin America in terms of their impact on energy consumption.

One of the first and key collaborative agreements that FIDE signed during its initial years of operation was with IDB, with whom they jointly funded the FIDE National Incentive and Rebates Program (NIRP). The total NIRP budget was USD 46.8 million, with CFE and IDB both contributing 50% of the costs. This large-scale program focused on the use of high-efficiency motors, compressors, CFLs, and public lighting.

Through the 1990s, FIDE developed and implemented targeted energy-efficiency programs in all of the key economic sectors in Mexico (large industry, small and medium industry, commercial, agriculture, municipal, and residential). FIDE also designed and executed large-scale multi-year rebate programs focused on market transformation to energy efficient equipment (CFLs, T-8 lamps, electronic ballasts, high-efficiency motors, and efficient compressors). In addition, FIDE worked on complementary programs for training, education, and introduction of new technologies (including the "Sello FIDE" green seal of efficiency). All of these programs were rigorously planned, reviewed, implemented, and monitored, yielding significant electrical energy savings and leveraging private investment and multilateral funding.

In 1989, after some initial work on energy audits and cogeneration potential and some attempts at developing financing programs for energy efficiency, CONAE focused on two key areas that provided a broad measure of success in energy efficiency in its first 10 to 15 years of operation. First, CONAE focused on developing energy efficiency standards for key equipment (such as motors, pumps, insulation, water heaters, and appliances such as refrigerators and clothes washers), for a total of 15 official Mexican standards. Second, CONAE developed a comprehensive promotional web site, with case studies, examples, facts and figures data sources, and other useful information for end users and policymakers. CONAE also put significant effort into promoting energy efficiency in federal government buildings and facilities, although with less success.

The only other agency working on energy efficiency in Mexico has been the Programa de Ahorro de Energía del Sector Eléctrico (PAESE). This agency worked with FIDE extensively, even sharing a common director for almost 15 years. It has promoted cogeneration projects and various energy-saving projects within CFE and invested significant resources in training CFE staff on energy efficiency matters applicable both to their jobs and to their homes. In the last year, they have increased their focus on identifying savings at CFE facilities, where a large potential remains to be tapped.

In the mid-2000s, the energy efficiency efforts described in the previous section flagged. FIDE underwent several leadership changes, reducing the strong technical focus that was the hallmark of its programs. During this time, FIDE supported large-scale projects for residential energy efficiency improvements, including insulation and efficient air conditioning for housing in the hot northern regions and refrigerator replacement programs. CONAE developed several additional energy efficiency standards but developed no important new programs, suffering from a lack of visibility as well as the complacency of the population in general. No new agencies or initiatives emerged, and FIDE, CONAE, and PAESE continued their business as usual. However, that finally changed with the energy reform of October 2008.

The energy reform passed in October 2008 had as its primary objectives the strengthening of the Mexican state oil company, Petróleos Mexicanos (PEMEX); regulating the hydrocarbons sector, providing PEMEX greater autonomy but creating independent regulatory oversight; and increasing private participation in the energy sector. The energy reform has inserted energy efficiency into the national conversation and created an energy-efficiency agency with strong regulatory authority and compliance verification. The package included two laws that deal directly with energy efficiency:

- *Ley para el Aprovechamiento Sustentable de Energía.* This law created CONUEE, formed from the staff of the previous CONAE. It also creates the Advisory Council for the Sustainable Use of Energy and an information system on sustainable energy use and requires the development of a three-year National Program for the Sustainable Use of Energy within a year. Equally important, the law assigns CONUEE the tasks of training and certification of energy-efficiency experts. Additionally, the law requires all federal public entities (including PEMEX and CFE) to report their energy consumption and progress on energy efficiency. Finally, the law allows CONUEE to impose fines or penalties on users that do not comply with the reporting rule or that provide false information.

- *Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética.* While this law deals primarily with promotion of renewable energy, energy efficiency is incorporated in the strategy of "energy transition," which is understood to imply a progressive diversification of Mexico's energy matrix to include more renewable resources. According to the law, the strategy should explicitly cover such activities as the promotion of energy efficiency and the development of energy efficiency standards. Furthermore, the law identifies a Fund for the Energy Transition that should support not only renewable energy but also energy efficiency. Ultimately, the regulation corresponding to this law will clarify

implementation, but the Congress' message is clear: energy efficiency is a fundamental part of the required energy transition in Mexico.

The 2009 budget also strengthened energy-efficiency efforts in the public sector. Previously, energy costs were simply a line item in each entity's budget from the Secretary of the Treasury, and any energy savings would simply result in a reduction in that line item the following year. Article 17 of the 2009 budget declared that all public-sector entities must:

1) dedicate resources from their budgets to implement energy efficiency for their buildings, installations, and vehicle fleets
2) send their energy-efficiency program and goals to CONUEE for review and approval by the end of February 2009
3) provide a quarterly report to CONUEE and to the Secretary of the Treasury on the savings generated and use the savings to continue funding their energy efficiency programs

On January 30, 2009, CONUEE published a detailed and obligatory protocol laying out instructions and formats to define how public sector entities must implement their program and what they must report to CONUEE and Treasury. Public entities throughout Mexico, including PEMEX and CFE, scrambled to submit their reports to CONUEE. These reports are being reviewed, and CONUEE is communicating with the reporting entities. At this point, no data is available yet on the level and depth of implementation in the public sector.

7.2 RENEWABLE ENERGY FOR RURAL AND OFF-GRID APPLICATIONS

Following the policy guidelines of the Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA), various actions to promote the use and application of renewable energy in agriculture have been implemented through the Fideicomiso de Riesgo Compartido (FIRCO) with the aim of fostering sustainable rural development.

The first effort started in 1994 through the joint implementation of a pilot program along with USAID/Mexico and the DOE's Sandia National Laboratory in order to increase the economic, social, and health standards in rural off-grid households and communities by utilizing renewable energy systems for productive applications. More than 200 pilot cost-shared renewable energy PV water pumping systems for irrigation were installed and led to a large-scale replication program.

This successful partnership secured GEF funding for a USD 31 million, four-year program from 2000 to 2004, the Proyecto de Energía Renovable para la Agricultura (PERA). The first GEF-funded renewable program for agriculture, this effort included the installation of more than 1,900 PV and 55 wind water pumping systems for new agricultural applications such as milk cooling, fruit refrigeration, and other small agro-businesses processes.

PERA's most important achievements included helping the expansion and transformation of the renewable technology market, including products and services; a steadily growing national registry of vendors and service providers; program replication by other producers utilizing their

own resources; wider cooperation with suppliers, leading to a decline in equipment prices; motivation and interest for further studies of new productive applications using renewable technologies; and specialized training for technicians, officials, and leading producers who promote renewable technologies.

7.3 REGULATORY MODIFICATION TO FACILITATE WIND INTERCONNECTION

Mexico has significant renewable energy potential, especially with respect to wind, solar, and geothermal technologies. Hydroelectric and geothermal energy have been Mexico's most important renewable sources, and its geothermal production is the third largest in the world. However, other renewable energy used for the generation of electricity, including wind power, solar PV, mini-hydroelectric, and biomass, have experienced slow growth in Mexico for a number of reasons:

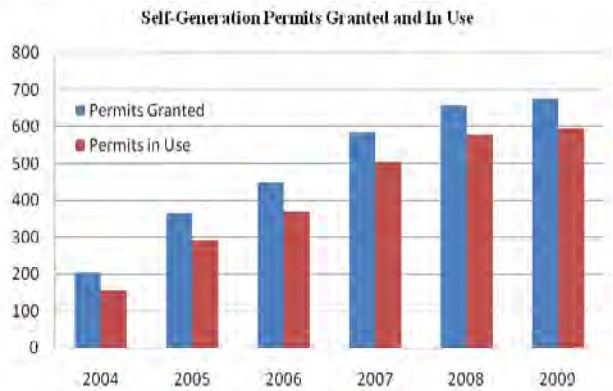
- *State-owned oil and electricity companies*. These entities have little incentive to look beyond fossil fuels.

- *Lack of a clear regulatory framework to promote development.* CFE dominates the electric power sector, accounting for more than 70% of generating capacity and controlling 100% of transmission and distribution. The cost and adequacy of transmission has limited private participation in generating activities, including renewable energy.

- *Geography.* Areas with the greatest potential for solar and wind power generation are often geographically remote and far from population centers. The most relevant example is the State of Oaxaca, which has been endowed with world-class wind resources, offering the prospect of economic competitiveness in the medium term. Although development of these resources offers potential benefits to the local and national economy and environment, efforts to date have been insufficient. Long-term energy policies are necessary to foster more private-sector participation in this and other states with wind resources.

- *CFE's financial interests.* The wind farms in Oaxaca are wheeling energy to sell to corporate clients in northern Mexico, who have become token investors in order to qualify as self-generators. The wind generating capacity is expected to grow 3,492.9 MW by 2014, but beyond that no further growth is projected. Given the current subsidies for the agricultural and residential sectors, it is not in CFE's long-term interest for their largest and best industrial and commercial clients, who pay the full cost of electricity service, to become self-generators and step out of the CFE system.

Over the last few decades, companies, grouped in associations or power consortia, have begun to obtain permits from the Comisión Reguladora de Energía (CRE) in order to generate their own electricity at costs that are 30–40% cheaper than CFE's tariffs. To date, the CRE has granted 595 self-supply power generation permits. In 1994, self supply accounted for only 7 MW; in 2000,



Source: Presidencia de la República (Mexico), "Tercer Informe de Gobierno," http://www.informe.gob.mx/#.

self-supply projects surpassed 2,000 MW; and in July 2009, these permits reached 6,556 MW. The number of permits granted tripled between 2004 and 2009.

Most of these projects use renewable energy sources. Wind energy is one of the most common technologies, with plants mainly in the Isthmus of Tehuantepec, State of Oaxaca, and in Tecate, Baja California, connected to firms in the food and retail sectors, breweries, and even entertainment in Central and North Mexico.

7.3.1 Open Season for Wind Transmission

In order to promote greater use of wind energy, CFE worked jointly with the Secretaría de Energía (SENER) and CRE to develop a new mechanism called Temporada Abierta (Open Season), which allowed joint participation of public and private sectors in the planning and construction of a transmission line. Through this mechanism, four CFE projects and seven private projects located on the Isthmus of Tehuantepec will invest more than USD 300 million to create new transmission infrastructure allowing wind power generated in that region to be evacuated and transmitted to other consumption centers in the country. Seven of these eleven companies will use the new infrastructure, and four are already using CFE's existing lines. Participating firms have committed to install up to 1,985 MW of new capacity that will systematically enter into operation over the period of 2010–2012.

7.3.2 The New Renewable Energy Law

As mentioned above, the Calderón administration's October 2008 energy reform focused largely on strengthening PEMEX and regulating the hydrocarbons sector but also addressed renewable energy and sustainable energy use.

The objective of the Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética is to reduce Mexico's dependence on hydrocarbons by promoting specific renewable energy technologies: wind, solar, hydro, tidal, geothermal, biofuels (as stipulated in the biofuels law), and other technologies sanctioned by the Secretary of Energy.[379] It provides long-awaited focus on the renewables sector and begins to address the idea that renewables need significant promotional support as well as financial incentives.

[379] The law explicitly excludes some technologies including nuclear energy and methane from landfills that do not comply with environmental rules.

- The CRE has (a) issued standards, directives and methodologies to regulate power generation from renewable sources; (b) regulated pricing of wheeling, back-up, and other services provided by the Mexican state-owned public utilities (including CFE) to private generating companies using renewable sources; (c) reviewed the public utilities' dispatch rules applicable to private generating companies using renewable sources; (d) issued new interconnection rules; (e) issued energy bank or set-off mechanisms with the public utilities for renewable sources self-supply, cogeneration, and small-scale production projects; and (f) outlined the principles to which contracts between the public utilities and private generators (including wheeling, back-up, power excess sales and other) shall adhere.

- CFE shall enter into long-term contracts with private power generators using renewable sources (i.e., wheeling, backup, power excess sales, and others).

- CFE shall accept into the national grid power input from private power generating facilities using renewable sources and render wheeling, backup, and other services in accordance with the terms and conditions established by the CRE as well as receive excess power input from such facilities.

- It created the Fondo para la Transición Energética y el Aprovechamiento Sustentable de Energía, to be funded from the federal budget, to promote the use of renewable sources and energy efficiency, including providing financing guarantees and direct support (although no guidance or detail is provided on how). Three billion pesos (approximately USD 220 million) will be allocated annually in the 2009–2011federal budget.

- SENER will create a new program to promote renewable energy, the Special Program for the Use of Renewable Energy.

On September 3, 2009, the Mexican government published specific guidelines to implement renewable energy sources and clean technologies to generate power. This new regulation states that federal, state, and municipal governments are now able to sign agreements with private power suppliers (developers) in order to take advantage of renewable energy resources in their territory.

SENER will be able to provide technical assistance to rural communities interested in renewable energy technologies under the national rural electrification program and as part of the Special Program for the Use of Renewable Energy described in the preceding section. In order to implement strategies and programs and develop and update renewable energy resource assessments, SENER will also be able to sign collaborative agreements with other federal government entities.

The CRE will work on two specific regulatory provisions of the new reform, wheeling charges and power purchases. On April 16, 2010, CRE issued a new framework for wheeling charges applied to private generators, aiming to ensure power quality benefits provided by these generators in using national grid are proven and establishing whether or not generators are eligible for compensation for the benefits they provide to the system. This new framework

reduces wheeling charges from an average of USD 0.15 per kWh to USD 0.09 per kWh. CRE will set up new calculation methods for counter-payments to buy power from renewable developers. The regulation itself does not add much detail to the law, but it affirms that key activities such as the methodologies described above, the development of the Strategy for the Energy Transition, and the Advisory Council are continuing to move forward with the implementation of the renewables law.

7.3.3 Wind Tenders

According to the Asociación Mexicana de Energía Eólica (AMDEE) in Mexico City, installed wind generation capacity stands at 518.63 MW, comprising eight wind energy projects installed from 1994 to 2010, including the two CFE projects of La Venta I and La Venta II (84.9 MW), five private self-supply projects, and one Baja California state-owned project. The value of these eight projects reached a total of USD 1.1 billion.[380]

The Mexican wind market today is growing rapidly, and several projects are under construction or development.

- Five large-scale wind energy projects are under construction, totaling 717.2 MW with estimated investments of USD 1.6 billion. The public projects include three from CFE using an independent power producer scheme: La Venta III (101 MW); Oaxaca I (101 MW); and Oaxaca II, III, and IV (304.2 MW). One privately sponsored project (Peñoles, 50 MW) is being developed for self-generation. These projects will enter into commercial operation by the end of 2010 or early 2011.

- Ten wind projects are under development, meaning that sponsors are still negotiating land leasing, securing capital and power markets, looking for off-takers interested to become partners, and/or seeking technology partners (turbines and transmission infrastructure). These projects represent 3,492.9 MW of installed capacity with a total investment level of USD 8.0 billion from 2011 to 2014. Most of these projects are planned under the “Open Season” period.

- Approximately 14 wind energy companies have expressed interest in developing projects in several Mexican states, mainly Oaxaca, and are negotiating with authorities to facilitate a new season of bidding and negotiations for additional transmission infrastructure called “Open Season II.” As such, current and future transmission infrastructure under Open Season I in the state of Oaxaca may be expanded even further in order to allow new capacity in that state. Conservatively, 1,000 MW with a market value of USD 2.3 billion may be added as a result of this additional interest.

- Finally, other projects are being developed in states other than Oaxaca and independent of the large amount of companies grouped within AMDEE under Open Season I and a potential Open Season II. These project developers are in the early stages, working mostly on negotiating land leases, processing environmental permits, looking for capital

[380] AMDEE provided an estimate of USD 2.3 million for the average cost per megawatt of wind energy, which has been applied for the several projects included in this report.

and power market partners, and seeking to finalize technology options (turbines and transmission infrastructure). These projects will represent an estimated USD 17 billion in investments to install more than 7,000 MW of wind power capacity from 2010 to 2020. One of these projects, Los Vergeles, is already being developed in Tamaulipas and is being financed by the North American Development Bank; the main market for the project will be public lighting systems for 43 municipalities in that state.

7.4 IMPLEMENTATION OF GLOBAL CLIMATE CHANGE PROGRAMS IN MEXICO

In parallel with the efforts of the energy sector discussed in the previous sections, Mexican environmental authorities have been looking at energy efficiency and renewable energy projects as key in the implementation of newly developing policies and commitments to climate change issues.

As with the energy efficiency and renewable energy discussions, the environment and context of climate change is an important recent development and a major change in Mexico's approach to the issue. On August 28, 2009, the Mexican government officially published its Plan Especial para Cambio Climático, which lays out a long-term vision (to 2050) concerning GHG mitigation as well as analysis of vulnerability, economic analyses, capacity building, and other adaptation activities. The plan also provides an important short-term commitment to reducing 50.7 million tCO_2e by 2012.

Section 8 Gap Analysis and Recommendations

This section reviews the progress made to date in achieving the goals established in Strategy 2020 and assess the factors contributing to the patterns observed in programmatic support for clean energy in Central America. Based on this analysis, it identifies gaps and areas of opportunity for USAID's Central America and Mexico Regional Program and reviews the criteria for potential clean energy and climate change activities. Finally, it outlines and ranks five summaries of concepts for programs that might be supported by the USAID Central America and Mexico Regional Program.

8.1 SUMMARY OF STRATEGY 2020 OBJECTIVES

The Estrategia Energética Sustentable Centroamericana 2020 (Strategy 2020) was approved by the energy and hydrocarbons directors and subsequently the ministers of energy in November 2007. The document approved at that time articulates the following general objective for Strategy 2020:

> "Ensure the energy supply of Central America—in terms of quality, quantity and resource diversity—that is necessary to guarantee sustainable development, taking into consideration social equity, economic growth, governability, and environmental compatibility, in accordance with international environmental commitments."[381]

The Strategy 2020 text then breaks down the areas identified in the general objectives and identifies seven specific objectives, activities linked to each specific objective, and ten targets for the Strategy 2020 (summarized in the table below). The document also highlights the following instruments and approaches to achieving these objectives, including: (1) investment promotion, both by the private sector and in the form of "mixed" initiatives (that is, public-private partnerships); (2) economic and financial mechanisms for promoting renewable energy resources and efficient technologies; (3) strengthening regional energy integration; (4) institutional strengthening in the energy sector and environmental protection agencies; (5) reinforcing competition in energy markets; (6) harmonization of regulatory instruments; and (7) improvement of economic instruments in the region.

[381] CEPAL/SICA, "Estrategia 2020," p. 100.

Summary of Specific Objectives, Activities and Targets in Strategy 2020

Specific Objectives	Activities	Targets
1. Reduce growth in demand for hydrocarbon-based fuels	• Increase energy efficiency • Substitute fossil resources • Reduce generation based on fossil fuels • Incorporate new technologies • Adopt pricing to foster efficiency and fuel substitution	• Reduce hydrocarbon fuel use by 10% through efficiency programs, standard-setting and public transport [T7]
2. Reduce dependence on imported energy by increasing use of renewable resources	• Increase endogenous energy resources • Increase energy efficiency • Create fiscal incentives for endogenous resources (generation and biofuels) • Remove barriers to use of endogenous resources • Promote biofuels, solar and wind power • Adopt price policies to promote renewables • Measure and evaluate impact of subsidies • Utilize the CDM • Institutionalize renewables	• Increase share of renewable resources in electricity generation by 11%, primarily through construction of hydroelectric facilities [T8] • Substitute 15% of fuel consumption for private and public transportation using biofuels [T9]
3. Improve efficiency and promote rational energy use on both demand and supply sides	• Implement regional efficiency information campaign • Implement training in efficient driving • Efficiency in energy intensive sectors • Harmonize technical standards • Coordinate with other agencies to increase efficiency • Evaluate fuelwood potential • Adopt programs for improved stoves and efficient fuelwood use • Assess externalities and sustainability of fuelwood use	• Reduce fuelwood consumption by 10%, with improved stoves, in 1 million homes [T2] • Reduce electricity use for residential, commercial, industrial and public lighting by 12% [T3] • Reduce electricity use for refrigeration by 35% through substitution of old units for efficient ones in 2.7 million homes [T4] • Reduce electricity use in industry by 10% through efficient motor use [T5] • Reduce line losses to at most 12% throughout region [T6]
4. Incorporate new technologies and cleaner energy resources	• Introduce natural gas into generation and other sectors • Expand biomass use in generation • Evaluate LPG use in transportation • Fiscal incentives • Remove barriers (legal, institutional, economic, financial, technical, social and environmental) • Harmonize regulatory standards	
5. Increase access to energy services for the poor and marginalized populations	• Expand supply alternatives for remote communities • Financial mechanisms for rural electrification • Improve technologies for residential use • Create opportunities for productive energy use in rural areas	• Achieve 90% electrification in each of the countries in the region [T1]

Summary of Specific Objectives, Activities and Targets in Strategy 2020, continued

6. Mitigate environmental impact of energy production and use	• Evaluate environmental impact of hydropower and hydrocarbon use • Introduce cleaner resources to substitute for polluting resources • Define standards and regulation • Pricing that reflects real costs	• Reduce emissions of GHGs by 20% relative to the baseline projection for emissions in 2020 [T10]
7. Develop energy projects using natural resources compatible with environment and human settlements	• Improve community communication and participation • Define regulatory frameworks for income redistribution • Sustainable watershed management • Evaluation of environmental impacts	

Source: CEPAL/SICA, "Estrategia Energética Sustentable Centroamericana 2020," 2007, pp. 99–102. Some wording has been abridged.

In a related initiative to the preparation of the Strategy 2020 document, the Interinstitutional Group of regional agencies, multilateral institutions, and donor agencies[382] formulated a matrix of actions that organizes the areas of activity drawn from the Strategy 2020 under the rubrics of (1) rational and efficient use of energy, (2) diversification of the energy matrix and new and renewable sources of energy, (3) access to energy, (4) energy and climate change, (5) regional integration, and (6) institutional issues (See Section 7 of the Statistical Annex).

8.2 RECENT ASSESSMENTS OF PROGRESS TO ACHIEVING STRATEGY 2020 OBJECTIVES

In late 2009, CEPAL completed a review of the progress made to date in achieving the goals established in Strategy 2020. In general, the report concluded that the region appears to be on a path to achieving these goals in the context of renewable energy generation in the power sector but that there has been considerably less progress in the areas of biofuels and energy efficiency and that achievement of the targets for 2020 in these areas appears unlikely. The report does not provide a line-by-line assessment for each of the ten targets noted above; rather, the presentation is more qualitative. Therefore, the following review of each target is intended to provide a more quantitative assessment and help anchor the gap analysis presented in the following sections. The figures in the table below are presented with the caveat that they have been developed by Nexant on the basis of the available data and documentation for Strategy 2020 but have not been reviewed or approved by SICA or any of the related organizations.

[382] SICA General Secretariat, SIECA, CCHAC, CEAC, CRRH, CEPAL, INCAE, CABEI, IDB, USAID and OLADE.

Review of Strategy 2020 Targets and Representative Values

Target Parameter	Reference Value(s) (2005)	Most Recent Value (2008)	Projected in 2020 at Current Rate of Change
Achieve 90% electrification in each of the countries in the region [T1]	55% (NI) to 98% (CR)*	61% (NI) to 99% (CR)*	All countries should exceed 90% target
Reduce fuelwood consumption by 10%, with improved stoves, in 1 million homes [T2]	Consumption: 62,860 kboe**	--	--
Reduce electricity use for residential, commercial, industrial and public lighting by 12% [T3]	Consumption: 28,542 GWh	33,230 GWh	Projected: 73,212 GWh@ Target: 8,785 GWh@
Reduce electricity use for refrigeration by 35% by substitution in 2.7 million homes [T4]	--	--	--
Reduce electricity use in industry by 10% through efficient motor use [T5]	Consumption: 2,858 GWh***	--	Projected: 6,589 GWh† Target: 658 GWh†
Reduce line losses to at least 12% throughout region [T6]	9.7% (CR) to 29% (NI)	10.6% (CR) to 27% (NI)	All countries should exceed target
Reduce fossil fuels in transport by 10% through efficiency, standards and public transport [T7]	137,270 b/d	143,380 b/d	Projected: 152,110 b/d Target: 136,900 b/d
Increase renewables in generation by 11%, primarily by adding hydroelectric plants [T8]	60.8%	63.1%	Projected: 88.4% Target: 74%
Substitute 15% of fuel consumption for private and public transportation using biofuels [T9]	--	Production: 2,520 b/d	Production: 7,800 b/d 15% target: 36,347 b/d#
Reduce GHG emissions by 20% relative to the baseline projection for emissions in 2020 [T10]	--	--	--

Source: From annexes.
Notes: *Reference is 2006, most recent is 2007.
**Kboe is thousands of barrels of oil equivalent, figure is for 2007 (ESMAP report, 2010, p. 34).
***Large consumers in 2007 (ESMAP report, 2010, p. 65; †Based on 9% share of total sales (2007 share from ESMAP report, 2010), and 10% of that value; @Medium scenario sales projection from CEAC (2009), and 15% of that value; #Amount equivalent to 15% of projected consumption of gasolines (leaded/unleaded) and diesel (transportation/industrial).

The figures presented above illustrate CEPAL's general point but also identify some important gaps in the availability of data, particularly in the area of the structure of electricity consumption, which will be essential for evaluating progress toward achieving targets 2, 4, and 5 as well as the target related to reduction of GHG emissions.

Recently, the SICA/UCE requested that the national agencies involved in the implementation of the matrix of actions provide their respective prioritizations of the specific actions identified in the matrix. According to Jorge Vásquez, Director of SICA/UCE, the each national counterpart scored specific activities on a scale of 1 to 5, with 5 indicating the highest priority. The items scored by all of the country counterparts resulted in average scores, which are presented in the table on the following page.

Prioritization of Actions in the Matrix of Actions, May 2010

Energy Efficiency			
Modify energy use	Program design	Have designs with financing and M&V defined (1.1.1.1)	4.0
	CFL programs	**Installation of 24 million CFLs during '08–'20** (2.1.1.1)	**4.6**
	Create regional fund	**Have resources for regional EE programs** (3.1.1.1)	**5.0**
Energy Matrix Diversification			
Add RE projects	Update project data	Have portfolio of bankable projects (10.1.3.1)	4.0
	Support hydro projects	Identify specific needs of portfolio projects (10.2.1.1)	4.2
	Conclude project prep	Identify at least 20 small hydro projects (10.3.1.1)	4.2
	Support geothermal	Eliminate barriers to geothermal projects and identify portfolio (10.4.1.1)	4.2
	Identify finance options	Incorporate new geothermal projects (10.4.2.1)	4.0
	Address project impacts	Conduct study of cases of negotiations and conflict resolution (10.7.1.1)	4.0
Access to Energy			
Electrification	Grid extension or off-grid	Achieve 90% coverage with portfolio of electrification projects (11.1.1.1)	3.8
Energy and Climate Change			
Energy planning	**Studies on GCC and energy**	**Incorporate impact of GCC in energy development alternatives** (12.1.1.1)	**4.4**
Support projects	Support CDM projects	Achieve more CDM projects (12.2.1.1)	4.0
Fuels' GCC impacts	Study EE in fuel use	Proposal for vehicle fleet improvement for region (12.3.1.1)	4.0
Regional Integration			
Consolidate regional integration	**Accelerate harmonization**	**Harmonization of sector, with MX and CO interconnections** (13.1.1.1)	**4.8**
	SIEPAC-Mexico	Conclude Mexico-Guatemala interconnection (13.1.2.1)	4.3
	Support transmission	**Have national transmission systems ready for MER** (13.1.3.1)	**4.5**
Institutional Issues			
Ensure institutions can execute plans	**Support regional entities****	**Ensure high level of capacity to execute integration programs** (16.1.1.1)	**4.8**
	Support national EE units	Ensure national agencies can implement EE programs (16.1.2.1)	4.2

Source: Jorge Vásquez, SICA/UCE. Data circulated to national counterparts on July 30, 2010. According to Vásquez, Honduras did not provide input in the survey.
**Specifically, CCHAC, CEAC, and SICA/UCE.
Note: Reference numbers in parentheses correspond to labeling in the matrix of actions; texts have been abridged and simplified to facilitate presentation.

The results of this survey provide insight into how the national agencies in the region assess the urgency of making progress in specific areas; in other words, the scores serve as a proxy for an assessment by national agencies of the gaps between the current state of the various initiatives and the targets established in the context of the Strategy 2020. In the table above, the items that received scores of 4.5 or more are highlighted in bold; for reasons related to the limited number of participants and their shared general interest in the objectives of the Strategy 2020, there is a bias toward the high end of the spectrum. Nexant has arbitrarily identified a score of 4.5 as the minimum value assigned by the national directors of energy to actions that they believe are the highest priority. Based on this reading of the data, four general observations seem appropriate:

- While activities in support of the expansion of renewable energy generation in the region are considered generally high priority, they do not score highest of all, suggesting that the directors believe that there is sufficient momentum toward a comparatively more rapid expansion of renewable generation based on the current project pipeline and that the target for 2020 will be achieved.

- Activities related to achieving progress on energy efficiency activities are given a higher priority, with the mobilization of resources for a proposed regional energy efficiency fund (not surprisingly) identified as the top priority of all, ratifying the general assessment that progress in the area of energy efficiency has been inadequate to date.

- Rural electrification activities are relegated to a lower-priority status because progress has been reasonably good and there is a strong likelihood that the target in this area will be achieved.

- Institutional strengthening in support of program implementation and regional integration is also ranked very high, reflecting the general assessment that there is considerable unfinished work in this area.

8.3 ANALYSIS OF DONOR ACTIVITIES AND PRIORITIES

Based on the analysis presented in Section 7 as well as the review of experience in the region with renewable energy resources and energy efficiency, this section assesses the factors contributing to the patterns observed in the programmatic support for clean energy in the region, namely a preponderance of programs at the national level, with a much broader range of activities at the national level as compared to those implemented at the regional level.

Bias toward national-level programs and initiatives. While considerable donor support has been given to regional institutions and initiatives, available data on donor lending and grants for activities in the renewable energy and energy efficiency subsectors appear to confirm what anecdotal evidence has suggested, namely that donor support has tended to be more significant for activities in specific countries (that is, at the national level) as opposed to initiatives undertaken at the regional level. Even if the significant IDB commitment to SIEPAC (which is not a renewable energy and energy efficiency investment) were included in the assessment, this conclusion would still hold true because of the considerable resources allocated to national institutions for conventional energy sector projects.

The apparent bias toward projects executed at the national level is important because of the factors that contribute to it and the effects that it produces. Several forces foster the emphasis on national-level projects:

- Deep-seated concerns with the defense of domestic prerogatives to protect national sovereignty

- Continuous political change at the national level, leading to regular reformulations of policy and staff turnover, which leads to new staff often requiring time and support to develop adequate knowledge of the subject matter

- Uneven donor coordination across the region, which creates space for the development and implementation of fragmented initiatives

- Small amount of donor resources, which encourages donor agencies to undertake programs that are limited in size so as to achieve a more clearly identifiable and measurable outcome

- Uneven capacity across regional institutions and lack of internal political coherence within them, resulting in skepticism and even frustration on the part of donors working at the regional level

- Limited number of independent organizations (NGOs, academic institutions) with capacity and experience to operate effectively at the regional level

- Despite two decades of steady progress in economic liberalization, restructuring and improvements in the transparency of regulatory frameworks, the attractiveness of the investment climate varies considerably from country to country, resulting in greater investment in certain countries

- Conversely, countries that have lagged behind others in the region tend to attract more donor funding for specific activities, such as rural electrification

- Structural biases that devolve financial and managerial responsibility to the national level even in the context of ostensibly regional institutions, as illustrated in the case of SIEPAC by the fact that debt for the high-voltage interconnection is payable by the national shareholder companies

- Limited willingness to invest national resources in energy efficiency has obliged donors to allocate grant resources to facilitate investments in national efficiency programs, while the lack of coherent national frameworks has made it necessary to pursue energy efficiency, particularly in the industrial and commercial sectors, through higher-cost "retail" strategies based on performance of audits, company-by-company capacity building, and programs that typically do not achieve national, much less regional, visibility

While the forces that reinforce this trend are understandable at various levels, the emphasis on national-level programs is not conducive to the achievement of environmentally sustainable and robust economic development over the long term. Fundamentally, the markets of the region are too small when taken individually to achieve economies of scale that will facilitate investment; create an attractive market for suppliers of new, greener technologies; permit the effective exploitation of energy resource diversity within the region; and generate volumes of emissions reductions that will be marketable in the international market. If it continues, segmentation into national markets will undermine discernable trends toward patterns of economic activity and growth that are more sustainable from an environmental and social standpoint, for the following reasons:

- *In the power sector, achieving higher levels of renewable energy penetration requires system operators to have access to sufficient dispatchable capacity to regulate intermittent resources*. Given the variations in resource endowments among countries, the least common

denominator is typically a thermal facility fueled with diesel or bunker fuel; in an integrated regional power market, it is a renewable and dispatchable resource, ideally hydroelectric but also thermal based on biomass, typically bagasse. Resource planning is conducted at the regional level, but the result lacks sufficient authority to ensure that trends are mutually reinforcing across the region.

- *In the liquid fuels sector, the variation in suitable agricultural resource endowments, if fully exploited, would lend itself to greater regional trade because some producers could exceed the demand for biofuels in their domestic market while others would be in a deficit position.* At the same time, the potential negative impacts of biofuels production due to land-use change and other impacts are likely to be greater in some countries than in others. By facilitating regional trade in biofuels, these impacts, which are inevitable to some extent, may be minimized while achieving optimal level of output.

- *In other areas of transportation for freight as well as passengers, efforts to speed integration, especially when linked to the development of railways, can create considerable efficiencies in the use of transportation fuels.* Even with transportation networks based on freight and passenger transport by highway, the process of harmonization of highway networks at the regional level will reduce inefficiencies, shorten transit times, and reduce costs.

- *In the area of energy efficiency, particularly with respect to the power sector, efforts to create a regional power sector, if incorporating provisions that foster higher levels of investment in efficiency, can exert a more powerful force to exploit energy savings, and by creating a larger market for efficient technologies, increase volumes and reduce costs.*

Notwithstanding the references to national-level programs noted in the review of donor activities and programming presented in Section 7, there is also evidence of long-standing support and commitment by some donors to the development of regional institutions in the energy sector. The IDB, with its long-standing and at times even lonely commitment to SIEPAC, is clearly in this camp. CABEI, while it did commit resources to SIEPAC, has primarily served as a regional conduit for resources allocated to the region by other multilateral institutions and international lenders, notably KfW, and these loans have gone to individual projects and initiatives, which are necessarily national in scope. Meanwhile, the World Bank, which has not been a very active player in the region over the last decade and which did relatively little to reinforce regional institutions during this time, appears to be changing course, as evidenced by the efforts of the Energy Division for LAC in the last six months. Even so, dialogue with officials from the Energy Division indicates that the Bank is limited by requirements to act on the request of national governments. For its part, UNDP, apart from a major GEF-funded program begun in 1999 to build capacity for policymaking on renewable energy at the regional level, has typically implemented programs at the national level.

Bilateral donors, meanwhile, have shown an even greater tendency to work at the national level, with some notable exceptions, such as Finland, with its long-standing commitment to AEA; Germany's KfW with its commitment to working with CABEI; and for its part, USAID, which has provided extensive support to CCAD. Other U.S. agencies are more active at the national level. In the case of MCC, this appears to be because of legal requirements, while in the case of other institutions it may be due to a measure of skepticism about the prospects for integration.

The more recently formulated ECPA, despite its mandate to work at the hemispheric level, features largely national-level initiatives and does not appear to have engaged SICA and the related regional institutions in Central America or even the wider Mesoamerica Program.

Emphasis on power sector and energy efficiency. With respect to the substantive areas of focus of donor initiatives, while programs have covered the entire spectrum of issues, the scope of regional activities have been focused on issues related to the power sector as a whole and energy efficiency, with a significant number of programs and activities that are focused on specific issues at the national level or sometimes on a subset of the seven countries in the region. The scope of the principal regionally oriented activities over the last five years or so has, in general, been narrowly focused on (1) regional transmission infrastructure and regulatory frameworks and to a lesser degree (2) energy efficiency and (3) renewable energy policymaking. The following points describe the relevant programs:

- *IDB*. IDB's emphasis in regional terms has been on the SIEPAC project, in the form of a USD 253 million loan program together with several million in technical assistance throughout the program to support the creation of a regional planning, operational, and regulatory framework. While renewable energy and energy efficiency are important in this context, the IDB's support has not addressed these issues specifically.

- *GEF*. Working through UNDP, GEF has dedicated some USD 10 million to supporting work on energy efficiency at the regional level. Biomass Users Network-Central America (BUN-CA), based in Costa Rica, has been an important part of the GEF's programming. Of relevance to regional energy efficiency issues, BUN-CA has worked with regional institutions, including the project office for the USAID-CCAD cooperative agreement to support the development of national energy efficiency standards for key appliances. When work began in 2004, there were no standards in place in the region; now there are 44, including at least two that are obligatory at the national level.[383]

- *USAID/CCAD*. The USAID-CCAD cooperation agreement encompasses a range of environmental management, trade, and competitiveness issues, within which energy efficiency plays an important role. The explicitly regional aspects of the work undertaken under the agreement include support for the development of energy efficiency standards throughout the region; the creation of a regional price for energy efficiency; and programs to facilitate communication among specialists at the regional level, including journalists and spokespersons from national institutions and ministries.[384]

Wide range of activities at the national level. Meanwhile, the scope and focus of national-level activities undertaken in the last decade has been far more varied and diverse in terms of coverage and types of support, including: (1) capacity building and support for entrepreneurs; (2) pre-investment studies; (3) financial mechanisms of various types; (4) rural electrification; (5) renewable energy resources assessments; (6) pilot projects in the biofuels sector; (7) support for greenhouse gas inventories and preparation of national communications; and (8) policy development support on a range of topics.

[383] Interview with José María Blanco, President, BUN-CA (Costa Rica), August 3, 2010.
[384] CCAD, USAID-CCAD cooperative agreement, "Informe Anual 2008–2009," November 2009.

- *IDB*. The IDB has provided support for a wide range of national-level activities, at least 64 according to internal data, covering a wide range of policy, institutional, and project-specific issues. In terms of financing and business support, it appears that the emphasis is more on energy efficiency, while renewable energy activities account for more than 80% of the grants.

- *CABEI*. With the exception of CABEI's loan, alongside IDB and CAF, for a small part of the financing of SIEPAC, CABEI's activities have been focused on national-level activities and projects. Renewable energy projects comprise perhaps as much as 80%, of CABEI's energy portfolio.[385] The emphasis has been on providing financing in the form of onlending facilities established with multilateral and bilateral financial institutions, notably KfW, and business support. The recently created Accelerating Renewable Energy Investment in Central America (ARECA) program, which is funded by GEF and implemented by UNDP, provides partial credit guarantees for small-scale renewable energy projects.[386]

- *World Bank*. The major project examples in Central America identified by the World Bank include rural electrification programs in Honduras and Nicaragua and energy efficiency in Honduras.

- *UNDP*. UNDP has undertaken a wide range of activities at the national level, covering carbon and climate change analysis and policy, energy efficiency, and renewable energy (including resource assessments such as those prepared by SWERA and the U.S. National Renewable Energy Laboratory), primarily with GEF funding but also with resources from other donors or its own budget.

- *UNEP/Risø – Capacity Development for CDM (CD4CDM)*. The CD4CDM capacity-building program provided support on issues related to the development of DNAs in Guatemala through a local NGO, Fundación Solar and in Nicaragua, working directly with MARENA. Capacity building is focused on the execution of national and regional workshops covering issues such as the development of technical and management capacity in DNAs, outreach and training for developers of CDM projects, introduction of emerging mechanisms within the CDM such as Programs of Activities (Programmatic CDM), and technical issues, such as baseline methodologies and additionality.

- *Proyecto Mesoamericano*. The Proyecto Mesoamericano's energy-sector activities encompass SIEPAC, specifically the extension of SIEPAC to Mexico and Colombia, as well as a series of small-scale biodiesel production facilities in El Salvador, Guatemala, Honduras, and Mexico using technology developed in Colombia. The initiative does not have resources of its own and constitutes a regional network that mobilizes support and disseminates information about a range of infrastructure development activities that are funded by development finance institutions, principally the IDB.

[385] Interview with Waldo Moncada, energy specialist, CABEI (Honduras), August 3, 2010.
[386] See the ARECA program description at http://www.bcie.org/english/banca-inversion-desarrollo/desarrollo-competitividad/areca.php.

- *USAID/FENERCA*. The FENERCA program, which concluded in 2005, delivered training, business development support and financial advisory services to dozens of small businesses and entrepreneurs in the renewable energy sector, achieving a considerable degree of leverage in terms of the financing mobilized. FENERCA was implemented by E&Co., with close cooperation from BUN-CA and several other regional NGOs. The program had ten target countries, including five in Central America: El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

- *Millennium Challenge Corporation (MCC).* MCC has agreements ("compacts") with two countries in the region, El Salvador and Honduras. Only the El Salvador program includes an energy-sector project, which will deliver electric service to some 50,000 people in a remote area in the northern part of the country.

- *KfW*. KfW has established credit lines with CABEI to provide a considerable amount of financing for large-scale as well as small-scale projects. The distribution of the projects that have received financing is limited still because much of the funding has not yet been placed.

- *GTZ*. GTZ's activities on renewable energy and energy efficiency typically feature studies of critical issues to support policymakers, delivered in the context of a close and long-term collaborative relationship with the relevant agency. In terms of regional activities, GTZ's collaboration is with the IDB, where it has provided funding for SECCI programming on the range of activities covered by the IDB, primarily at the national level. As noted, GTZ is beginning to implement a new initiative. Although this program has a regional scope and does include engagement with SICA, its primary focus is on national-level institution building.

- *Finland*. Finland, through its cooperation with AEA, is supporting project development activities with funding for pre-investment studies as well as some pilot projects. The projects are distributed throughout the region and the Dominican Republic, but there is considerable concentration in Guatemala and Nicaragua, with 90 projects between them accounting for 41% of the grants awarded.

8.4 ASSESSMENT OF CURRENT GAPS

Numerous gaps and areas of opportunity for USAID's Central America and Mexico Regional Program have emerged in the discussion of the evolution of the region's energy sector in recent years as well as the activities of major donors active in the area. The gaps are (1) substantive, (2) institutional, and (3) geographic. The following section contains observations under each of these three headings.

Substantive gaps. From the standpoint of the topics and issues that have been left uncovered or underrepresented by donors and institutions active in the region, the following require attention in the short to medium term in order to ensure the success of SIEPAC and advance the cause of regional energy integration.

- Institutional restructuring of CEAC is urgently needed to align its membership with the current structure of the regional power sector and its activities and work products support the

objectives of SICA and the national governments as articulated in the Strategy 2020 and their national policies, particularly with respect to energy efficiency but also with respect to the integration of renewable energy generation. The planning document produced by CEAC does not incorporate energy efficiency and distributed generation in any meaningful way, nor does its treatment of renewable energy resources adequately reflect the opportunities available. For this reason, the planning process does not yet rise to the standard of integrated resource planning as practiced elsewhere.

- Training and support for the institutional development of the Central American regional regulatory agency, CRIE, are essential so that it can (1) assume the tasks assigned to it in the launch of the MER under the RMER; (2) support efforts to incorporate more renewable energy generation in the regional market by developing a regional framework for procurement of renewable generation; and (3) incorporate regulatory measures that will drive greater progress in energy efficiency throughout the region. At present, CRIE is understaffed and faces an enormous workload in order to ensure the consolidation of the regional market.

- The future expansion of generation capacity in the country is predicated on a considerable amount of new hydroelectric capacity, yet there is widespread concern about the environmental and social impacts of such development. From the community perspective, these projects are viewed as unacceptably destructive. From the national perspective, the local opposition puts policymakers on the horns of a cruel dilemma, pitting national energy development priorities against specific environmental protection objectives. For investors and lenders, the opposition dramatically increases the level of risk associated with the projects and decreases the number of projects that can be executed. Given these challenges, there is an urgent need for governments, NGOs, and other national and international organizations to develop strategies for finding solutions to hitherto irreconcilable conflicts.

- Support is necessary for the continuation and expansion of work to establish obligatory regional energy efficiency standards, proceeding from the starting point provided by the current set of 44 national standards in various stages of development. National governments have expressed frustration that they do not have the resources to pursue this objective, which remains a relatively long-term proposition.

- Monitoring and evaluation of national energy programs, energy efficiency initiatives, and many other government initiatives is largely non-existent. While SICA has presented some proposals for the creation of a SICA energy information system, to date this activity does not appear to have received support.

- Significant resources (greater than the donor grants and financing provided to date) will be needed to fund incentive programs for energy efficiency and renewable energy and drive significant change in energy-use patterns and the energy matrix. In order to secure these resources, economic and finance policymakers throughout the region need to be exposed to the results of analyses showing the economic and financial returns of aggressive energy efficiency programs. One of the immediate applications of better data and analysis from program monitoring and evaluation will be to support economic and financial analysis that will help justify national investments in energy efficiency.

- The region's engagement with international carbon markets, while long-standing, has been disappointing, and the level of activity at national agencies has been uneven over time. The quality, coherence, and timeliness of data in national inventories are weak. At the same time, the region has lost prominence on the international stage even as a Costa Rica takes charge of the UNFCCC Secretariat. With greater attention to national-level activities in the aftermath of the Copenhagen Agreement, there is a pressing need to update national data and make it more consistent at the regional level.

Institutional gaps. A plethora of institutions and initiatives are active on energy issues at the regional and supra-regional level in Central America. In part, the existence of multiple institutions is a legacy of the transition from the organization of the region's energy sector as it existed prior to the restructuring of the 1990s to the far more diverse configuration in place at present. It also reflects the fact that regional integration is occurring at different levels, with considerable overlap among the initiatives and organizations at each level.

This proliferation contributes to the risk of spreading resources too thinly as a result of providing support to a large number of institutions and initiatives and makes selection of the institutions and initiatives for support particularly important. At the same time, there is no question that some institutions in the regional energy sector, given their current structure and configuration, are ill suited to taking on the responsibilities that are required in the emerging regional market in order to achieve the objectives laid out in Strategy 2020. In particular, a program of reorganization and strengthening is needed at two organizations:

- *CEAC*. CEAC's role as a long-term planning institution has been undertaken without a permanent secretariat and with a rotating leadership. Its membership does not reflect the current composition of the power sector in the region or the reality that the power sector must integrate both the supply and the demand sides of the market in order to achieve the objectives of the long-term planning process: security of supply; relative price stability; and economic, social, and environmental sustainability. Though it predates SIEPAC, CEAC has been part of the SIEPAC process in part because it has been institutionally useful (it is legally constituted and recognized), but this does not mean that it has benefited as an organization from the process. This is probably due in part to the fact that CEAC appears to be more a legacy of the past and because new institutions have been created. However, now that SIEPAC is on the verge of becoming a reality, it is time for CEAC to benefit from institutional support, though this should be provided on condition that changes to its constitution are made in light of changes in the regional power sector over the last decade, particularly in order to clarify the relationship between CEAC and EOR (more on EOR follows below).

- *CCHAC*. CCHAC exhibits even greater weakness for many of the same reasons as CEAC, with the major difference being that CCHAC, unlike CEAC, has not been able to play a role in a major regional integration initiative. While the political impediments to any sort of initiative to integrate the liquid fuels sectors of the region are considerable, and perhaps insurmountable, CCHAC does have an important role to play in the context of regional standards setting and as a forum for policymaking on issues related to hydrocarbon-based and renewable fuels. It also could benefit from support to facilitate the dissemination of critical data on liquid and solid fuels in the region.

In addition, two agencies that have been created in the context of SIEPAC require strengthening and support in order for them to perform their roles in the regional power sector and contribute to achieving the objectives of 2020.

- *CRIE*. CRIE has a limited staff and an enormous mandate in the context of SIEPAC. Given this, the commission will be hard pressed to deliver what is expected of it, making additional regulatory improvements extremely difficult to consider.[387] While additional staff resources and training are certainly necessary, CRIE's authority is constrained by national prerogatives. While it will be politically challenging to expand CRIE's authority vis-à-vis national regulatory bodies, at least in the near term, the commission can become a forum for discussion and a source of ideas and best practices of regulatory strategies for fostering expansion of renewable energy and achieving rapid improvements in energy efficiency.

- *EOR*. EOR likewise faces an enormous challenge as it takes up the role of regional system operator. Its immediate task is to ensure that improvements to the regional grid are made to enable SIEPAC to operate securely, while at the same time EOR must increase its capability to conduct annual planning. EOR's planning activities are distinct from CEAC's work because EOR must focus on near-term conditions and operational considerations, as opposed to CEAC's long-term expansion planning. However, system and operational planning activities by EOR and CEAC must be integrated and mechanisms must be established to ensure communication and data flows. At the same time, some friction is evident between EOR and CEAC as they compete to establish themselves in the context of SIEPAC and secure resources. For instance, EOR staff reported that they are working with the Unidad Coordinadora to secure resources for development of an integrated system model; work would need to start in late 2010. EOR argues that long-term integrated planning with a five-year time horizon will eventually have to be led by EOR given its role within the SIEPAC system.[388] Diffusing the potential for conflict will require concerted effort at the political level combined with integration at the technical level.

Geographic gaps. Support at the national level has inevitably been uneven, reflecting differences in size and economic development, institutional capacity, and political factors, among other things. One gap appears to be partly the product of arbitrary institutional donor decisions and is at odds with the understanding of integration articulated by the countries at the level of SICA as well as in the broader Mesoamerican region. Specifically, there appears to have been relatively little support given to Belize, and virtually none in the context of regional activities such as SIEPAC, of which Belize is not a part. However, recent developments between Belize and Mexico, with the termination of CFE's PPA to supply electricity to BEL, together with recent additions to domestic capacity, suggest that Belize is becoming increasingly interested in the possibility of interconnection with Guatemala and could, in the longer term, be interested in becoming part of SIEPAC.

[387] Interview with Edgar Navarro, Coordinador General, and Susana Latrónico, Regulatory Advisor, CRIE (Guatemala), May 28, 2010.
[388] Interview with José Hernández, Planning Manager, William Martínez, and Edgar de Assis, Ente Operador Regional (El Salvador), May 28, 2010.

8.5 CRITERIA FOR IDENTIFICATION OF USAID OPTIONS

Activities undertaken by USAID's Central America and Mexico Regional Program in the area of clean energy and climate change must meet three sets of criteria: (1) the requirements established in Congressional language on Global Climate Change and Clean Energy activities (and, when relevant, language on Microfinance and Renewable Energy); (2) the program's programmatic criteria; and, if approved based on this report, (3) criteria recommended here regarding their relevance to achieving the objectives set forth in the Strategy 2020, and (4) potential quantitative performance indicators for future programs.

Congressional language definitions. The guidance provided by USAID encompasses an expanded definition of what is considered "clean energy" as well as criteria in terms of funding source, policy priorities, objective, indicators, and outcomes. The language for the definition (as of May 2010) is presented in the text box at the end of this section; the criteria for focused/direct GCC-funded investments in clean energy are reproduced here:

1. Funding. Program/activity must use focused funding from the GCC initiative and the clean energy pillar (i.e., must use funding apportioned from the USD 108.5 million clean energy directive) and not be attributed to any other initiative.

2. Policy Priorities. Program/activity helps developing countries achieve climate-resilient and low-emissions development through support for the creation and implementation of national strategic plans on climate change, emissions inventories, carbon market readiness, targeted clean energy field demonstration activities, and activities that promote or establish critical preconditions to sustainable clean energy programs that will lead to significant deviations in carbon emission trajectories from established baselines over the long term.

3. Objective. Program/activity has an explicit objective to seek climate change-related outcomes of reducing, mitigating, and/or sequestering GHG emissions.

4. Indicators. Program/activity monitors its impact using one or more USAID climate change indicators, at least one of which must be a standard indicator. Relevant standard indicators are under 4.4.1 (Modern Energy Services), 4.8.1 (Natural Resources and Biodiversity), and 4.8.2 (Clean Production) and include the following language: "Quantity of GHG emissions, measured in metric tons CO_2 equivalent, reduced or sequestered as a result of USG assistance."

5. Outcome. The activity contributes to the objective of stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration. Such a program/activity would contribute to one or more of the following:

    - The mitigation of climate change by limiting anthropogenic emissions of GHGs including gases regulated by the Montreal Protocol
    - The protection and/or enhancement of GHG sinks and reservoirs
    - The integration of climate change concerns with the recipient countries' development objectives through institution building, capacity development, strengthening of the regulatory and policy framework, or research

- Developing countries' efforts to meet their obligations under the UNFCCC

In addition, operating units must provide the following information on USAID's clean energy programs:

- A brief explanation of the relationship between the activity/program and the sustainable deployment of clean energy technologies
- The anticipated long-term impact on CO_2 emissions in that country
- How the activity supports that country's commitments under the UNFCCC
- How the activity supports USG commitments under the UNFCCC

Mission programmatic criteria. The Program has articulated the following criteria for activities undertaken at the regional level; the activity(ies) must:

- Have an immediate impact or in the short to medium term
- Have the potential to be sustainable beyond the life of the activity
- Build upon ongoing efforts or past successes and synergies
- Be cost-effective and/or innovative

Strategy 2020 criteria. Based on the presentation of Strategy 2020, which is the centerpiece of the region's efforts to ensure the expansion and development of the energy sector consistent with objectives in terms of quality, quantity, diversity, and sustainable development (encompassing social equity and governability, environmental protection, and congruence with international environmental commitments), the activities should:

- Contribute to at least one of the following targets included in Strategy 2020: reduce fuelwood consumption [T2]; reduce electricity use for residential, commercial, industrial, and public lighting [T3], or for refrigeration [T4], or industry through efficient motor use [T5]; reduce line losses [T6]; reduce fossil fuels in transport [T7]; increase use of renewable resources in generation, primarily by adding hydroelectric plants [T8]; substitute fossil fuel consumption [T9]; and/or reduce GHG emissions [T10]

- Contribute to the process of regional energy integration by supporting the implementation of SIEPAC and/or the development of the regulatory, operational, and planning capabilities needed for its long-term sustainability; or by supporting the strengthening of other energy sector institutions and programs under the umbrella of SICA

- Foster regional integration at the level of Mesoamerica, through the participation of institutions in Mexico and/or Colombia as well as Central America in the context of the Proyecto Mesoamericano, or hemispheric level, through engagement with institutions in the context of the ECPA or with multilateral and regional financial institutions such as the IDB, CABEI, or CAF

Performance criteria. These criteria encompass a series of potential *quantitative* performance indicators for future programs. Clearly, when viewed prospectively, before the programs are even designed in detail, scoring is necessarily based on a qualitative assessment of the potential

volume of investment, emissions reductions, or other indicator being addressed. Quantitative estimates of the outcomes for these indicators could be developed, but this effort would require more detailed program designs than are presented here as well as detailed modeling, which is beyond the scope of this study. An initial set of criteria might include:

- Value of anticipated investment
- Value of reduction in petroleum-based fuels imports
- Volume of GHG emissions reductions
- Reduction in electricity or fuel costs for end users
- Increase in share of renewable resources in energy matrix
- Volume of grant funding leveraged from other sources

Goal, Strategic Approach, and Expanded Definition of GCC Clean Energy*

USAID's clean energy programs and activities reduce global warming by promoting the sustainable use of renewable energy technologies, energy efficient end-use technologies, carbon sequestration, and carbon accounting. A primary objective of these programs must be to reduce, mitigate, and/or sequester GHG emissions. Clean energy includes USAID programs and activities in the following areas:

- Direct expenditures on promotion and deployment of clean energy (renewable energy technologies, energy efficient end-use technologies, carbon sequestration, and carbon accounting).
- Expenditures related to the preparation and implementation of the clean energy components of Low Carbon Development Strategies or Low Emission Development Strategies (LEDS).These expenditures may include preparation of strategies and support for implementation of specific LEDS components. Support for implementation of LEDS components related to nuclear or fossil-fuel technologies, including the production or direct use of these fuels, does not qualify.
- Expenditures for strengthening greenhouse gas inventory and accounting systems, including methodological development, energy statistical systems, archiving, quality control and improvement, reporting, and institutions and human capabilities.
- Expenditures related to promoting carbon market readiness and carbon market mechanisms, institutions and human capabilities.
- Expenditures on programs that promote or establish critical preconditions to sustainable clean energy programs. These can include:
    - Design and technical support for development of clean energy programs and their components
    - Support for reforms that significantly improve cost recovery and establish the financial capacity in the energy sector to make investments in clean energy
    - Development of the enabling environment (policies, laws, regulations, and institutions) that directly support sustainable clean energy programs
    - Establishment or strengthening of energy sector and utility regulatory and planning capacity that is an essential precondition to sustainable clean energy development
    - Transmission and system operating investments that are specifically designed for the evacuation, transport, and trade in renewable energy
- Expenditures on nuclear, gas, coal, and oil for production direct use as well as electricity generation in almost all situations do not qualify as clean energy expenditures. In general, do not classify funds used for the production, direct use, or improvement of energy efficiency of nuclear, coal, oil, or other fossil fuels as "clean energy" expenditures. There may be a very limited number of exceptional cases of fossil-fueled generation that can be classified as clean energy due to exceptional greenhouse gas reductions involved. The expenditures that would qualify are limited to those associated with electricity generation and gas transmission infrastructure using gas that would otherwise be flared or vented.
- For transmission and operating system infrastructure, where only part of the energy carried by the system is "clean energy," a reasonable allocation of a portion of the USAID expenditure should be determined and documented.
- Expenditures that are intended to significantly improve the performance and reduce losses of electricity and gas distribution utilities may qualify as clean energy if they are integral to a GHG emissions reduction plan.

*As of May 2010.

8.6 OPTIONS FOR USAID ACTIVITIES

The following pages contain five summaries of concepts for programs that might be supported by the USAID Central America and Mexico Regional Program. In each instance, the presentation refers to the likely partner agencies for the activity, but actual execution of the project will likely be limited to a far smaller number of entities drawn from the list of partners, with the remaining organizations included as participants.

I. Support for Renewable Energy Generation: Social/Environmental Impact Issues

Title	Program to improve community participation in development of large-scale hydropower facilities and manage social and environmental risks
Objective(s)	Facilitate development of low-carbon generation capacity in the power sector
Rationale	Achievement of low-carbon growth in the power sector in Central America is dependent on the expansion of hydropower capacity in the region; hydropower development is an explicit part of Strategy 2020 (Target 8). However, hydropower projects have triggered community opposition in virtually every country, resulting in delays, cancellation, and perceptions of increased risk on the part of investors and lenders. The program will facilitate the preparation, development, financing, and implementation of hydropower projects through support for exchanges of best practices, training, community-level outreach and development, and preparation of detailed plans for addressing and managing social impacts.
Scope	The proposed program will: (1) create a forum for exchanges on best practices from hydropower developments elsewhere in Latin America and in other regions, working with international institutions such as the International Hydropower Association (IHA) and the World Commission on Dams (WCD); (2) support local organizations working with indigenous and other communities in areas where hydropower development could take place to foster early-stage dialogue on the potential project, projected impacts, community involvement in the project, and strategies for managing and/or off-setting those impacts, including implementation of income-generating activities, watershed management programs with carbon emissions reduction benefits, and other projects; (3) support studies to evaluate social and environmental impacts and prepare action plans for management of impacts and/or other documents required for the permitting process; (4) support studies and document preparation to sell emissions reductions from specific community-based forestry projects on international carbon markets; (5) support communication strategies for regional and national agencies for public education and awareness of the tradeoffs involved in pursuing development of hydropower resources; and (6) prepare tools and methods for monitoring the implementation of hydropower projects and measuring results of community-oriented development strategies.

I. Support for Renewable Energy Generation: Social/Environmental Impact Issues, continued

Partner agency(ies) drawn from	SICA/UCE, CCAD, CEAC, AEA, ministries of energy and environment, national utilities, national associations of renewable energy producers; IHA and WCD; IDB, CABEI, World Bank, GTZ; Brazilian authorities and project developers
Outputs	The program will result in: (1) seminars and training programs; (2) community-based consultations and program development activities; (3) studies (may be inputs for impact assessments or stand-alone deliverables); (4) carbon transaction documents (PDDs or similar); and (5) communications programs, brochures, videos, and material for websites.
Indicators	• Value of anticipated investment • Value of reduction in imported petroleum-based fuels • Volume of reductions of GHG emissions • Reduction in cost of electricity or fuel to end-users • Increase in share of renewable resources in energy matrix • Volume of grant funding leveraged from other sources

II. Support for Renewable Energy Generation: Uniform Procurement Processes

Title	Program to support development of uniform procurement documentation for regional renewable energy projects in Central America
Objective(s)	Facilitate development of low-carbon generation capacity in the power sector
Rationale	SIEPAC will create a new vehicle for transactions in the regional energy market. Several countries are poised to issue tenders for energy capacity and are considering establishing set-asides for renewable energy technologies. Variations in national requirements and other contract provisions may make it difficult for renewable energy projects to participate in procurement processes. The program will foster regional dialogue to develop a set of procedures for procurement of renewable energy generation in the regional market and will develop template documents for use in completing contracts for renewable energy projects. The establishment of uniform procedures and templates for key documents will create a more favorable investment environment in the regional power market.
Scope	The proposed program will: (1) create a regional dialogue on arrangements for contracting renewable energy generation in the regional market, with the objective of harmonizing national procurement processes and balancing national priorities with critical issues for investors and lenders; (2) facilitate the preparation of a template PPA for regional renewable energy projects (one for each project technology); and (3) facilitate the establishment of consistent procurement processes for regional projects, contributing to a more transparent business environment.
Partner agency(ies) drawn from	SICA/UCE, CEAC, CRIE, national regulatory agencies; IDB, CABEI, World Bank, GTZ; associations of private power producers, generators, and investors
Outputs	The program will result in: (1) contribution to creating a clearly defined process for renewable energy procurement in Central America and increased harmonization of procurement processes; (2) a template PPA for renewable energy projects; and (3) a resource center for documents and information on best practices in competitive procurement of renewable energy.
Indicators	• Value of anticipated investment • Value of reduction in imported petroleum-based fuels • Volume of reductions of GHG emissions • Reduction in cost of electricity or fuel to end-users • Increase in share of renewable resources in energy matrix • Volume of grant funding leveraged from other sources

III. Support for Renewable Energy Generation: Grid Analyses for Intermittent Resources

Title	Program to support the regional and national system operators with analytical tools for evaluating the impact of additions of wind generation capacity on system operations
Objective(s)	Strengthen the capacity of EOR and national system operators to manage wind generation capacity in Central America and facilitate the introduction of more wind generation capacity in the region
Rationale	Achievement of low-carbon growth in the power sector in Central America is dependent on the expansion of non-conventional capacity in the region (Target 8). However, with the exception of Costa Rica and very recently Nicaragua, Central America has no wind capacity in place, and utility and other officials do not have significant experience with wind power. Concerns about operational impacts have impeded more aggressive development in Costa Rica, and in Nicaragua there is considerable interest in the potential for adding more capacity, but officials recognize that the associated operational challenges are considerable. The proposed program will increase the familiarity of regional and national officials with the specific issues associated with wind development, methods and tools for evaluating system impacts, advances in technology, and strategies for attracting and managing the investment in necessary system upgrades to facilitate wind development.
Scope	The proposed program will: (1) create a forum for discussion, training, and exchanges of best practices in the area of fostering development of transmission infrastructure to accommodate wind generation; (2) increase capacity of regional and national operators to include wind generation capacity in the regional and national markets; and (3) create a regional system model with the capacity to model and illustrate system impacts under different wind and atmospheric conditions or support the inclusion of modeling capacity in the context of detailed system modeling work undertaken by EOR and/or CEAC for near-term and longer-term planning.
Partner agency(ies) drawn from	SICA/UCE, SIEPAC, EOR, national system operators, CEAC; CRIE, national regulatory agencies; CRE (Mexico), CFE; regional and international wind energy associations; operators and investors in wind energy facilities; IDB, CABEI, GTZ; Proyecto Mesoamericano, ECPA
Outputs	The program will result in: (1) seminars and training programs on wind integration issues, transmission planning for wind development and related issues and (2) support and/or input on system modeling to incorporate wind resource characteristics and patterns to evaluate system impacts.

III. Support for Renewable Energy Generation: Grid Analyses for Intermittent Resources, continued

Indicators	• Value of anticipated investment • Value of reduction in imported petroleum-based fuels • Volume of reductions of GHG emissions • Reduction in cost of electricity or fuel to end-users • Increase in share of renewable resources in energy matrix • Volume of grant funding leveraged from other sources

IV. Support for Energy Efficiency Programs: Accelerating Investment in Energy Efficiency

Title	Support to national governments for development of national energy efficiency programs
Objective(s)	Increase national governments' (and particularly finance officials') understanding of the economic and financial returns of investment in energy efficiency at the national level; develop regional and national regulatory agencies' familiarity with mechanisms and policies for accelerating the implementation of utility demand-side management programs; and support agencies involved in long-term regional power sector planning to incorporate energy efficiency into the planning process
Rationale	Energy efficiency programs offer opportunities for "investment" in generation capacity that are cheaper than any new generation capacity and faster to bring online. SIEPAC's near-term success will depend on the creation of excess capacity to permit exports through the new interconnection. Energy efficiency opportunities have only begun to be exploited in Central America, primarily through the implementation of CFL substitution programs funded with a mix of donor grants and financing. Governments have increased subsidies for electricity in the last few years in order to shield consumers from the impact of rapid increases in petroleum prices. To capture the benefits of energy efficiency opportunities, governments will have to marshal domestic resources to fund efficiency programs. Before freeing up resources for this purpose, economic and finance officials seek justification of investments in energy efficiency. To date, national governments have done little analysis to evaluate the impact and benefits of programs implemented to date. The proposed program will: (1) result in an analysis of the economic and financial benefits at the national level of energy efficiency programs implemented to date; (2) introduce economic and finance policy officials to these results; and (3) foster capacity building and development at regulatory and planning agencies to incorporate strategies to accelerate investment in energy efficiency into regulatory frameworks and long-term planning.
Scope	The proposed program will: (1) support a systematic review of the impacts of energy efficiency programs implemented to date and the economic and financial impacts of those programs; (2) provide case studies from other countries, including Mexico, that explain various programs' results in terms of energy savings and economic returns; (3) provide exchanges, training, and capacity building for regional and national regulators on approaches employed in other countries, including Brazil, Chile, Mexico, and the United States; and (4) exchanges, training, and capacity building on methods and tools for integrating energy efficiency into long-term system planning.

IV. Support for Energy Efficiency Programs: Accelerating Investment in Energy Efficiency, continued

Partner agency(ies) drawn from	SICA/UCE; CEAC, CRIE, SIEPAC, EOR; national regulatory agencies; national and private sector utilities; national ministers of economy and finance (hacienda); National Association of Regulatory Utility Commissioners; FIDE, CONUEE (Mexico); IDB, World Bank, CABEI, GTZ; Proyecto Mesoamericano, ECPA
Outputs	The program will result in: (1) a study providing a systematic, region-wide assessment of the results of energy efficiency initiatives executed to date, with an assessment of the economic returns of these investments; (2) studies and/or presentations on regulatory approaches to accelerate investment in energy efficiency, including strategies such as decoupling, which have been implemented in the United States; and (3) guidelines and/or presentations on methods for incorporating energy efficiency planning into system planning activities.
Indicators	• Value of anticipated investment • Value of reduction in imported petroleum-based fuels • Volume of reductions of GHG emissions • Reduction in cost of electricity or fuel to end-users • Increase in share of renewable resources in energy matrix • Volume of grant funding leveraged from other sources

V. Enhancing Readiness to Participate in Carbon Markets: Regional Inventories

Title	Development of a uniform regional emissions inventory for Central America through establishment of monitoring, reporting, and verification (MRV) systems and procedures
Objective(s)	Upgrade, standardize, and harmonize GHG inventories across the Central American region; establish MRV systems and procedures
Rationale	The Copenhagen Accord calls for Non-Annex I countries to establish MRV systems and report on emissions mitigation actions, including inventories, every two years. The Accord also encourages developing countries to elaborate NAMAs and push for policies to continue in a low-carbon development path. The requisite reporting and documentation cannot be prepared without reliable and updated GHG emissions data. All countries in Central America have reported challenges in preparing national inventories as part of the requirement to deliver national communications to the plenary of the UNFCCC. Although there is considerable variation in the capacity of national DNAs, every country has presented at least one communication, and some analytical capabilities are resident at research institutes, NGOs, and academic institutions. There is a clear need for a deep understanding of the inventory of emissions, projections, marginal abatement costs, and definition of policies with that framework. Furthermore, with the new push in the Copenhagen Accord and current negotiations for developing (non-Annex I) countries to step up their efforts to establish NAMAs and MRV systems, there is a clear need for further institutional strengthening in Central America. This activity will result in the development in MRV systems and procedures that deliver country inventories that are easily comparable, thereby facilitating more effective analyses of emissions trends at the regional level and development of regional strategies and NAMAs.
Scope	The proposed program will encompass: (1) review of national inventories and collection of relevant data on energy production and consumption, land use change, agricultural production; (2) organization of regional seminars including specialists from each country to review and assess available information as well as reach consensus on the organization and presentation of a regional inventory; (3) preparation of updated national inventories for a common reference year; (4) preparation of a comprehensive report containing chapters presenting data for each of the seven countries in the region; (5) review of existing MRV procedures at a country and regional level; and (6) preparation of a comprehensive report containing specific recommendations to strengthen MRV capabilities and infrastructure across the region.

V. Enhancing Readiness to Participate in Carbon Markets: Regional Inventories, continued

Partner agency(ies) drawn from	SICA/UCE, CCAD; Universidad Centroamericana, CEPAL, CATIE, CATHALAC; UNEP Risø, GEF, national DNAs, IDB/SECCI
Outputs	This program will result in: (1) a comprehensive study or series of studies in a standard format presenting updated inventories of emissions data, with disaggregation into sectors, emissions sources, and other ways of presenting the data; (2) establishment of a regional forum to review emissions inventories; (3) strengthened capacity at the national DNAs; and (4) updated and strengthened MRV systems and procedures in line with new demands of international climate negotiations.
Indicators	• Value of anticipated investment • Value of reduction in imported petroleum-based fuels • Volume of reductions of GHG emissions • Reduction in cost of electricity or fuel to end-users • Increase in share of renewable resources in energy matrix • Volume of grant funding leveraged from other sources

8.7 RANKING OF OPTIONS AND RECOMMENDATIONS

The foregoing options for the USAID Central America and Mexico Regional Program have been developed based on the observations presented above and the comments and input received from the individuals with whom the Nexant team conducted interviews during the preparation of this report. This subsection reviews the degree to which each of these options meets the criteria presented in Section 8.5 and presents the larger rationale for the recommended activities.

In the table below, each of the options is scored against the criteria, with the scores reflecting their consistency with each criterion. In the case of the funding criterion, scoring is based on the assumption that the resources for the program will be allocated from the appropriate budget line item. In the case of the indicators criterion, it is assumed that the indicators chosen for the program design will be appropriate to conform to this requirement.

Criterion	*Weight*	I	II	III	IV	V
Congressionally mandated criteria						
Funding						
Policy priorities	*2*	2	2	2	1	2
Objective	*1*	2	2	2	1	2
Indicators						
Outcome	*2*	2	2	2	2	2
Mission programmatic criteria						
Short-/medium-term impact	*2*	0	1	1	2	1
Sustainability potential	*2*	1	1	1	2	1
Builds on past efforts	*1*	1	1	1	2	0
Cost-effectiveness/innovation	*2*	2	2	1	2	2
Strategy 2020 criteria						
Contributes to achieving target	*2*	2	2	2	2	1
Contributes to integration	*2*	2	2	2	2	2
Fosters broader integration	*2*	1	2	2	2	2
Performance criteria						
Investment value	*2*	2	2	1	1	0
Reduces petroleum-based fuel imports	*2*	1	1	1	1	0
Reduces GHG emissions	*2*	2	2	2	2	1
Reduces cost of energy for end users	*2*	1	1	1	1	1
Increases share of renewables in matrix	*2*	2	2	2	1	1
Grant funding leveraged	*2*	2	2	2	2	1
Score		2.94	3.19	2.94	3.06	2.25

The criteria described above have been assigned weights (2 for high and 1 for low) or removed from the scoring as follows:

- *Funding*. This is an administrative issue and cannot be known at this point, so it is left out.
- *Policy priorities*. This is given a high weight.

- *Objective*. This is given a low weight, as it may narrow the focus to climate-related considerations, whereas a broader set of objectives, including social considerations, may well yield climate as well as energy integration and other benefits.
- *Outcome*. This is given a high weight.
- *Short-/medium-term impact*. This is given a high weight.
- *Sustainability potential*. This is given a high weight.
- *Builds on past efforts*. This is given a low weight because it may limit the scope for climate-related activities and introduces a limitation to innovation that is (in part) at odds with the next criterion.
- *Cost-effectiveness/innovation*. This is given a high weight.
- *Contributes to one of the targets*. This is given a high weight.
- *Contributes to energy integration*. This is given a high weight.
- *Fosters broader integration*. This is given a high weight.
- *Investment value*. This is given a high weight.
- *Reduces petroleum-based fuel imports.* This is given a high weight.
- *Reduces GHG emissions.* This is given a high weight.
- *Reduces cost of energy for end users.* This is given a high weight.
- *Increases share of renewables in matrix.* This is given a high weight.
- *Grant funding leveraged.* This is given a high weight.

The following points provide additional context for the scoring given to the options:

- Any activity related to the support of renewable energy generation is unlikely to have a short-term impact given the long lead times associated with project development; activities related to energy efficiency, in contrast, are much more likely to deliver results within one to two years. Support for the development of generation based on renewable resources is critical to the achievement of regional energy development based on a more diversified energy matrix and would reinforce the national governments' clear efforts to foster more renewable energy development, while strengthening the efforts undertaken by regional institutions, specifically CEAC and SIEPAC. With respect to energy efficiency, while efforts to date at the national and regional levels have demonstrated the potential for achieving savings, they have not been implemented on the scale required to make a meaningful impact or to contribute to regional energy integration by freeing up surplus generation.

- The proposed activity focused on the reinforcement of policies in support of energy efficiency investments has the greatest potential for resulting in sustainable activities in the long term because it focuses on supporting policymakers in establishing the justification for publicly funded investments in energy efficiency programs at the national level.

- The proposed activity in the area of developing a regional inventory holds considerable promise for supporting the preparation of national and regional programs to reduce GHG emissions because the timing is opportune. Previous efforts in the context of national communications have established some of the institutional capacity and framework for conducting this sort of work in preparation for participation in the CDM. While the successor to the Kyoto Protocol is not yet defined, the direction established in the Copenhagen Accord (and indeed in the refinements made to the Kyoto Protocol, such as Programmatic CDM)

indicates that national initiatives, and not just projects in the Kyoto Protocol, will play an increasingly important role. USAID's recent activities in the region have not encompassed work on capacity building related to the carbon markets, so it is difficult for the proposed program to build on previous activities supported by USAID in this specific area. There are, however, many potential synergies with activities undertaken in the area of energy efficiency and cleaner production.

The activities presented above do not include anything related to the promotion and development of biofuels programs in the region or programs focused on the development of alternative transportation options. This reflects the following assessments regarding program activities in these areas and the extent to which they meet the criteria presented in Section 8.5 above:

- There is considerably less regional institutional capacity in the area of liquid fuels than in the power sector. While CCHAC is the regional institution charged with managing regional dialogue on policy issues for liquid fuels, it is considerably less developed than its power-sector counterparts, and there is far less scope for the development of regional policy in this area in the near term given the political realities related to national oversight of the liquid fuels sector. Programs to support CCHAC, while worthwhile, would likely be confined to supporting the development of regional biofuels standards, which could yield results relatively quickly. However, without the capacity to produce substantial volumes of biofuels, something that will take three to five years to materialize, there is limited potential for the standards to facilitate regional trade in biofuels in a meaningful way in the near term.

- The transportation sector offers considerable potential for achieving energy efficiency improvements, and it has not received as much attention from policymakers as the electric power sector. This is unfortunate, and USAID could and should consider efforts to foster greater awareness of the considerable environmental, social, and economic development benefits derived from the implementation of transportation-sector initiatives in the region, specifically in the area of public transportation infrastructure. Another area that could be explored would be measures to encourage accelerated turnover of the vehicle fleet in each country and the establishment of vehicle fuel efficiency standards for imported vehicles. However, it is not clear that significant results in terms of reductions of GHG emissions can be achieved in the short term through activities in either area.

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9.2 PERSONAL COMMUNICATIONS

Nexant’s field team for the preparation of this report (Edward Hoyt and Jorge Landa, a Nexant subcontractor) visited all seven countries in the region in during May and June 2010. In addition, the field team conducted numerous telephone interviews during the following two months, as did Sonia Medina, a second Nexant subcontractor. Ms. Medina also conducted some interviews with representatives of the region attending CarbonExpo in Bonn, Germany, in May 2010.

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