Low Emission Development Strategy (LEDS) for Guatemala:

Pre-Scoping Report

EC-LEDS Guatemala Scoping Team

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Acronyms

ACOFOP	Asociación de Comunidades Forestales de Petén
AECID	Agencia Española de Cooperación Internacional para el Desarrollo, Spain
ALIDES	Alianza para el Desarrollo Humano Sostenible
ASIES	Asociación de Investigación y Estudios Sociales
ASAZGUA	Asociación de Azucareros de Guatemala
ASOREMA	Asociación Nacional de Organizaciones No Gubernamentales de los Recursos Ambientales y el Medio Ambiente
CIA	Central Intelligence Agency
CCIC	Comisión Interinstitucional de Cambio Climático
CDM	Clean Development Mechanism
CEA	Centro de Estudios Ambientales
CNCC	Consejo Nacional de Cambio Climático
CNEE	Comisión Nacional de Energía Eléctrica
CONADES	Comisión Nacional de Desechos Sólidos
CONAP	Comisión Nacional de Áreas Protegidas
CSUCA	Consejo Superior Universitario Centroamericano
ECLAC	Comisión Económica para América Latina y el Caribe
EC-LEDS	Enhancing Capacity for Low Emission Development Strategies
ENRD	National Strategy for the Reduction of Deforestation
FAO	Food and Agriculture Organization of the United Nations
FLACSO	Facultad Latinoamericana de Ciencias Sociales
FONACON	*Fondo Nacional para la Conservación de la Naturaleza*
FUNDESA	Fundación para el Desarrollo de Guatemala
GDP	Gross Domestic Product
Gg	gigagram
GHG	greenhouse gas
GEF	Global Environmental Fund
GoG	Government of Guatemala
GIZ	Gesellschaft für Internationale Zusammenarbeit, Germany
ha	hectare
IARNA	Instituto de Agricultura, Recursos Naturales y Ambiente de la Universidad Rafael Landívar
IDB	Inter-American Development Bank
IUCN	International Union for the Conservation of Nature
IPNUSAC	Instituto de Análisis e Investigación de los Problemas Nacionales
INAB	Instituto Nacional de Bosques
kWh	kilowatt
LEDS	Low Emission Development Strategies
MBR	Maya Biosphere Reserve
MAGA	Ministerio de Agricultura, Ganadería y Alimentación

MARN	Ministerio de Ambiente y Recursos Naturales
MEM	Ministerio de Energía y Minas
MNCC	Mesa Nacional de Cambio Climático
MW	megawatt
MWh	megawatt hour
PACUNAM	Fundación Patrimonio Cultural y Natural Maya
PARPA	Programa de Apoyo a la Reconversión Productiva Agroalimentaria
PINFOR	Programa de Incentivos Forestales
PINPEP	Programa de Incentivos para Pequeños Poseedores de Tierras de Vocación Forestal o Agroforestal
PIPAA	Programa Integral de Protección Agrícola y Ambiental
PPAFD	*Programa Piloto de Apoyos Forestales Directos*
PREVDA	*Programa Regional de Reducción de la Vulnerabilidad y Degradación Ambiental* (Centroamérica)
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDFIA	Red de Formación e Investigación Ambiental
R-PP	Readiness Preparation Proposal
SEGEPLAN	Secretaría de Planificación y Programación de la Presidencia
SICA	*Sistema de Integración Centroamericana*
SIGAP	Sistema Guatemalteco de Áreas Protegidas
SWERA	Solar and Wind Energy Resource Assessment
UICN	*Unión Internacional para la Construcción de la Naturaleza*
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
URL	Universidad Rafael Landívar
USAID	United States Agency for International Development
USG	US Government

1 Introduction and Background

Low Emissions Development Strategy

A Low Emission Development Strategy (LEDS) is a strategic framework that articulates concrete actions, policies, programs and implementation plans to advance economic growth, improve environmental management and meet development objectives. This framework provides a foundation for achieving long-term, measurable greenhouse gas emission reductions as compared to a business-as-usual development pathway.

The following elements form a general framework that illustrates the U.S. perspective on LEDS:

- A country's integrated development goals and objectives, national greenhouse gas (GHG) inventory and economic and resource data
- Long-term projections of business-as-usual economic growth and greenhouse gas emission pathways
- Alternative development scenarios that achieve economic and development goals, slow the growth rate of GHG emissions and support climate change resilience
- A set of prioritized policies, programs and measures – identified through broad stakeholder engagement – that are necessary to achieve the low emission development pathway
- Domestic implementation plans that include strategies for attracting private sector investment and channeling international support from a range of sources and appropriate partners necessary to facilitate implementation.

Enhancing Capacity for Low Emission Development Strategies

Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) is a U.S. Government (USG) initiative to support developing countries' efforts to pursue long-term, transformative development and accelerate sustainable, climate-resilient economic growth while slowing the growth of greenhouse gas emissions. The initiative aims to build capacities in partner countries, provide targeted technical assistance and build a shared global knowledge base on LEDS. This program is country-driven; support for creating and implementing a LEDS will be tailored to each country's unique capacity, technical, analytical and policy needs.

Guatemala was selected as a priority country for engagement under the EC-LEDS initiative. In order to engage the Government of Guatemala (GoG), scoping missions are being planned for the summer of 2012 with the overall goal of creating a document that will guide future collaboration on LEDS in Guatemala. The scoping team will be comprised of representatives from various USG agencies (Department of State, US Agency for International Development, Department of Energy, Department of Agriculture, etc) to ensure broad technical coverage. This pre-scoping report will serve as a reference document to the individuals participating in the

scoping missions and a primer on climate change and low emission development work in Guatemala. The information presented within this work is by no means exhaustive.

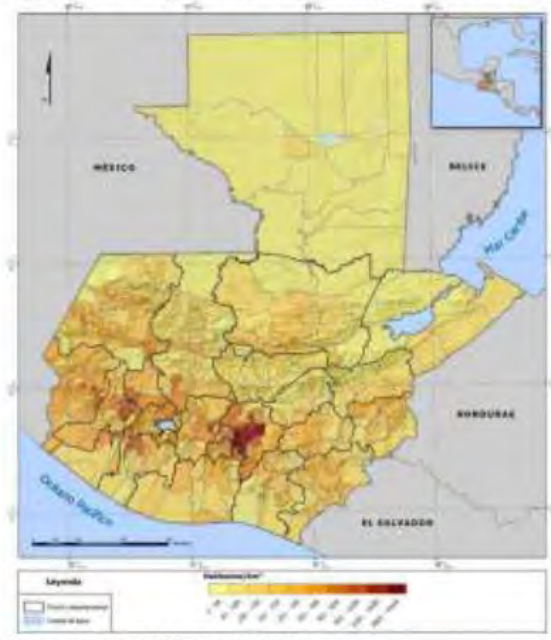
2 Country Overview

General Country Context

In 1996, Guatemala signed the Peace Accords that ended the 36-year Internal Armed Conflict that claimed the lives of more than 200,000 people, mostly indigenous, and is responsible for the forced disappearance of another 50,000. The period from 1961 to 1996 is characterized by widespread repression and violence, impunity, political instability and economic stagnation and its effects can be observed to this day. Violence, crime, drug trafficking and gangs are widespread in the country and are focused particularly in urban areas and especially in the capital city of Guatemala. The current government of Otto Perez Molina from the right wing Patriot Party won the elections of 2011 with a clear message of addressing the overwhelming crime levels in the country. It is the first time that a former member of the military is elected to power since the signing of the Peace Accords. Perez Molina assumed power in January of this year and his term will run until 2016.

Guatemala's population is estimated to be 14 million. There has been a marked increase in population growth since the 1980's reaching its peak annual growth rate (4%) in 2002. More than 60% of the population is Maya, while the Garifuna and Xinca indigenous groups represent a very low fraction of the population. Spanish is the national language and 23 different indigenous languages are used in different parts of the country. Traditionally, the majority of the population has been rural, but the urban population has been growing consistently (specifically in Guatemala City, Sacatepéquez and Quetzaltenango) since 2000 and currently represents 50% of the total (CIA 2012). This trend is depicted in Figure 1.

Figure 1: Population Density in Guatemala



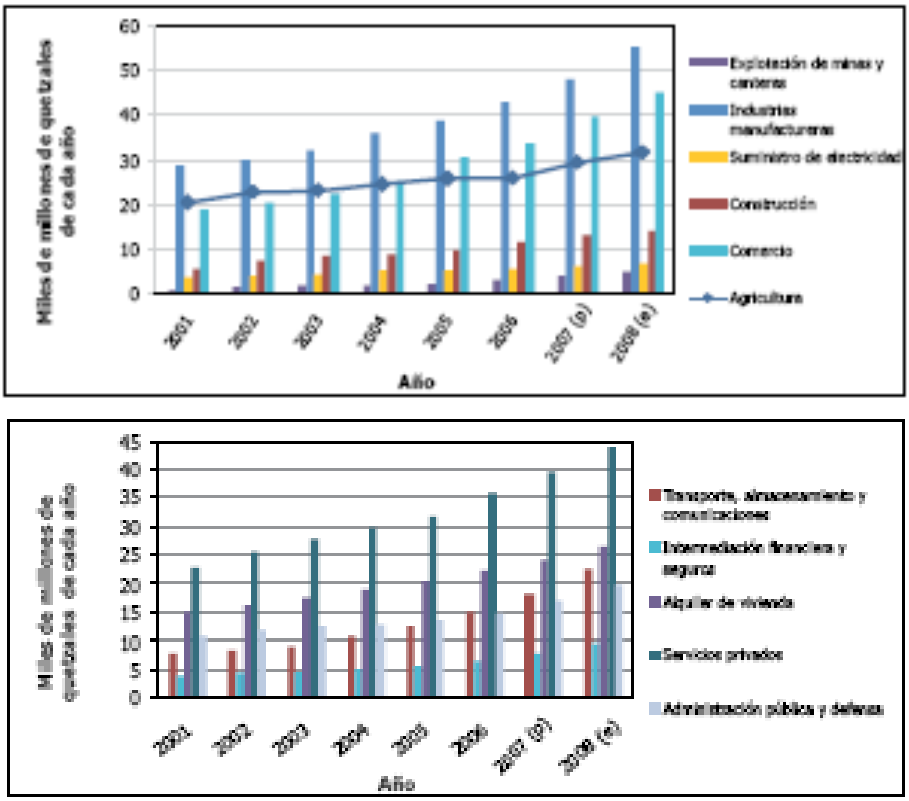
Source: IARNA 2009A

The literacy rate in the country is 69%, and 54% of the population currently lives under the poverty line, with 15% of that sector living in extreme poverty (IARNA 2009A). Guatemala has the highest level of chronic malnutrition in Latin America and the Caribbean, affecting 43% of the population (FAO 2009). Per capita GDP estimates for 2011 are $5000, ranking the country in 149th place worldwide (CIA 2012).

The country's main industries include sugar, textiles and clothing, furniture, chemicals, petroleum, metals, rubber and tourism. Agriculture employs 38% of the population, while industry employs 14% and services 48% (CIA 2012). Since the 1990's, the contribution of

agriculture and the manufacturing industry to Guatemala's GDP has decreased, while commerce, transport, construction, mining and communications have increased, as seen in Figure 2 (MARN 2009). Guatemala is also Central America's most significant recipient of remittances, with inflows equivalent to one-tenth of the GDP. Since the signing of the Peace Accords, Guatemala has seen an increase in foreign investment, coupled with the signing of the Dominican Republic-Central American Free Trade Agreement, which came into force in 2006.

Figure 2: Economic Significance of Guatemala's Productive Sectors



Source: MARN 2009

From a geographic perspective, Guatemala is divided into eight regions, 22 departments and 335 municipalities, and covers an area of 108,889km^2. It shares borders with Mexico, Belize, Honduras and El Salvador, and is directly exposed to the Pacific and Atlantic Oceans. It has one of the greatest levels of climate and topographic variability in the region and is located over three tectonic plates. Being in the hurricane route of the Atlantic Ocean, the country is highly vulnerable to environmental disasters which have in the past represented significant financial costs and have placed great strain on the food security levels of the country.

Land tenure in the country has been a source of tension for much of its history. The highest levels of land concentration are found in the most fertile areas, whereas subsistence farming is mostly found in areas with poor or eroded soil. These areas tend to be mostly utilized by Indigenous communities.

Guatemala does not have a clear agrarian policy or land law. Its 1973 Civil Code provides general principles relating to the possession, use, transfer and ownership of land, and its registration. Furthermore, various rules for registering land rights are set forth in different legislation spanning 1880 to the present.

Country Context for LEDS

Guatemala emits less than 0.4% of global greenhouse gas (GHG) emissions. However, it is one of the most affected countries by this phenomenon. The UN has indicated that Guatemala is one of the 10 countries most vulnerable to climate change in the world, and the 4th most vulnerable to natural disasters. Its strategic geographic location, as well as its limited infrastructure, expose it to considerable risk and damage from hurricanes and tropical storms as well as substantial and frequent draughts and floods. In past years, Guatemala has been strongly affected by a number of well-known environmental disasters, including Hurricane Mitch in 1997, Tropical Storm Stan in 2005 and most recently Agatha Storm in 2010. The estimated accumulated financial costs of Mitch and Stan surpass $1.5 million (MARN 2009).

The repercussions of the 36-year internal armed conflict are not only evident in the societal structure of the country, but in governmental structure and planning as well. The current levels of violence and crime, limited access to formal education, and poverty limit the extent to which the government has focused concerted efforts on concrete and attainable development goals and objectives in general, and on aspects relating specifically to climate change in particular. Furthermore, consistent changes in focus of government objectives depending on the particular political party in power have also limited the continued relevance of any particular goal or objective over time.

Nevertheless, the last few years have seen a marked increase in programs that address areas related to climate change, and most particularly deforestation – a significant challenge faced by Guatemala. There has also been an increase in the number of government policies and agencies that have come into existence in relation to these themes, though their funding and scope of influence are often limited, or may contradict other extant policies.

A significant portion of the focus placed on climate change and the environment is related to international factors, including the signing of particular agreements (and most significantly the United Nations Convention on Climate Change -UNFCCC). The financial and technical support provided by the international community in the form of bilateral projects, multi lateral projects, and projects supported by specific international organizations have also been influential, in a context where domestic funding and technical capacity in this area are considerably limited.

Summary of Existing Strategic Plans and Legal Framework

Since the 1970's, and particularly since the 1990's, Guatemala has passed a range of legislative documents that relate in some way to the environment, environmental degradation and climate change. A World Bank report estimates that Guatemala has issued more than 2,500 legal instruments, but that by 2006 only 65% of the regulations required by the *Ley de Protección y Mejoramiento del Medio Ambiente* (described below) of 1986 had been approved.

In some cases, these documents directly regulate specific aspects relating to forestry, natural resources, etc. In other cases, different policies and laws exercise jurisdiction over specific topics or areas, which can lead to conflictive policies on a particular issue, overlapping of policies and responsibilities, or gaps in the management and attention provided to the environment and climate change. It appears that, despite the number of policies that relate to the environment, these are not organized strategically to effectively and constructively cover all aspects relating to a particular issue. Such is the case of water as a natural resource. The administration of the water system is assigned to 17 different institutions which all have direct and/or indirect regulations that affect it. There have been more than 20 attempts to draw a clear and all-encompassing legislation on water, but none of them have come to fruition.

These overlaps and gaps can also be observed with regards to governmental institutions that in some way have worked on environmental and climate change issues. According to Yuri Melini, a nationally recognized defender of the environment, there are 58 entities in the executive branch of the government that address issues relating to the environment (*Plaza Pública 2012A)*, with varying degrees of common goals and collaboration.

Guatemala is signatory to more than 75 regional and international agreements and treaties that relate to the environment, though few relate specifically to climate change. A list of these agreements is found in Appendix 1.

Enacted Policies and Plans

The following are policies and plans which impact various areas relating to climate change. More specific policies and plans are highlighted later in this report, in relation to the particular sectors of GHG emissions.

2.1.1.1 National Constitution, 1985

Article 97 – Indicates that the State, municipalities and residents of Guatemala are to foster social, economic and technological development that may prevent the pollution of the environment and which may maintain ecological balance. Furthermore, it states that the necessary norms will be created to ensure that fauna, flora, land and water resources are used in a rational manner avoiding their plundering.

Article 126 – Declares the reforestation of the country and forest conservation to be a national emergency and of significance for the country.

2.1.1.2 Peace Accords, 1996

Acknowledge the significant cultural and spiritual relevance of natural resources to Guatemala's Indigenous population and the risk to sustainable development posed by the irrational exploitation of forest resources.

2.1.1.3 Ley de Protección y Mejoramiento del Medio Ambiente, 1986

This legislation is one of the most significant for the purposes of this report, and allows for significant development in areas relating to climate change. Its objectives are the protection,

conservation and improvement of the country's natural assets; the prevention and control of damaging forces, pollution and the misuse of ecological systems; and the restoration of the environment.

2.1.1.4 Estrategia Nacional de Cambio Climático, 2008

Its objective is to reduce the country's vulnerability to climate change, to strengthen national capacity to adapt to climate change and to develop strategies to reduce GHG emissions. Its work areas include institutional capacity building in relation to climate change, a national program on adaptation to climate change, a national program for the reduction of GHG emissions, and strengthening of international negotiation abilities in relation to climate change.

2.1.1.5 Política Nacional de Cambio Climático, 2009

This policy seeks to contribute to the Millennium Objectives with an emphasis on poverty reduction. Its areas of work include reducing vulnerability to environmental disasters, capacity building in adaptation to climate change, and the development of strategies for the reduction of GHG emissions. The creation of this policy involved the participation of eleven government agencies and five national and international civil-society organizations.

2.1.1.6 Plan Sectorial Multianual de Ambiente y Agua, 2010

The Plan Sectorial is a result of the "*Declaración de Antigua II*" of 2008 between the GoG and international aid organizations. This first plan is designed for 2011 to 2013, and seeks to promote the development of areas related to the environment and water providing strategic guidelines and clear direction for institutional actions and the effective use of financial, human and physical resources. It was created with the collaboration of more than thirty government organizations, led by Ministry of the Environment and Natural Resources (MARN). Its four main objectives are: to decrease vulnerability to extreme weather-related events; so strengthen water management and use; to contribute to ecological balance and biodiversity through conservation, protection and sustainable management of natural resources; to strengthen socio-environmental awareness and accountability in all sectors to ensure widespread and long-lasting access to natural resources.

Pending Policies and Plans

The nature of the bills that have not been passed in recent years, and their potential implication for the reduction of GHG emissions, is significant. One such bill is included in this section with the idea of providing greater perspective of the national governmental context in which climate change has been addressed.

2.1.1.7 Bill - Ley de Ordenamiento Territorial

This bill seeks to clearly define the national territory, providing clear boundaries for the country's forests and thus allowing for better protection of their integrity.

2.1.1.8 Bill – Ley Marco para Regular la Reducción de la Vulnerabilidad, la Adaptación Obligatoria ante los Efectos del Cambio Climático y la Mitigación de Gases de Efecto Invernadero

The bill embodies the main components of the *Política Nacional de Cambio Climático* and is seen as the main technical tool to carry out national actions in relation to mitigation and adaptation to climate change.

2.1.1.9 Bill - Ley de Aprovechamiento y Manejo Sostenible de los Recursos Hídricos[1]

This is the most recent water bill tabled, and seeks to regulate the use of water in the country particularly in how it relates to its industrial use, which accounts for 98% of the total levels of water consumed nationally.

2.1.1.10 Bill - Ley de Desechos Sólidos (not passed)

The bill sought to create mechanisms to reduce the amount of solid waste disposal in the country, allowing for increased funding in this respect for municipalities and establishing a working structure in cooperation with different government bodies including the Ministry of Agriculture and Natural Resources (MARN), the Ministry of Health, and the Ministry of Energy and Mines (MEM).

Country Capacity

Further to Guatemala's range of policies that directly and indirectly address climate change, there exist a number of government entities whose work in relation to climate change can be of a collaborative, isolated or conflictive nature. Government bodies most specifically focusing on the environment and climate change are comparatively new, having been created mostly in the late 1990's and onwards. As such, there appear to be "growing pains" in their work structure, approach, collaboration, etc, which could be expected to improve with experience.

Climate change does not seem to play a very significant role in the national discourse, and funding for programs and ministries working on it has in the past been limited in comparison to the substantial need. Sources indicate that public spending on the environment in 2006 was less than 4% (IARNA 2009B; MARN 2009). National spending on the environment per person in 2006 was rated at $11.8, which is considerably low in comparison to Mexico ($47 per capita) and Costa Rica ($34 per capita) (IARNA 2009B). The concept of climate change is often addressed in relation to food security, as natural disasters have in the past substantially affected subsistence and commercial agricultural practices in the rural southern areas of the country.

Projects and programs that directly impact climate change and GHG emissions, whether from a mitigation or adaptation perspective, have been limited in scope. There are currently three pilot projects in relation to Reducing Emissions from Deforestation and forest Degradation (REDD+), examined later in this report. Clean Development Mechanism projects, as addressed later, are

[1] A thorough search of publicly available information did not provide any further information regarding this bill. This main mean that the bill was not passed. However, it was not possible to confirm this statement.

limited by international standards, at 11 current projects. However, Guatemala is the most advanced in this regard within Central America.

Federal Government Ministries and Agencies

2.1.1.11 Ministerio de Ambiente y Recursos Naturales (MARN)

MARN was established in 2000, replacing the *Comisión Nacional del Medio Ambiente (CONAMA)*. Its main objective is the appropriate management of Guatemala's environment and natural resources. Areas of work include the protection and strengthening of the environment and environmental services; adaptation and mitigation of climate change; water and the management of bodies of water; awareness raising within the population at large in relation to the environment and health; and capacity building on socio-environmental issues. From 2009 to 2011 it tabled more than 27 bills in relation to natural resources (MARN 2011).MARN is the main government actor on climate change. MARN is also the National Contact Point for UNFCC.

- *Unidad de Cambio Climático* – established at the end of Phase I of the First National Communication Project. It is directly involved with follow-up activities relating to UNFCCC, and has created the *Programa Nacional de Cambio Climático* to focus exclusively on responsibilities in relation to UNFCCC.
- *Oficina Nacional de Desarrollo Limpio* – reviews, promotes and monitors clean development mechanism projects in the country.

2.1.1.12 Ministerio de Agricultura, Ganadería y Alimentación (MAGA)

The involvement of MAGA on environmental and climate change topics is mostly through INAB.

- *Instituto Nacional de Bosques (INAB)* – established in 1996, it focuses on forest management through programs to reduce deforestation, increase reforestation and strengthen forest productivity. Its programs have attained a certain degree of success, but are limited in their scope due to the scarcity of funding.

2.1.1.13 Consejo Nacional de Áreas Protegidas (CONAP)

Created in 1989 to manage the protected areas of the country, which cover one third of Guatemala (see Appendix 2). CONAP manages:

- *Sistema Guatemalteco de Áreas Protegidas (SIGAP)* –consists of the 219 protected areas in the country and the entities that manage them. Its purpose it to conserve, recover and protect biological diversity and the natural resources of the country.
- *Fondo Nacional para la Conservación de la Naturaleza (FONACON)* – the role assigned to FONACON is to secure and distribute funding to institutions that are working in the protection, conservation and restoration of natural areas.

2.1.1.14 Ministerio de Energía y Minas (MEM)

MEM formulates and coordinates policies, plans and programs related to energy and mining, including renewable energy sources. To date, it has carried a number of mapping studies to

determine renewable energy potential in various areas of the country in relation to solar, wind and geothermal energy in particular (see Annex 4).

2.1.1.15 Ministerio de Comunicación Transporte y Obras Publicas (MCTOP)

MCTOP took its current form in 1999 and is responsible for infrastructure such as roads, ports, airports, rail, and telecommunications lines. It also sets regulations to coordinate the use of this infrastructure and conducts studies to see how best to expand it.

2.1.1.16 Coordinadora Nacional para la Reducción de Desastres (CONRED)

CONRED was created in 1996 and works in a collaborative fashion with social sectors to foster the coordination of teams to address adaptation to climate change, with the support of trained technicians.

2.1.1.17 Fondo Guatemalteco del Medio Ambiente (FOGUAMA)

FOGUAMA, a member of the *Sistema Nacional de Gestión Ambiental*, raises and administers funds from various sources to provide funding for initiatives that seek to ensure a sustainable environment for Guatemala.

2.1.1.18 División de Protección de la Naturaleza (DIPRONA)

DIPRONA is a division of the National Civil Police. It monitors natural assets in 11 departments in the country, focusing its work in Petén (with 10 control posts in the Maya Biosphere Reserve), Cobán, Quetzaltenango, Salamá and Chimaltenango.

2.1.1.19 Fiscalía de Delitos contra el Ambiente.

Created in 1996 within the *Ministerio Público*, the *Fiscalía* investigates and takes penal action as appropriate in relation to criminal acts that involve the environment. It has offices in Guatemala City, Izabal and Petén. In 2008, it received 1,124 filed reports (MARN 2009).

2.1.1.20 Secretaría de Planificación y Programación de la Presidencia (SEGEPLAN)

SEGEPLAN is responsible for structuring the annual budget for the country, and works closely with the Cabinet.

Inter-Agency Partnerships

2.1.1.21 *Consultation Group on Climate Change*

This group was created earlier this year under the leadership of MARN, with the participation of MAGA, CONAP and INAB. It seeks to foster research and policy creation related to the environment (Barreto, 2012).

2.1.1.22 Inter-Institutional Commission on Climate Change (CCIC)

CCIC was created in 2009, with the participation of over a dozen government actors including MAGA, MEM, Ministry of Education, and Ministry of Public Health. CCIC seeks to work with different sectors of the executive government to develop policies, strategies and concrete actions with the overall purpose of adaptation and mitigation of climate change. It is headed by the Vice-President through coordination with MARN. The consolidation of the CCIC is also part of the objectives set forth by the $250 million loan from the Inter-American Development Bank to strengthen Guatemala's work in relation to climate change.

2.1.1.23 Consejo Nacional de Cambio Climático (CNCC)

The CNCC examines and provides alternatives to a range of topics relating to climate change. It is coordinated by MARN and is composed of government organizations, private organizations (such as the Comité Coordinador de Asociaciones Agrícolas) and non-governmental organizations including ASOREMA and REDFIA.

2.1.1.24 Comisión Interministerial de Biocombustibles

The commission is composed of MARN, MAGA and MEM and has mostly focused its efforts in defining national policy objectives on biofuels.

Funds, Civil Society and Academia

2.1.1.25 Instituto de Agricultura, Recursos Naturales y Medio Ambiente (IARNA)

IARNA was created by Rafael Landívar University to strengthen the research, training, and knowledge transference processes related to the environment and the use of natural resources. Another purpose is to make information readily available, stimulate analysis, and foster debates about production and the environment in order to improve private and public management (IARNA 2012). IARNA also collaborates with two programs that can contribute particularly pertinent work to the topic of climate change:

- SIESAM – Sistema de Información Estratégica Socio Ambiental
- SCAEI – Sistema de Contabilidad Ambiental y Económica Integrada de Guatemala

2.1.1.26 Centro de Estudios Ambientales (CEA)

CEA, at *Universidad del Valle*, was founded in 1972 and focuses on multidisciplinary research on socio-environmental issues. It has substantial experience working in partnership both with governmental and non-governmental organizations.

CEA is currently collaborating with the U.S. Department of Agriculture Food for Progress program in part studying "sweet sorghum" (*sorgo dulce)* for biofuel use. Tests have been carried out using a pickup truck fueled by biofuel made from sweet sorghum, which resulted in the smooth functioning of the vehicle (Instituto de Investigaciones, 2012). The program will continue for another 18 months from the date of this report.

2.1.1.27 Observatorio Ambiental

The *Observatorio* is an academic initiative managed by FLACSO, the *Universidad de San Carlos de Guatemala* through its *Instituto de Análisis e Investigación de los Problemas Nacionales* (IPNUSAC) and IARNA which provides analytical and methodological frameworks and ways of action to reach a balanced management of the natural, social, economic and institutional systems.

2.1.1.28 Instituto Privado de Investigación sobre Cambio Climático

This private institute was created in 2010 by the sugar cane industry and focuses on research and specific programs on climate change mitigation and adaptation in the communities, infrastructure, and productive processes of the southern region where it operates. The former director of CEA currently directs the *Instituto Privado de Investigación sobre Cambio Climático.*

2.1.1.29 Asociación Nacional de Organizaciones No Gubernamentales de los Recursos Naturales y el Medio Ambiente (ASOREMA)

ASOREMA was created in 1995 with the purpose of providing a main body of representation for non-governmental organizations that focus on environmental work. It is composed of 24 organizations and regularly participates in dialogues with national governmental actors such as MARN, CONAP, INAB, FOGUAMA and FONACON. It works closely with REDFIA.

2.1.1.30 Red de Formación e Investigación Ambiental (REDFIA)

REDFIA is an inter-agency network in which universities, research centres and MARN collaborate to further training and research on issues relating to the environment. Some of its members include the *Asociación de Investigación y Estudios Sociales (ASIES),* FLACSO, MARN, Universidad Rafael Landívar, Universidad del Valle, Universidad San Carlos de Guatemala and Universidad Galileo.

2.1.1.31 Centro de Acción Legal Ambiental y Social de Guatemala (CALAS)

CALAS was founded in 2000 and works towards the strengthening of environment management, public engagement and the respect for collective rights of Indigenous communities in relation to the environment.

2.1.1.32 Coalición Ambiental

The coalition was created in 2007 by CALAS and is composed of 14 environmental organizations. Its purpose is to provide an open space for discussion and analysis by environmental organizations to design concrete actions that may lead to long term change for the protection of the environment. Some of its members include *Fundación para el Ecodesarrollo y la Conservación, Asociación Pro Defensa del Medio Ambiente* and ASOREMA.

2.1.1.33 Mesa Indígena de Cambio Climático

The roundtable represents various Indigenous communities from different parts of the country, and addresses the rights and interests if Indigenous Peoples in relation to climate change. The roundtable seeks to affect change at the local, national and international level including discussions relating to UNFCC.

2.1.1.34 Fundación Defensores de la Naturaleza

The Foundation has been in existence for 28 years and seeks to create and manage protected areas in various regions of the country. It is currently in charge of protecting and managing four areas: Reserva de Biosfera Sierra de las Minas, Refugio de Vida Silvestre Bocas del Polochic, Parque Nacional Sierra del Lacandón and Parque Nacional Naciones Unidas.

2.1.1.35 Asociación Balam

Since its creation in 2002, the Association works towards the integrated conservation of natural and cultural resources. In order to achieve this objective, it works in collaboration and actively seeks partnerships with local communities, non-governmental organizations, the private sector and governmental organizations.

2.1.1.36 Fundación Patrimonio Cultural y Natural Maya (PACUNAM)

PACUNAM fosters archeological and scientific research to strengthen the development of productive activities and contribute to environmental conservation. With this purpose in mind, the organization provides support to various initiatives throughout the country.

2.1.1.37 Fundación para el Desarrollo de Guatemala (FUNDESA)

FUNDESA is a private organization of businesspeople which acts as a think-tank to contribute to sustainable and democratic development from a holistic perspective.

2.1.1.38 Mesa Nacional de Cambio Climático (MNCC)

MNCC was originally created in 2009 to garner support for the bill on climate change (which was eventually rejected) and is composed of a wide range of actors in the climate change sector.

International, Diplomatic and Donor Community

Guatemala participates in a number of international and regional coalitions, including:
- ALIDES – *Alianza Latinoamericana para el Desarrollo Sostenible*
- CSUCA – *Consejo Superior Universitario Centroamericano*
- SICA – *Sistema de Integración Centroamericana*
- CCAD – *Comisión Centroamericana de Ambiente y Desarrollo*
- PREVDA – *Programa Regional de Reducción de la Vulnerabilidad y Degradación Ambiental* (Centroamérica)
- UICN – *Unión Internacional para la Construcción de la Naturaleza*

2.1.1.39 Inter-American Development Bank (IDB)

In response to the various environmental disasters that Guatemala has endured in recent years including Hurricane Stan and the wettest rainy season of the last 60 years in 2010, the Inter-American Development Bank has provided a loan of $250 million to be destined to the implementation of a new national policy on climate change, to develop disaster prevention plans and to improve adaptation to climate change. Furthermore, in 2011 IDB approved $736 million in financing for private sector climate-friendly projects, leveraging over $4.1 billion in additional climate change investments.
As Guatemala nears the adoption of its Readiness Preparation Proposal (discussed further below) by the Forest Carbon Partnership Facility, the IDB has offered to continue assisting the country in further REDD+ preparations (Lacandón 2012).

2.1.1.40 World Bank

In 2009, the World Bank approved the Catastrophe Development Policy Loan Deferred Draw Down Option with August 2012 as its closing date, and a total cost of $85 million to focus on water, sanitation and flood protection.

Since 2009, the Forest Carbon Partnership Facility (FCPF), of which the World Bank is a trustee, secretariat and delivery partner, has been supporting Guatemala in the production of the Readiness Preparation Proposal (discussed further below) for developing a REDD+ (Reducing Emissions from Deforestation and Forest Degradation Plus).

2.1.1.41 USAID

USAID has been working in Guatemala since the early 1990s on issues related to the environment, particularly in the Maya Biosphere Reserve (MBR). The main GoG counterpart for this protected area has been CONAP as the administrator of the MBR. USAID also supported the creation of MARN in 2000. USAID recently approved a new Guatemala Country Development Cooperation Strategy (2012-2016) with a Development Objective to “Improve Management of Natural Resources to Mitigate Impacts of Global Climate Change” through: 1) Market-driven conservation and management strategies improved (e.g., timber and non-timber products, ecotourism, carbon credit markets), 2) Vulnerability to the effects of global climate change reduced, and 3) environmental governance strengthened. Recently, USAID/Guatemala has provided support towards the development of a national REDD+ strategy.

2.1.1.42 GIZ and German Government

GIZ and other German donors including the German government have been supporting a wide range of initiatives on climate change and renewable energy sources. Some examples include: decentralization efforts in environment management; strengthening of environmental impact assessment tools; development of network of environment-related information and risk management in the eastern area of the country; and support for MARN to develop a Strategic Analysis of the Environment.

In the last few years, GIZ has been instrumental in the trinational Selva Maya Program. The program seeks to coordinate actions between various actors at the governmental and non-governmental level in Guatemala, Belize and Mexico to promote the conservation of the existing and shared ecosystems through sustainable management of natural resources. It is currently in its initial face, estimated at €5M.

2.1.1.43 Agencia Española de Cooperación Internacional para el Desarrollo (AECID) – Government of Spain

AECID is one of the major donors in the country and heads the *Grupo de Cooperantes* in the *Mesa Sectorial de Ambiente y Agua.* Other areas of support include: Reconstruction after Stan Storm; Programs for Social Cohesion; Programs for Sustainable Local Development; Governance Programs. Its *Fondo de Cooperación para Agua y Saneamiento* has a number of projects in the country focused on increasing availability of drinking water and water drainage systems, and strengthening institutional capacity related to water management in the country.

2.1.1.44 Global Environmental Fund (GEF)

GEF has been an important actor in relation to international cooperation for projects and programs addressing climate change. Some of the areas where it has provided support include integrating the concept of the environment in the general development agenda; institutional capacity building; and fostering private sector involvement.

2.1.1.45 The Nature Conservancy

This organization has a number of programs functioning in the country addressing deforestation, forest conservation and biodiversity. Its current geographic areas of work are the Gulf of Honduras, the Maya Biosphere Reserve, the Motagua/Polochic System and the Sierra Madre Volcanoes.

2.1.1.46 Mesa Sectorial Ambiente y Agua

This roundtable was created in 2009 as a result of the "*Declaración de Antigua II*." Its main purpose is to strengthen communication and actions between pertinent GoG bodies and the international donor community to allow for greater development efficiency and results as the local country sees best fit. Its characteristics include: leadership taken by the home country; the use of one main budget and program framework; a formalized process for the coordination of donors and consistency of requirements in relation to reporting, budgets, etc.; a striving to increase local capacity for program design, management, implementation and evaluation.

2.1.1.47 CARE

Since 2008, CARE has been supporting the *Mi Bosque* project which seeks to create more opportunities for rural communities to grow forests and manage natural resources. In collaboration with *Universidad del Valle*, by 2010 it had supported the reforestation of 239,833 ha in 132 communities (CARE 2010).

3 National Greenhouse Gas Inventories

Background

There is limited availability of public data in relation to climate change in Guatemala that is updated, reliable and comprehensive. Nevertheless, there are a number of sources (e.g. MARN, MEM, IARNA) which have published reports with pertinent data towards the end of the last decade, and on which the present report draws substantially. Although there exist sources projecting possible climate change in the future (see Guatemala's First National Communication, for example), there appears to be a lack of GHG emissions projections in the sources consulted and for that reason they are not included in this report.

The First National Communication with 1990 as the base year created in relation to Guatemala's commitments as a signatory to the UNFCCC also provides historical context and GHG emission-specific information. This is coupled by the data provided in the Inventory of GHG Emissions published in 2010 with 2000 as its base year, for comparative purposes.

Clean Development Mechanism (CDM)

In 2005, MARN became the Designated National Authority and was charged with the administration of Clean Development Mechanism projects. The same year saw the inauguration of the *Oficina Nacional de Desarrollo Limpio*. There are currently 11 CDM projects (see Annex 5), and in 2009 there were 10 projects approved by MARN, which were being registered. The projects focus on hydroelectric dams and to a lesser extent on solid waste management. In 2010 these projects were reducing 864,760 tons of carbon dioxide emissions annually (MARN 2010).

GHG Inventory

Guatemala is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), and submitted its First National Communication in 2001. The Second National Communication was originally expected to be published in 2007, as stated in the First Communication. Preparatory work for this report is under way, and preliminary data has been made publicly available by the GoG, including the *Actividades Habilitadoras para la Preparación de la Segunda Comunicación Nacional sobre Cambio Climático* as well as the *Inventario de Gases de Efecto Invernadero Versión Preliminar*. The first document outlines the institutional framework pertinent to climate change, current situation, and general expected results and actors who may be involved in the Second National Communication. The second document exclusively provides initial data in relation to GHG emissions with 2000 as the base year. The data from this inventory appears to be consistent with trends of climate change events and developments over the last few decades. However, the inventory does not outline methodologies used to obtain the data, and contains noticeable typos in data entering, as well as apparently erroneous information. For these reasons, the current report refers to this data for broad comparison purposes only.

In relation to UNFCCC GHG emissions recording, Guatemala does not report on solvent use, and does not provide conversions of non-carbon dioxide gases to carbon dioxide values for

comparative purposes. As such, analysis of data provided in the First Communication and the Inventory focuses predominantly on carbon dioxide emissions, which is by far the gas responsible for the largest emissions by weight (without using comparative values).

The overall GHG emissions by sector are outlined in Table 1, based on the data from the First National Communication and the inventory for 2000. In 1990, the two main contributors of GHG emissions were the energy sector, with 49.4% of GHG emissions (with transport accounting for 28.3% of these emissions), and land use and land use change, which accounted for 43.3% of GHG emissions. In considering estimates for 2000 as the base year, total carbon dioxide emissions have tripled, as have carbon dioxide emissions specifically from the land use sector, while such emissions from the energy sector doubled.

Table 1: GHG Emissions per Sector 1990/2000 (in Gg)

		Carbon Dioxide							
		Emission	Absorption	Methane	Nitrogen Dioxide	Nitrogen Oxide	Carbon Monoxide	Organic Compounds	Sulphur Dioxide
Energy	1990	3,770.40		34.40	0.52	36.91	725.73	91.74	74.23
	2000	9,342.93		41.61	0.68	69.84	1015.55	135.72	97.87
Industry	1990	544.66						14.21	0.26
	2000	1,235.73						3121.14	0.59
Agriculture	1990			129.87	19.69	5.67	193.09		
	2000			130.56	53.97	15.74	490.28		
Solid Waste	1990			30.39	0.46				
	2000			41.48	0.57				
LULUCF	1990	3244.55	-42903.73	4.9	0.034	1.22	42.84		
	2000	10742.16	-37460.17	16.64	0.11	4.14	145.62		
Total	1990	7,559.61	-42903.73	199.56	20.704	43.80	961.66	105.95	74.49
	2000	21,320.82	-37460.17	230.29	55.33	89.72	1651.45	3256.86	98.46
Difference		13,761.21	5443.56	30.73	34.626	45.92	689.79	3,150.91	23.97

4 LEDS Inputs Analysis

Energy Use and Power Generation

From the 1990's until 2000, there has been a significant switch in Guatemala from using hydroelectric dams as the main energy source (about 90% of the energy generated in 1990), to a considerable reliance on fossil fuels (60% of total energy generated in 2005). Guatemala underwent an energy crisis in the 1990's, which led to fast-paced agreements for energy plants and to the opening up of the market to the private sector through the passing of the *Ley General de Electricidad* in 2006. The idea of hydroelectric projects could not be considered due to their very high cost, and the social conflict and rejection that they had generated in the past (IARNA 2009A).

Figure 3: Oil Resources in Guatemala

Source: MEM 2007

Currently, the private sector generates 73% of energy, and hydroelectric energy production has been consistently increasing over the last few years (IARNA 2009A). The Ministry of Energy and Mines has high hopes for the future of renewable energy sources, and in January of this year indicated that it expects that in 2026 78% of energy in Guatemala will come from renewable sources (Bolaños 2012).

Figure 4: Energy consumption, 2005

Source: MEM 2007

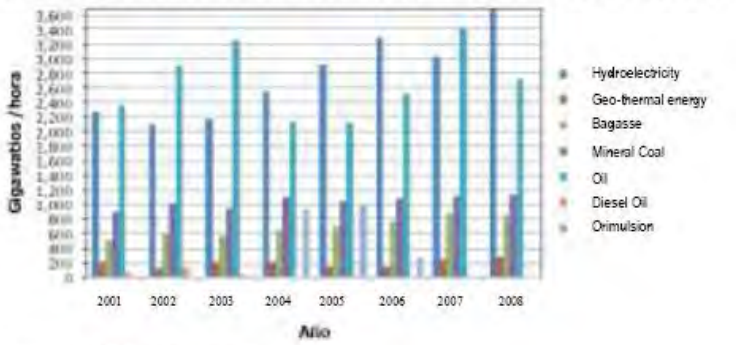
Since the signing of the Peace Accords in 1996, the government has been opening areas for bidding and granting concessions in the oil-rich Petén department of northern Guatemala. One of the last bids was granted to City Petén towards the end of 2011 for an oil exploration project of up to 25 years of duration with an expected cost of $30 million. Figure 3 depicts the areas that are deemed to be resource rich.

Energy sources are divided in four areas, with two very significant actors being fossil fuels and firewood, as depicted in Figure 4. These particularities speak to the extensive use of firewood for domestic use in rural Guatemala, and to the substantial consumption of fuel of Guatemala's motor vehicles.

In the last decades, the demand and production of electricity has seen an increase. From 2001 to 2007, it rose from 6,382 GWh to 8,752 GWh – a 37% increase, which was mostly satisfied through oil and coal. From 2001 to 2008, 36% of electric energy was created through cleaner energy sources. The increasing use of hydroelectric dams is depicted in Figure 5.

In terms of energy consumption per sector (not including the use of firewood), in 2006 the main actors in Guatemala included the production of bakery goods (17,421TJ), transportation (17,039TJ), grain mills (15,777TJ), production of cement, quicklime and plaster (12,478TJ), commerce (11,390TJ), and pottery (10,417TJ) (IARNA 2009A). This data is partially reflected in Figure 6 which portrays the national demand for electric energy specifically. The demand has been rising over the years with industry and residential being the main users.

Figure 5: Production of electricity based on energy source



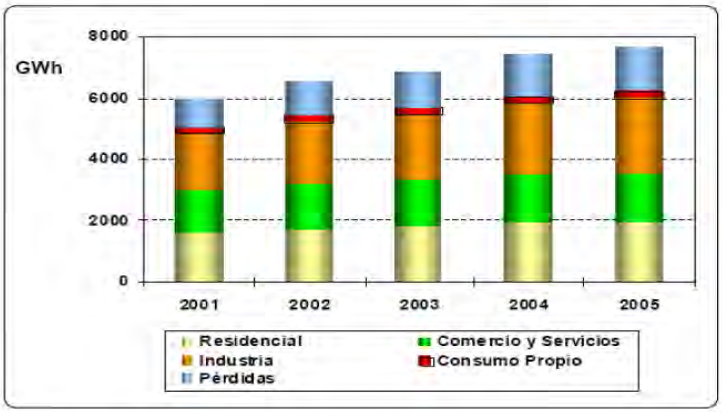
Source: MARN 2009

Transportation, which is the second largest consuming sector, is largely dependent on petroleum. The number of vehicles registered in the country increased 1.7 times between 2000 and 2008 and

reached a level of one vehicle for 8 individuals in the populations. The area where the increase was most significant was in Guatemala City, where the number of vehicles increased by two thirds, whereas in most of the rest of the country, it doubled (IARNA 2009A).

Public transportation in the country is widely available in much of the country in the form of buses and mini-buses ranging in age and quality standards. Regarding urban transport in Guatemala City, there is a bus system that is supplemented with bus rapid transit (BRT). The BRT system, Transmetro, began operating in 2007, and has successfully improved traffic flow. There are plans to expand the BRT system from the existing 2 lines to 10 lines.

Figure 6: Increase in demand for electric energy – 2001-2005



Source: MEM 2007

Baseline Energy Supply and Demand

Based on data from 2008, Guatemala's available energy is 451,309 TJ (IARNA 2009A). There has been a continued increase in the demand for energy, which can be linked to population growth and a stronger emphasis on industrial production in the country. The energy supply has been able to meet the growing demand, with a significant reliance on the use of fossil fuels.

The following section depicts the particular situation for each energy source in order of significance with regards to their current energy production. Unless otherwise specified, the source for data of these sub-sections is MEM 2007.

Biomass

CEPAL has deemed Guatemala to be the most important consumer of firewood in Central America, given that in 2002 57% of households cooked with firewood. It accounts for 46% of the energy consumed in the country. Of the 3.4 million cubic metres of wood harvested between 1999 and 2004, 35% was used for firewood. The areas that most depend on firewood are El Petén, Alta Verapaz, Baja Verapaz, Quiché, Huehuetenango, Chimaltenango and Sacatepéquez – where 40% of wood extracted was used for firewood.

Fossil Fuels

Guatemala's production of crude oil has been growing since 1990, reaching its peak in 1998 at 9.2 million barrels. The oil is extracted by foreign-owned companies, and 95% of it is exported to the United States as Guatemala does not have the facilities to process it in-country. In turn, the country imports the great majority of the oil consumed nationally (again, mostly from the United States).

Oil imports have been increasing in the last years, with 2006 oil imports amounting 26,589,410 barrels, an 8.5% increase from the previous year. In 2008, Guatemala imported 3.7 million barrels of oil and processed into 7.5 million barrels of gasoline and 8.9 million barrels of diesel fuel (Hoff and Tay 2009). IARNA reports that in 2006 54% of the fuel available in the country was consumed by households, which mostly need it for motorized vehicles (2009).

Hydroelectric Energy
Energy production through hydroelectric means has seen a continuous strengthening since 2000, going from 2110 GWh in 2002 to 3246GWh in 2006 (a 54% increase). Seventy percent of this energy is produced by the State. It is estimated that the production potential for this sector is 4100MW, of which only 13% (650MW) are currently being used (IARNA 2009A).

There is also an interest in further developing Guatemala's hydroelectric sources, including the Xalalá project which has caused social tension in the past (IARNA 2009A) due to the damage it would create to the surrounding community and the uncertainty of fair compensation to be provided to affected communities. On the other hand, there are smaller dams, like Microhidroeléctrica Chelense, which are portrayed as a less damaging example of hydroelectric power creation (Castellanos and Guerra 2009). In 2008 there were four projects that had received authorization from MEM, and nine small projects that had been registered (see Annex 6).

With regards to active dams, in 2008 there were 23 active hydroelectric dams generating over 600MW. The main dams include:

- Chixoy (41.6% of energy generation)
- Aguacapa (12.2% of energy production)
- Jurún Marinalá and Renace (9.2% of energy production each)
- Canada (7.3% of energy production)
- Las Vacas (6% of energy production)

Geothermal Energy
Guatemala's geothermal potential is estimated to be 1000MW, of which 3% (29MW) is currently being used. There are 27 geothermal sites identified and three of these (Tecuamburro, Amatitlán and Zunil) have been studied in detail, are close to Guatemala City, and have a production potential of 180MW (IARNA 2009A) (see Annex 4).

Biofuels
Guatemala has been recognized as having a large potential for biofuels. The by-product of sugar production has been used to create energy from seven sugar mills in southern Guatemala, which is then used for their own operations (during the sugar harvesting season) and the rest sold into the national energy grid. According to the national sugar mill association, ASAZGUA, the installed capacity is more than 324 MW and growing (Schmick, 2012). As of 2008, Guatemala produced 265 million liters of dehydrated alcohol from sugarcane byproducts.

A number of sugar mills have placed bids to the *Comisión Nacional de Energía Eléctrica* (CNEE) and some of the major energy producers in the country, to increase energy production through biomass and other fuels. Some of these mills include *Ingenio Magdalena, Ingenio Pantaleón, Ingenio Santa Ana* and *Ingenio Madre Tierra* (Coronado, 2012A).

Since the 1980's Guatemala has been producing African palm and in 2009 the annual production was 290,000 tonnes. In 2006 the area of growth reached 45,000 ha, with roughly half of this area at the production stage, while the other half was maturing. The estimated long term potential for palm biodiesel in the country is close to 4.0 million metric tons (Hoff and Tay 2009).

Solar Energy
There exist a number of small solar energy projects in the country. The *Ley de Incentivos para el Desarrollo de Proyectos de Energía Renovable* has led to the creation of projects approved in 2005 to provide energy to a number of communities in the municipality of Panzós in eastern Guatemala. The project is supported by NRECA (National Rural Electric Cooperative Association). According to the 2002 census, there were 18,000 families using solar panels and in 2006 3,400 solar panels were installed by the Ministry of Energy and Mining, financed by the European Union. The Ministry of Energy and Mines is carrying out studies to measure the potential for solar energy technology in various parts of the country (see Annex 4).

Wind Energy
The production potential for wind energy is 7800MW (MARN 2009). The Buenos Aires project in Santa Elena Barillas in the central area of the country is expected to be the first wind powered energy plant, with an initial capacity of 15MW and an estimated cost of $17million. The Ministry of Energy and Mines is carrying out studies to measure the potential for wind energy technology in other parts of the country (see Annex 4).

GHG Emissions Data and Modeling

According to the First National Communication using 1990 as the base year, carbon dioxide emissions from the energy sector were the greatest (3700Gg) in comparison to the other sectors, and are the second highest (9342Gg) according to the estimates for the 2000 from the National Inventory. In both cases, transport emissions were by far the largest component, accounting for 57% of carbon dioxide emissions in 1990 and 45% in 2000.

In 2009, Rafael Landívar University compiled a chart of GHG emissions in carbon dioxide equivalents to measure the contributions of various energy products (firewood, crude oil, etc) for the year 2006. Based on these calculations, of the 45.5 million tons of carbon dioxide equivalent, the single most significant contributor to GHG emissions was firewood, consumed mostly for domestic purposes (29.5 million tons), accounting for 65% of GHG emissions.

Policies and Programs to Reduce Emissions in the Energy Use and Power Generation Sector

4.1.1.1 Policies

- *Ley de Incentivos para el Desarrollo de Proyectos de Energía Renovable*, 2003. This legislation promotes the development and use of renewable energy sources in the country providing tax incentives from the pre-investment stage to the operation stage. A list of projects arranged by energy sector is provided in Annex 7.
- *Propuesta de Reglamento de Control de Emisiones de Fuentes Móviles* (MARN 2009)

- *Política Estratégica y Minera, 2007* (MARN 2009)
- *Bill - Ley del Uso de los Biocombustibles* – This bill is currently being developed and is expected to be tabled by MEM, with the support of the Organization of American States and the *Centro de Derecho Internacional para el Desarrollo Internacional* (Coronado, 2012B)

4.1.1.2 Programs

- *Central American Bank for Economic Integration Line of Credit, 2012* - $30 million loan through Banco Agrícola Mercantil to support the development of small projects that focus on the generation of renewable energy in the country. (*El Periódico 2012)*

- *Programa de Eficiencia Energética, MEM* – series of small programs to allow exchanges of incandescent light bulbs for energy-efficient ones, installation of solar panels in the main building of MEM, etc.

- *Renewable Energy Project MARN/Finland-Austria* – approval of 10 project proposals for the generation of renewable energy within the context of a larger agreement between Finland, Austria, and Central America.

- *Exploration of Renewable Energy Potential, MEM* – a number of studies that have determined the areas throughout the country that hold the greatest potential for different forms of sustainable energy (wind, geothermal, etc.), with the support of Solar and Wind Energy Resource Assessment (SWERA) (see Annex 4).

- *Technical Support from the Government of Brazil* - design of an ethanol combustion program which seeks to find alternatives to the high use of polluting fuels in the country.

- *Bioethanol for Sustainable Development in Central America*. A two year project funded by ECLAC/Italia to promote the development of more sustainable energy production.

- *Regional Biofuel group* – Funded by IDB/GIZ with the coordination of SICA.

- *Creation of university programs focusing on energy resources* -
  – Masters on Renewable Energy, Universidad Galileo.
  – Masters on the Environment and Energy. Universidad de San Carlos de Guatemala.
  – Masters on Environmental Studies, specialization on Energy. Universidad del Valle de Guatemala.

Barriers to Reducing GHG Emissions

A limiting factor in relation to reducing GHG emissions in the energy field concerns the bureaucratic and lengthy processes required to carry out studies to determine the potential for a particular form of energy exploitation. Further, in the cases of renewable energy, the costs

implicated in the exploration phase are very high and do not guarantee results, which limit their appeal for investment.

Another challenge that has been noted in the past is the conflicting priorities that have become apparent between the State and rural communities in areas deemed suitable for significant renewable energy developments, such as hydroelectric dams. This has been case with the Chixoy and more recently Xalbal dams. In such cases, whereas the State is seeking to provide sustainable energy sources for a growing population, communities physically affected by the project are concerned about the flooding of their lands, which have represented their sustenance for generations.

Lastly, climate change and the role of GHG emissions therein do not appear to have great significance in the strategic planning and actions of the Ministry of Energy and Mines. Though hydroelectric energy consumption has increased significantly in the last few years, it appears that the drive for this development lies more on the idea of sovereignty and reduction of imports. Furthermore, the sustained development of oil exploration and exploitation in the department of Petén, both a source of GHG emissions in its process, and in relation to the product, can seem particularly attractive given the royalties and financial benefits related to the process.

In the particular case of transportation which, as noted, accounts for over 28% of GHG emissions, there are at least two identified impediments to improvements in transit that could help to reduce GHG emissions. One major problem identified in the Guatemalan transportation sector is the need to reform the regulatory system to reduce duplication of responsibilities and programs, and streamline bureaucratic procedures. A primary concern is that there is an absence of authorities responsible for regulating and supervising the same sector. This great competition between different government departments can create regulatory conflicts and political interference, and then result in uncertainty for private investors (Ernst and Young 2005).

Forestry and Land Use Change

Loss of forest cover is a significant concern in Guatemala, with deforestation currently at an alarming level, and growing. From the estimated 7 million ha of forest in existence in 1950, there has been an average of about 60,000 to 70,000 ha of forest land lost per year, amounting to 3 million ha of forests lost (IARNA 2009A). Hence, there is not only an increase in carbon dioxide emissions due to deforestation, but the extent to which carbon dioxide is reabsorbed is also limited.

Given that one of the main reasons for loss of forest cover is its domestic use for a majority of the Guatemalan population, particularly in rural areas, it is significant to relate the increase in deforestation with the substantial increase in population growth since the 1990's. Whereas in 1950 availability of forest per inhabitant was 2.22ha, in 2006 it was of 0.39 ha, a decrease in availability of more than 80% (IARNA 2009B).

More than half of Guatemala's forests, which compose 32% of the Guatemalan territory, are within nationally protected areas under the jurisdiction of National Council for Protected Areas (CONAP). Nevertheless, this does not impede those very forests from being logged illegally. The

three studies that have addressed illegal logging (Arjona 2003; Kiuru 2003; IARNA 2008) indicate that it is responsible for between 30 to 75% of logging (studies were carried out in different areas of the country, which helps contextualize the varying results). It is also estimated that 75% of wood used for domestic use is acquired without permits. Lastly, another analysis portrays that in 2006 more than 90% of the reduction of forests was due to illegal logging (IARNA 2009A).

The geographic area most affected by deforestation is the north of Guatemala, in the departments of Petén, Alta Verapaz, Quiche, Izabal and Huehuetenango. Five particular foci of deforestation have been identified which represent 39% of deforestation and forest degradation. These are Petén Sur, La Libertad and Montañas Mayas (Petén), Cuchumatanes Norte (Huehuetenango) and Manabique (Izabal) (IARNA 2009A) (see Annex 8). The data shows a trend with the information presented in the First Communication, which indicates that in 1990 the two departments most affected by deforestation were Petén and Alta Verapaz, followed by Quiche, Izabal and Huehuetenango.

Furthermore, there is a direct correlation between the existence of transportation infrastructure and deforestation. In the case of the Maya Biosphere Reserve in Petén, this has been well documented – where the areas most significantly impacted by deforestation are the ones adjacent to paved roads (see Annex 9). It appears to be a logical conclusion that with an increase of possibilities to enter forested areas through roads, there is also a greater area of forest exposed to logging potential. Another protected area with a well developed road structure is Tikal National Park also in Petén – a significant tourist destination. In this case, this relation is not evident, and is likely counterbalanced by the much greater number of forest rangers assigned to that area (MARN 2009).

The steep rates and expansiveness of deforestation in Guatemala is closely linked to its sociopolitical history. Some of the main reasons include:

- Expansive domestic use of firewood for cooking and other purposes in 86% of rural areas and parts of urban areas
- Substantial increase in population, particularly in the last 20 years
- Limited financial resources
- Challenges relating to land holding titles in relation to forest management
- Expansion of land for agricultural use –commercial agricultural exports , African palm harvesting, and cattle (MARN 2009)
- Expansion of hydrocarbon extraction projects
- Drug harvest, smuggling and trafficking in forest areas and physical inaccessibility of some areas – clearing of forests within national parks for the construction of landing strips for drug trafficking with an estimated 50 such structures in Petén, according to the national daily *Prensa Libre* (2009)
- Industrial use by the manufacturing industry – in 2006, it consumed 5.6 million of cubic metres of wood products from forests (IARNA 2009B)

Reducing Emissions from Deforestation and Forest Degradation (REDD)

Reducing Emissions from Deforestation and Forest Degradation projects have been slow to develop in Guatemala. Some of the reasons for this delay include lack of financial resources and staff, as well as limited technical know-how. Another difficulty has reportedly been discontent from indigenous communities over lack of consultation (*The Guardian* 2009; Castellanos and Guerra 2009). The initiative Growing Forest Partnerships, which seeks to support a varied range of actors involved in the sustainability of forests in five countries, is currently active in Guatemala and has partnered with the *Programa Forestal Nacional de Guatemala*. Part of its work includes support in the development of the Guatemala Readiness Preparation Proposal (R-PP), which is in the last stages of approval by the Technical Advisory Panel of the Forest Carbon Partnerships Facility this year (Growing Forest Partnerships 2011). The R-PP was last submitted in March 2012 following recommendations to the January 2012 version. Upon revision, further recommendations[2] have been suggested.

Guatemala has undertaken important steps towards the development of a "National Strategy for the Reduction of Deforestation" (ENRD). Furthermore, in 2011 a REDD+ Working Group was formed, composed of a number of organizations including *Asociación de Comunidades Forestales de Petén*, *Asociación de Forestería Comunitaria de Guatemala* and the *International Union for Conservation of Nature*, which have come together to share experiences and set up joint activities to limit deforestation and forest degradation. The formation of this working group is seen as a support element in the preparation process of REDD+ in Guatemala, in particular through devising recommendations on REDD+ key elements such as financing mechanisms and legal frameworks (Lacandón Forests for Life 2011).

Guatemala currently has three REDD+ pilot projects that are being coordinated by the National Council of Protected Areas (CONAP).

a. A forest concession project in the Maya Biosphere Reserve, promoted by *Asociación de Comunidades Forestales de Petén* (ACOFOP) and Rainforest Alliance;
b. A project in Sierra del Lacandon National Park, promoted by *Fundación Defensores de la Naturaleza*, *Oro Verde*, and Rainforest Alliance;
c. A project in Lachuá National Park, promoted by *Fundación Lachuá* and the International Union for Conservation of Nature (IUCN).

With the support of USAID/Rainforest Alliance, AGEXPORT/Danish Development Cooperation (DANIDA), and the Wildlife Conservation Society, these three projects have also contributed to the development of REDD+ methodologies. Deforestation scenario models have also been developed with projections to 2037. Eventually CONAP's initiatives should be scaled up to establish national reference levels that take into account the specific characteristics of different regions and the possibility of interregional leakage of deforestation. CONAP and MARN, with

[2] To see recommendations, please refer to http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Mar2012/Guatemala%20TAP%20Synthesis%20Review-March%2010%202012.pdf and http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Mar2012/R-PP%20Guatemala-PC-compiled%20revised%20clean.pdf

support from IUCN and Rainforest Alliance, are currently analyzing the legal framework for REDD+ in Guatemala. With USAID and other donors' support, the GoG has developed various stages of the REDD+ strategy for Guatemala, including national consultations, the methodological platform, and the legal definition of rights to emissions.

In order to establish a baseline upon which to evaluate emission reduction objectives, the country has been divided into five geographic areas. A survey is to be carried out in each particular area to define the specific characteristics of deforestation for each of them, which will serve as a point of reference in the design and implementation of REDD+ activities in each region. Currently, the deforestation baseline for the Northern Lowlands has been completed. This area encompasses the regions of Petén and Lachuá in the northern area of the country and has been strongly affected by deforestation and forest degradation.[3].

GHG Emissions Data and Modeling

The reported level of GHG emissions from the First National Communication, using 1990 as the base year, and the estimates from the National Inventory using 2000 as the base year portray a substantial increase in emissions of carbon dioxide and a substantial decrease in the carbon dioxide absorption rates. Carbon dioxide emissions due to land use change have increased by 331% from 1990 to 2000, going from 3,244.55 Gg to 10,742.16. In contrast, carbon dioxide absorption rates decreased by 5,443Gg, going from 42,903Gg in 1990 to an estimated 37,460 in 2000.

Policies and Programs to Reduce Emissions in the Forestry/Land Use Sector

4.1.1.3 Policies

- *Ley de Áreas Protegidas, 1989* – This legislation has as its objectives the conservation, recovery, improvement and protection of natural resources in the country, and establishes the creation of the Sistema Guatemalteco de Áreas Protegidas (SIGAP)

- *Ley Forestal, 1997* – This legislation establishes the State responsible for providing 1% of national revenue to be used as forestry incentives.

- *Política Forestal de Guatemala, 1999.* The main objective of this policy is to increase socioeconomic benefits from the goods and services produced by forest ecosystems and to contribute to land regulation in rural areas.
- *Agenda Nacional Forestal, 2003* – The agenda provides a framework for actions between 2003 and 2012 to foster the achievements of objectives as set out by the *Programa Forestal Nacional.*

[3] Please refer to the baseline report posted in the Guatemala wiki site.

4.1.1.4 Select Programs

- *Forest Licensing Program, MAGA* – Provides licenses for forest management, change of use, and salvaging of forested areas
- *Programa de Incentivos Forestales (PINFOR), INAB* – A 10-year program (1997-2016) of economic incentives through payments to land holders of forest areas. In the period from 1998 to 2010 it has affected the reforestation and forest management of 291,000 ha. Since 2010 its funding has been greatly reduced.
- *Programa de Apoyo a la Reconversión Productiva Agroalimentaria (PARPA)* – established the *Programa Piloto de Apoyos Forestales Directos (PPAFD)* to contribute to the conservation of natural forests in central and western Guatemala by providing payments directly to property owners and landholders as a way of compensating and ensuring that their lands continue to be protected. PPAFD provides financial compensation to individuals who do not have access to PINFOR due to lack of land title. Up until 2008, PPAFD has supported in the conservation of 33,400 ha of natural forest land (MARN 2009).
- *Programa de Incentivos para Pequeños Poseedores de Tierras de Vocación Forestal o Agroforestal (PINPEP), INAB.* Reforestation and conservation program for which beneficiaries do not need to show a land title (allowing for projects in community lands), started in 2006 with support from the Netherlands. In 2011 it covered 9,000 ha in 79 municipalities (*El Periódico 2011)*
- *Programa Forestal Nacional, 1997.* The program has a vision of attaining a sustainable management of the country's forest resources, with a focus on the strengthening of forest activity and conservation efforts. The program is currently linked to the Growing Forest Partnerships program.
- *Fortalecimiento Forestal Municipal y Comunal (BOSCOM), MAGA* – capacity strengthening project for municipalities and rural communities members to foster the decentralization and strengthening of forest management in the country

Barriers to Reducing GHG Emissions

Some of the most significant causes of deforestation in Guatemala are related to significant developments that occurred since the 1990's, namely a surge in population growth dependent on firewood for livelihood, an increase in export agriculture, and an increase in African palm farming. Drug trafficking appears to become an increasingly significant problem as well. The ex-Minister of the Environment and Natural Resources, Luis Ferraté, himself indicated he had received threats from drug trafficking rings in relation to his work on forestry (*Plaza Pública 2012B).* All of these issues represent increasing pressures on forested land. Although addressing them is imperative, their complexity calls for broader and more comprehensive measures which are likely more difficult to program and implement than individual reforestation programs.

Furthermore, the limited funds allocated to forestry and reforestation efforts significantly limit the extent of such efforts. Significantly, there was an attempt in 2010 to reduce the annual budget

for the National Council of Protected Areas (CONAP) by around 40%, which was not enacted perhaps in relation to the organized reaction and pressure from environmental networks and organizations.

Though some programs appear to have positive relations with the general population, there are sometimes challenges in the relation between different ministries. Such has been the case on some occasions between MARN and MEM, which have mandates that do not always coincide in relation to forestry conservation and oil extraction developments that require deforestation to be implemented.

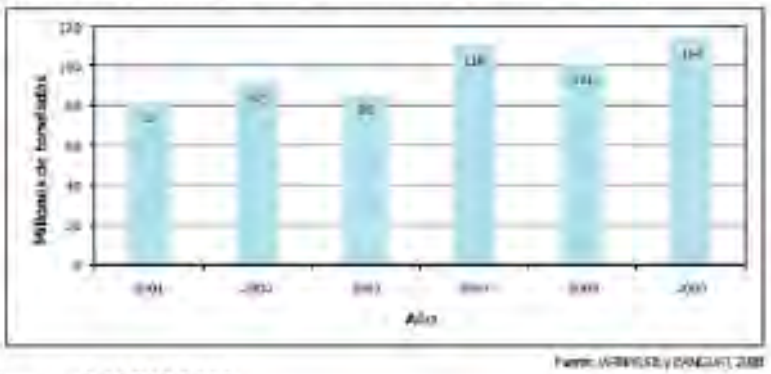
Solid Waste

From 2001 to 2006, there has been a consistent increase in the production of solid waste, as exemplified in Figure 7, accounting for at least 5% of methane emissions. In 2006, most of the waste was created by the meat industry (35%), chemical industry (15%), the production of mineral products (10%), farming of non-traditional goods (10%) and farming of traditional goods (5%). It is not clear the extent to which industrial waste contributes to GHG emissions, given that a considerable proportion of GHG emissions are derived from anaerobic decomposition of organic waste.

Domestic solid waste only accounted for slightly over 1% of the total, but contains 35% of organic matter (IARNA 2009A). Also, the proximity of domestic solid waste to residential areas, its visibility and its role in the spread of disease and bad odours have given it a more prominent position in the field of solid waste management (MARN 2009).

More than 80% of the landfills in the country are illegal, and hence do not have an Environmental Impact Assessment to help determine the best location and potential effects on the population and the environment. Furthermore, only 30% of the population has access to a waste collection program, whether it be private or public, and 60% of that sector is in Guatemala City (MARN 2009). Hence the majority of the country's population finds alternate ways of disposing of waste, which may be burning it, burying it, or taking it to (or creating) a landfill themselves.

Figure 7: Generation of Solid Waste at the National Level



Source: MARN 2009

Domestic solid waste is most significant in urban areas (54%), and particularly in Guatemala City, which accounts for 456,484 tons per year. In general, the nature of the majority of the waste produced would allow for it to be recycled or composted if facilities existed. However, the substantial proportion of organic waste that goes into the landfills and is deprived of

oxygen as it piles up leads to the avoidable methane emissions. It is estimated that in 2006, 85% of solid waste was disposed of in open areas without any further treatment (MARN 2009).

GHG Emission Data and Modeling

Although the data from the 2000 National Inventory is preliminary, it does portray an increase in comparison to the 1990 data from the First National Communication. In 1990, it is estimated that methane emissions from solid waste amounted to 30.4Gg (18% of the national methane emissions), which increased substantially in the 2000 estimates, at 41.5Gg. The estimated level of nitrous oxide emissions in 1990 is 0.5Gg (1% of the national emissions), and it increased to 0.6% in the 2000 estimates.

Policies and Programs to Reduce GHG Emissions

4.1.1.5 Policies

- *Política sobre Manejo de Residuos Sólidos, 2005* – Grants responsibility to MARN and the *Comisión Nacional para el Manejo de los Desechos Sólidos* to manage solid waste removal and processing and to provide support to municipalities in their work on this field.

4.1.1.6 Programs

- *Pre-viability study on methane combustion* – Focus on Zone 3 and Vida Nueva landfills in Guatemala City to study options to reduce methane emissions
- *Recycling Awareness Program, Comisión Nacional de Desechos Sólidos (CONADES)* – program started in 2008 and focuses recycling awareness in underprivileged areas of Guatemala City and surrounding area.

Barriers to Reducing GHG Emission

In relation to domestic waste disposal, there are very limited alternatives to the current situation in place at the moment. Especially in densely populated urban areas, opportunities for composting are limited, and municipal programs of waste collection are not always available, let alone recycling or composting programs. Lack of infrastructure and resources is evident. Lack of information and limited planning for alternative ways of disposing of waste, or limiting waste creation, also appears to be a challenge.

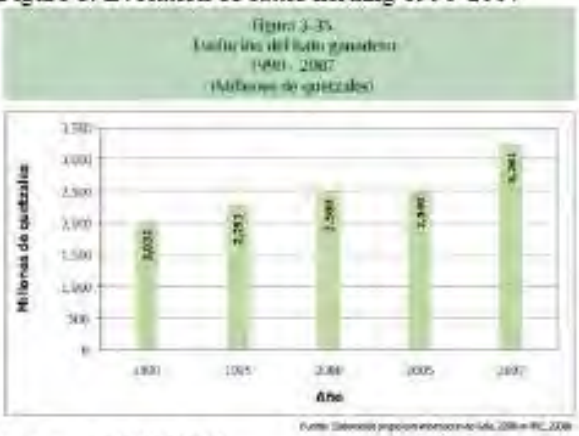
At a greater level, waste production and management is lacking strong legislation to guide its process (and a bill on solid waste tabled in the last few years has been rejected). There are no clear incentives for industries, the most significant producers of waste, to become involved in any form of waste reduction program.

Agriculture and Industry

The availability of data relating to agriculture and GHG emissions or environmental impacts of agriculture and industry is very limited, even though industry is the third most significant contributor of carbon dioxide emissions. Because Guatemala does not have equivalent values of other GHG emissions in carbon dioxide, and given that according to the methodologies presented by the Intergovernmental Panel on Climate Change the overall agricultural process does not produce carbon dioxide (because the emissions are later reabsorbed in the continuous growth and production cycle), this may be a reason for the limited analysis on agriculture. The lack of carbon dioxide-equivalent values limits the extent to which the sector's methane emissions may be considered.

In the case of industry, the production of cement, lime, asphalt, food and drinks, and glass can be significantly polluting because of the energy that their production requires. As part of the preparatory work to create the First National Communication, research was carried out to determine the potential existence and emissions of other industrial processes relating to metals (iron, steel, etc) and pulp/paper production. The results demonstrate that the emissions from the first are very limited, and that there are no mechanisms in place for measuring them. In the case of the latter, Guatemala does not have a paper manufacturing industry from raw materials (its production is from recycled paper). Thus these categories are not considered. Total GHG emissions from recorded industries are measured in relation to volatile organic compounds, sulphur dioxide and carbon monoxide.

Figure 8: Evolution of cattle herding 1990-2007



Source: MARN 2009

Between 2001 and 2008 agricultural activities grew slightly but their role within the economic structure has lessened considerably as other sectors like transport, communications, and extractive industries, have gained greater importance. The farming of domestic products, such as rice, corn, beans and wheat have continued to use the same expanse of land in the last decades, whereas the farming of non-traditional products and of export products (cotton, banana, coffee, sugar cane) have increased. It is important to highlight that much of the waste produced in farming is recycled (composting, animal feed, etc). Nevertheless, at least 20% does become a source of GHG emissions due to its inadequate disposal, including burning (MARN 2009).

On the other hand, African palm and cattle farming have increased substantially as portrayed in Figure 8 (for the case of cattle), particularly in Petén and Izabal. These increases can be linked to the particularly high deforestation levels in these two departments.

Sugar cane is a significant industry in Guatemala. It accounts for 25% of national agricultural production, and almost 14% of annual exports. Though the industry certainly has substantial benefits for the country, it also represents an important source of GHG emissions, as 90-95% of harvested sugar cane is burned as part of its processing. This generates 9,000 tons of carbon dioxide annually (MARN 2009). Given the precedent set in Latin America by Brazil and Costa

Rica, and the substantial presence of the sugar cane industry in Guatemala, supporting the sugar cane industry in moving away from burning sugar cane fields both before and after harvest could be a significant opportunity for EC-LEDS efforts (Schmick 2012).

Agricultural and Industry GHG Emissions Data and Modeling

Agricultural GHG emissions for the base year of 1990 compared to the 2000 estimates, are as portrayed in Table 2. Most GHG emissions have doubled over the ten-year period, except for the values for NO_x, which have tripled.

Table 2: Agriculture GHG Emissions 1990/2000

GHG Emission Category	Value (Gg) in 1990	Value (Gg) in 2000
methane	129.9	130.6
nitrous oxide	19.7	54.0
NO_x	5.7	15.7
carbon oxide	193.1	490.3

Industry GHG emissions for the base year of 1990 compared to the 2000 estimates are portrayed in Table 3. Although emissions have increased in all areas, volatile organic emissions are particularly remarkable, having ascended from 14Gg to an outstanding 3121Gg. According to the 2000 Inventory, this is due to a dramatic increase of volatile organic emissions from the food and beverage industry. Although this particular industry has shown consistent growth in recent years (SIB 2012), it has not grown so substantially to explain the upsurge in emissions. Because of the limited access to additional data to corroborate results in relation to the estimates of the 2000 Inventory, it may be useful to confirm this data and check methodologies for the Inventory through primary sources of data.

Table 3: Industry GHG Emissions 1990/2000

GHG Emission Category	Value (Gg) in 1990	Value (Gg) in 2000
carbon dioxide	544.7	1235.7
volatile organic compounds	14.21	3121.14
sulphur dioxide	0.26	0.59

Policies and Programs to Reduce Emissions in Agriculture Sector

It is significant to note the power held within the sugar cane industry, composed of 12 large and well established mills. Its weight has been noted in the various processes that have taken place to create legislation to regulate the use of water – a clearly vital element in the industry.

Within this context, the Association of Sugar Producers of Guatemala (ASAZGUA) created in 2010 its own Private Institute of Climate Change Research, represented by a team of highly educated and foreign-trained staff. Its foci of work include research, water source management, risk management in relation to environmental disasters, and capacity development.

A thorough search through publicly available information did not shed light on any policies or other programs relating to GHG emissions from the agriculture and industry sectors in

Guatemala. This is not particularly surprising, given the limited information available on both sectors in relation to GHG emissions and climate change. As there is no clear understanding of the extent and processes by which these two sectors emit GHG, especially in the case of industry, it would be difficult to design or implement programs that could get to the root of these issues. A solid starting point would be an increased focus on research on these areas, which to this date has not been attended to in any considerable extent.

With regards to the lack of policies, it could be argued that given the limited significance of GHG emissions from these sectors as measured in the First National Communication and the Inventory for 2000, there is not a significant draw to focus on policies or legislation that address it specifically. This is particularly the case given the comparatively more significant need for action on the energy and land use sectors, based on their GHG emissions.

Barriers to Reducing GHG Emissions

Given the above situation, it appears that one of the main challenges relating to reducing GHG emissions is the lack of detailed, reliable and updated information on the topic. Furthermore, the ministry responsible for agriculture, MAGA, did not appear to have publicly available information of any type on this topic, which could be stemming from the potentially limited priority it is awarded.

Given the very limited attention that this topic warrants from the State, and the lack of information or clear evidence of its effects in relation to climate change, it is likely that the international community also does not see this area as a ground for work on GHG emissions reduction.

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Annex 1: List of Key Documents

The documents listed below are those deemed most critical for review by the pre-scoping team before a mission to Guatemala. Further documents can be found in the bibliography and the EC-LEDS Wiki Site (http://guatemala-scoping.ec-leds.wikispaces.net/pre-scoping) for possible review by other team members

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Annex 2: International Agreements on Environmental Issues Ratified by Guatemala

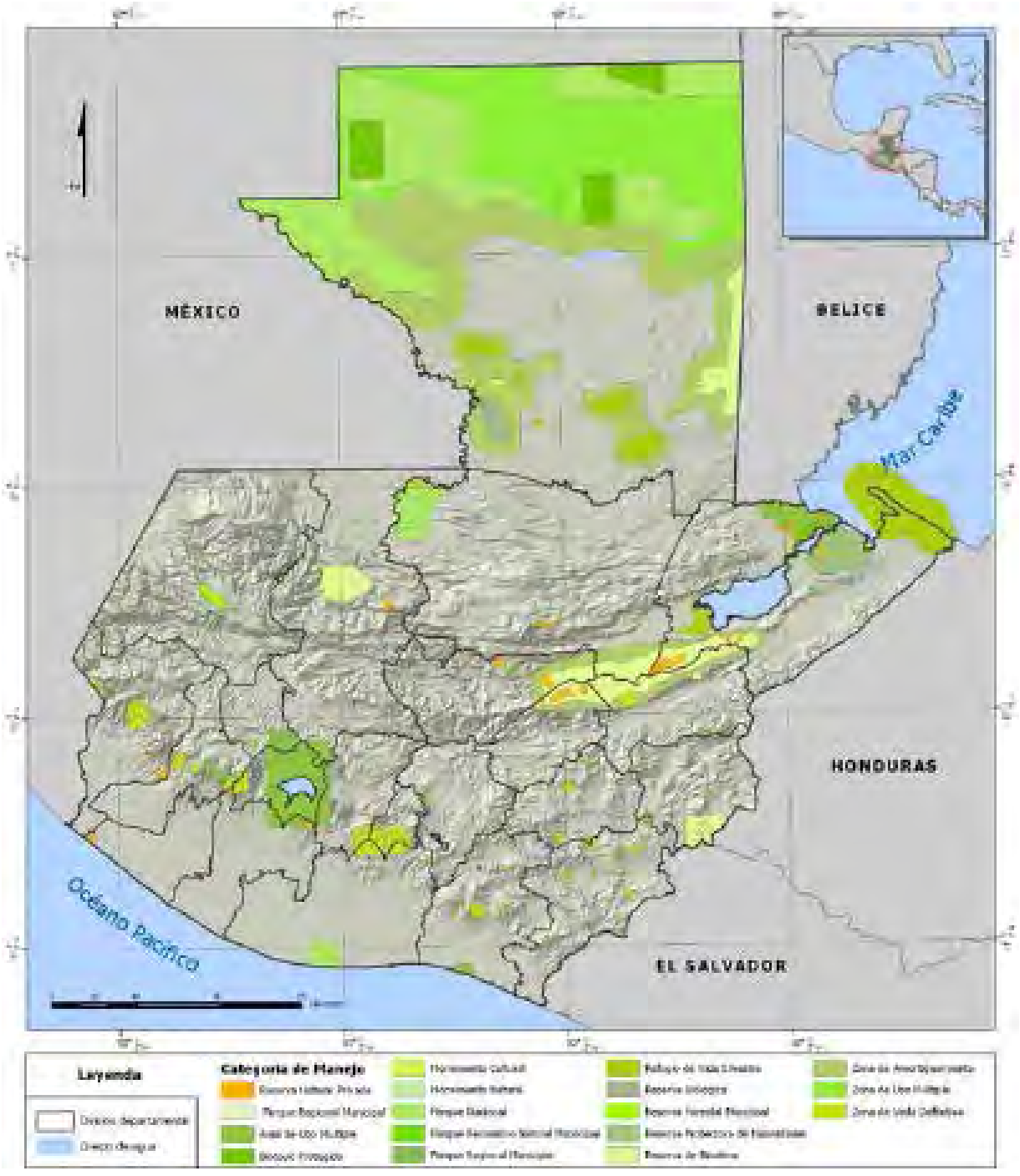
Cuadro 5-2
Tratados y convenios internacionales ambientales más relevantes ratificados por Guatemala

Año	Instrumento ratificado
1979	Convención sobre el Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestres (CITES)
1988	Convención Relativa a los Humedales de Importancia Internacional Especialmente como Hábitat de Aves Acuáticas (Convenio de Ramsar) Convenio de Viena para la Protección de la Capa de Ozono
1992	Convenio Centroamericano de Biodiversidad Convenio Centroamericano de Bosques
1994	Alianza para el Desarrollo Humano Sostenible (ALIDES)
1995	Convenio sobre la Diversidad Biológica (CDB) Convenio de Basilea sobre el control de los movimientos transfronterizos de los desechos peligrosos y su eliminación Convención Marco de las Naciones Unidas sobre el Cambio Climático (CMNUCC) Convención Regional sobre Cambios Climáticos
1999	Protocolo de Kioto Convención de las Naciones Unidas de Lucha contra la Desertificación y Sequía (CNULD)
2000	Declaración del Milenio
2001	Enmiendas al Protocolo de Montreal relativas a las sustancias agotadoras de la capa de ozono
2002	Declaración sobre Desarrollo Sostenible, Johannesburgo
2003	Convención Interamericana para la Protección y Conservación de las Tortugas Marinas
2004	Protocolo de Cartagena sobre Seguridad de la Biotecnología del CDB
2005	Convenio de Cooperación para la Protección y el Desarrollo Sostenible de las Zonas Marinas y Costeras del Pacífico Nordeste en Centroamérica Convención Internacional para la Regulación de la Caza de la Ballena, reglamento y protocolo Plan Ambiental de la Región Centroamericana 2005 - 2010 Tratado Internacional sobre los Recursos Fitogenéticos para la Alimentación y la Agricultura Declaración de París, sobre Eficacia de Ayuda al Desarrollo
2006	Comisión Ballenera Internacional Tratado de Libre Comercio entre República Dominicana, Centroamérica y Estados Unidos de América (DR-CAFTA) Normativo de Reglas de Origen y Procedimientos de Origen en el Marco del DR-CAFTA Normativo para la Presentación, Recepción y Consideración de las Comunicaciones a que se refiere el artículo 17.6.1 del Capítulo Ambiental del DR-CAFTA Tratado de Budapest sobre el Reconocimiento Internacional del Depósito de Microorganismos a los Fines del Procedimiento en Materia de Patentes para la aplicación del DR-CAFTA
2007	Acuerdo entre los Gobiernos de Costa Rica, República Dominicana, El Salvador, Guatemala, Honduras, Nicaragua y Estados Unidos de América sobre Cooperación Ambiental Convenio para el Establecimiento de la Zona de Turismo Sustentable del Caribe Convenio de Estocolmo sobre Contaminantes Orgánicos Persistentes (COP) Conferencia de Oslo sobre Responsabilidad Social y Ambiental

Fuente: Elaboración propia con información de CRS, 2009; IDEADS, 2008

Source: IARNA 2009A

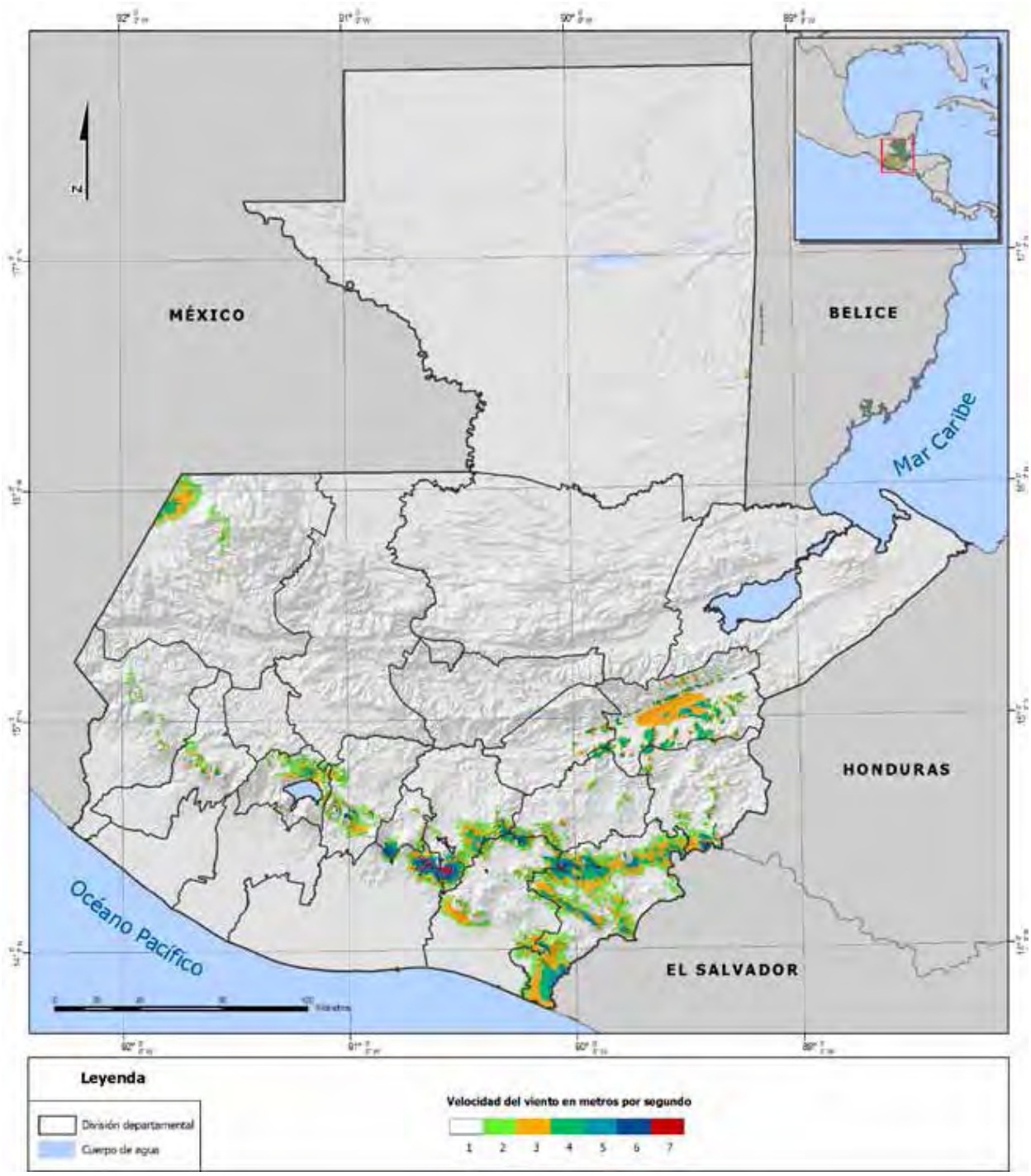
Annex 3: Protected Areas in Guatemala



Source: MARN 2009

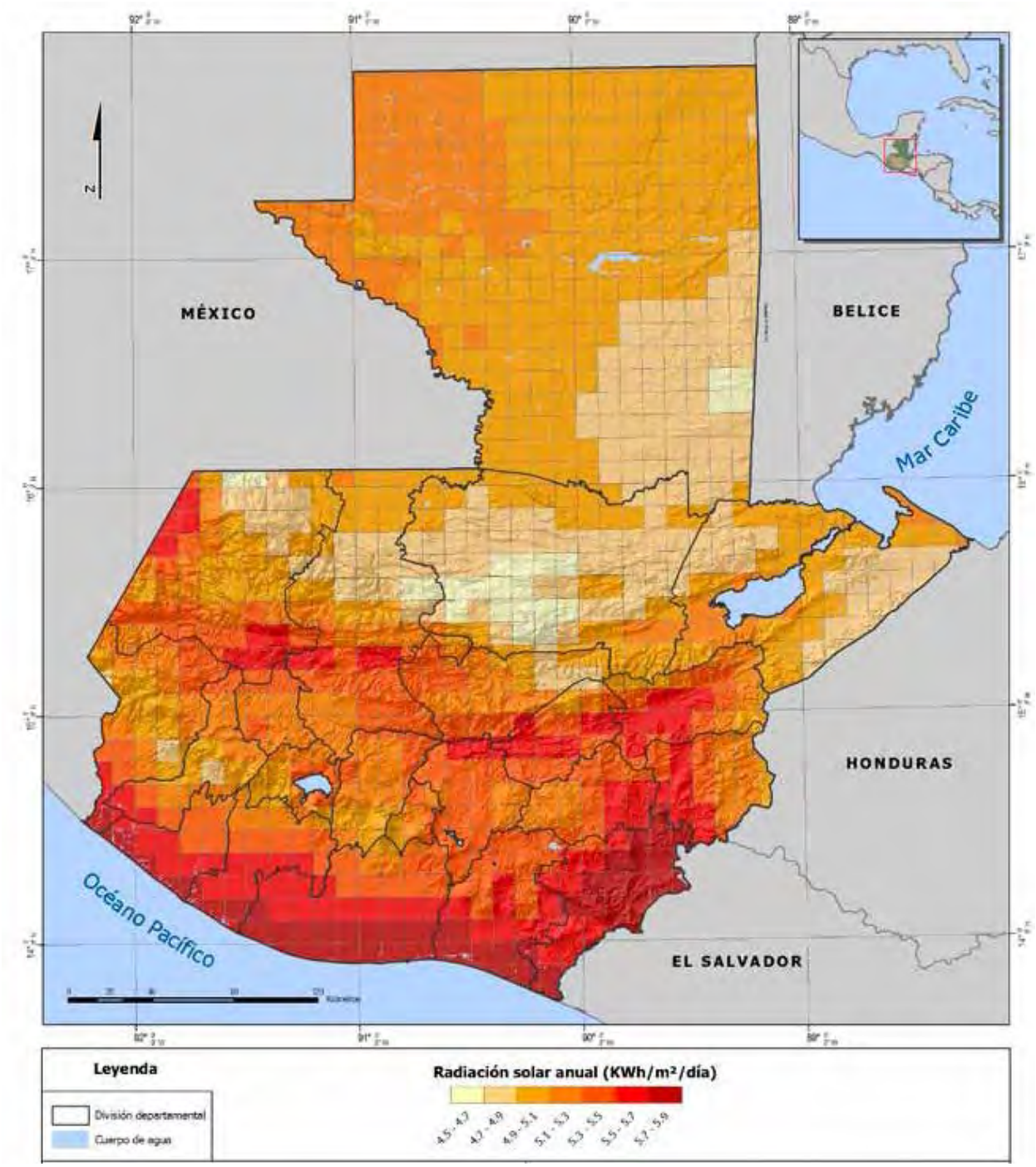
Annex 4: Renewable Energy Potential Mapping Samples, developed by MEM

Areas with Highest Potential for Wind Energy Harvesting



Source: MARN 2009

Areas with Highest Potential for Solar Energy Harvesting



Source: MARN 2009

Areas with Highest Potential for Geothermal Energy Harvesting

Source: MARN 2007B

Annex 5: Sample of CDM projects

No.	Nombre del Proyecto	Capacidad instalada (MW)	Emisiones de CO_2 reducidas (toneladas)
1	Proyecto Hidroeléctrico Las Vacas	45.00	90,383
2	Planta Hidroeléctrica Matanzas	11.70	38,493
3	Planta Hidroeléctrica San Isidro	3.92	13,389
4	Proyecto Hidroeléctrico Candelaria	4.30	18,922
5	Proyecto Hidroeléctrico El Canadá	31.00	118,527
6	Planta de Energía de Biogás del Efluente de Aceite de Palma	1.62	30,333
7	Proyecto Geotérmico Amatitán	25.20	82,978
8	Proyecto Hidroeléctrica Xacbal	94.00	311,438
9	Proyecto Bioenergía-Planta Generadora de Biogás para la producción de vapor utilizado en destilería	-	100,000
10	Co-composteo de racimos vacíos de fruta y efluentes de extracción de molino de palma africana	-	22,940

Fuente: MARN, 2009

Source: MARN 2009

Annex 6: Hydroelectric Projects in Guatemala (2006)

Proyectos	Cantidad	Capacidad (MW)	Producción (GWh/año)
Menores de 5 MW	13	43.3	126.4
Entre 6 y 15 MW	28	288.7	1,028.1
Mayores de 16 MW	27	2,369.6	8,194.4
Entre 50 y 75 MW	4	256.8 - 262.2	1,071 - 1,099
Mayores de 100 MW	3	805.0 - 905.0	3,219 - 3,474
Cuenca río Suchiate	12	78.2	645.5
Cuencas río Naranjo	4	23.5	198.4
Proyectos con autorización definitiva	4	101.7	442.1
Pequeñas centrales registradas	9	30.7	
Total	104	3,997.5 - 4,102.9	14,924.9 -15,207.9

Fuente: MEM 2006

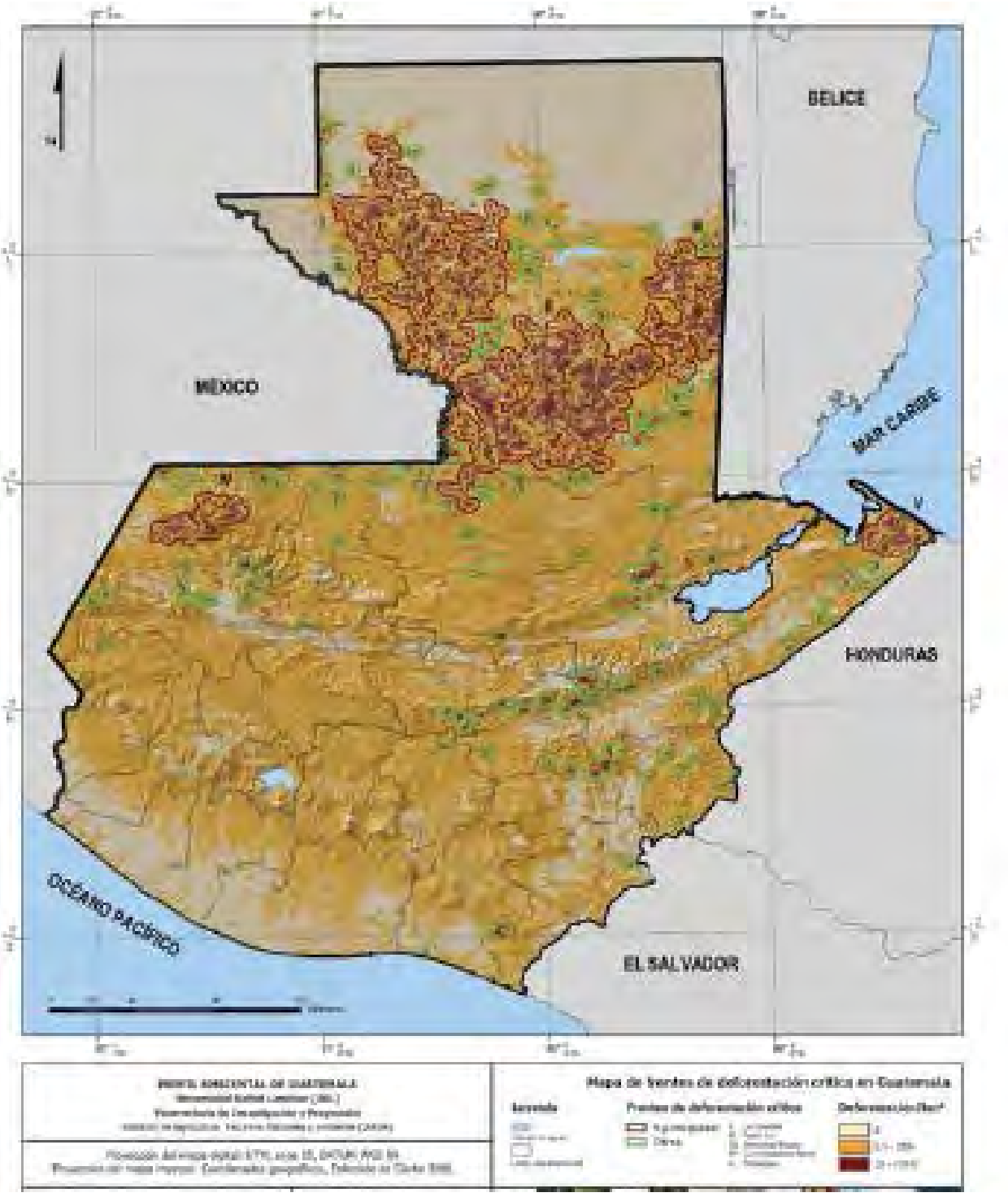
Source: MARN 2009

Annex 7: Renewable Energy Projects Approved by *Ley de Incentivos para el Desarrollo de Proyectos de Energía Renovable* (2003-200)

Tipo de proyecto	Proyectos presentados	Proyectos aprobados	Etapa
Eólico	5	2	preinversión
Hidroeléctrico	8	7	5 ejecución, 2 operación
Geotérmico	1	1	ejecución
Fotovoltáico	1	1	ejecución
Biomasa	3	3	ejecución
Cogeneración	6	5	1 ejecución, 4 operación
Total	24	19	

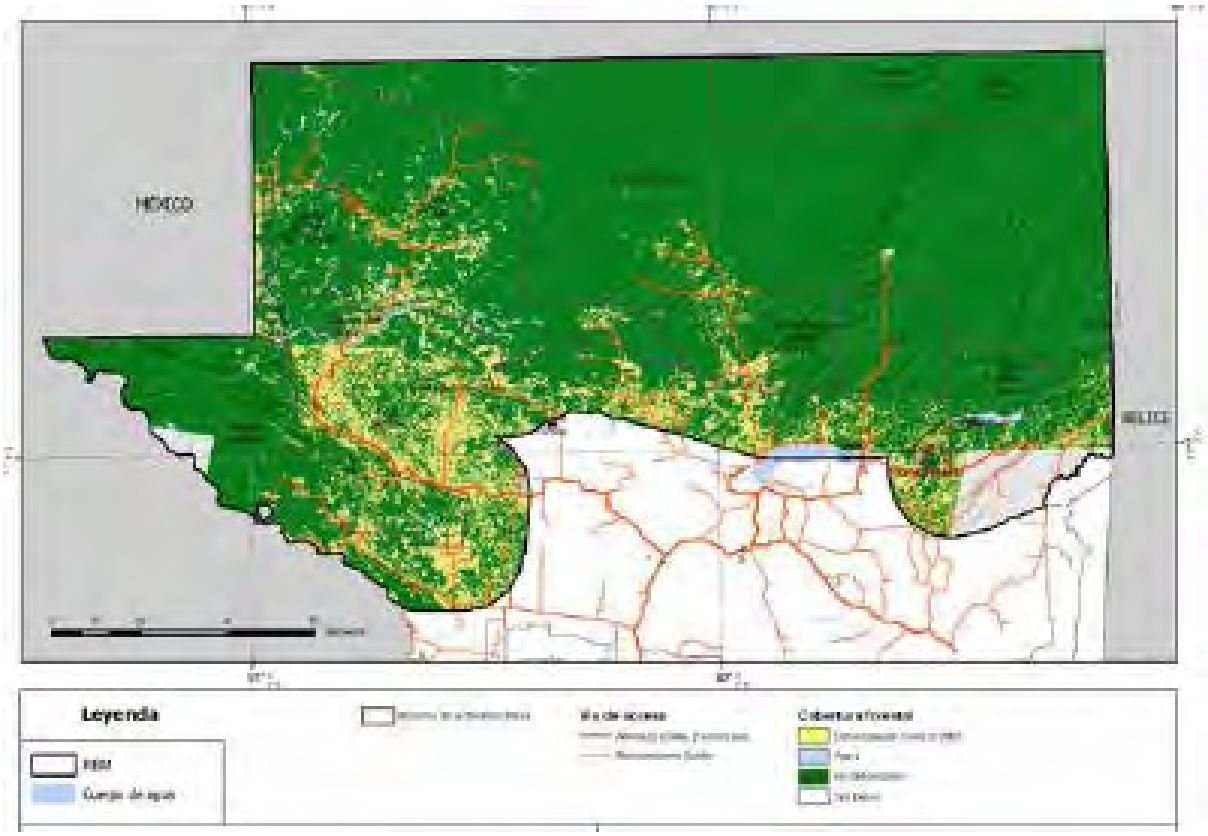
Source: MARN 2009

Annex 8: Critical Deforestation Areas



Source: MARN 2009

Annex 9:Paved roads in Petén (Northern Guatemala) and deforestation



Source: IARNA 2009A