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INSTITUTIONAL ASSESSMENT AND SECTOR ANALYSIS FOR THE LOW-EMISSIONS DEVELOPMENT STRATEGY IN GUATEMALA

FOREST CARBON, MARKETS AND COMMUNITIES (FCMC) PROGRAM

JULY 2013

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ACRONYMS AND ABBREVIATIONS

ACOFOP	Asociación de Comunidades Forestales (Association of Forest Communities)
AGER	Asociación Gremial del Empresariado Rural (Trade Association for Rural Enterprise)
AGEXPORT	Asociación Guatemalteca de Exportadores (Guatemalan Association of Exporters)
AMCHAM	American Chamber of Commerce in Guatemala
AMM	Administrador del Mercado Mayorista (eléctrico) (Administrator for the Wholesale Electricity Market)
ANACAFÉ	Asociación Nacional del Cafe (National Coffee Association)
AOP	Annual Operating Plan
ASAZGUA	Asociación de Azucareros de Guatemala (Guatemalan Association of Sugar Producers)
ASOCUCH	Asociación de Organizaciones de los Cuchumatanes (Association of Cuchumatanes Organizations)
ASOREMA	Asociación Nacional de Organizaciones No Gubernamentales de los Recursos Naturales y el Medio Ambiente (National Association of Natural Resources and Environmental Non-Governmental Organizations)
BAU	Business as usual (baseline of GHG emissions under current conditions, without including possible measures to reduce emissions)
BBL	Barrel (of oil)
CDM	Clean Development Mechanism
CECON-USAC	Center of Conservation Studies at San Carlos University
CEPAL	Comisión Económica para América Latina (Economic Commission for Latin America)
CGP+L	Centro Guatemalteco de Producción más Limpia (Guatemalan Center for Cleaner Production)
CICC	Comisión Inter-institucional del Cambio Climático (Inter-institutional Commission on Climate Change)
CIG	Cámara de Industria de Guatemala (Guatemalan Chamber of Industry)
CNEE	Comisión Nacional de Energía Eléctrica (National Electric Power Commission)
CO_2e	Dióxido de carbono equivalente (carbon dioxide equivalent)
CONADUR	Consejo Nacional de Desarrollo Urbano y Rural (National Council on Urban and Rural Development)

CONAP	Consejo Nacional de Áreas Protegidas (National Protected Areas Council)
CPA	CDM Program of Activities
DEED	Dirección de Estudios Estratégicos del Desarrollo (Directorate for Strategic Development Studies)
DGT	Dirección General de Transportes (General Transportation Directorate)
DOE	Designated Operating Entity (for CDM projects)
EC-LEDS	Enhancing Capacity for Low Emissions Development Strategies
EMETRA	Entidad Metropolitana Reguladora de Transporte y Tránsito (Metropolitan Transportation and Traffic Regulatation Entity)
FUNDAECO	Fundación para el Ecodesarrolllo y la Conservación (Foundation for Eco-Development and Conservation)
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographic Information System
GoG	Government of Guatemala
Ha	Hectare
IADB	Inter-American Development Bank
IARNA	Instituto de Agricultura, Recursos Naturales y Ambiente de la Universidad Rafael Landívar (Rafael Landívar University's Institute of Agriculture, Natural Resources and the Environment)
ICC	Instituto Privado de Investigación sobre Cambio Climático (Private Institute on Climate Change Research)
IGN	Instituto Geográfico Nacional (National Geographic Institute)
INAB	Instituto Nacional de Bosques (National Forest Institute)
INE	Instituto Nacional de Estadísticas (National Statistics Institute)
INSIVUMEH	Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología (National Institute of Seismology, Volcanology, Meteorology and Hydrology)
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau (Bank of Credit for Reconstruction)
LEDS	Low Emissions Development Strategy
LULUCF	Land Use, Land Use Change and Forestry
MAGA	Ministerio de Agricultura, Ganadería y Alimentación (Ministry of Agriculture, Livestock and Food)

MARN	Ministerio de Ambiente y Recursos Naturales (Ministry of the Environment and Natural Resources)
MEM	Ministerio de Energía y Minas (Ministry of Energy and Mines)
MICIVI	Ministerio de Comunicaciones, Infraestructura y Vivienda (Ministry of Communications, Infrastructure and Housing)
MINECO	Ministerio de Economía (Ministry of Economics)
MINFIN	Ministerio de Finanzas Públicas (Ministry of Public Finance)
MRV	Measurement, Reporting and Verification
NAMAs	National Appropriate Mitigation Actions
PACUNAM	Fundación Patrimonio Cultural y Natural Maya (Maya Cultural and Natural Heritage Foundation)
PINFOR	Programa de Incentivos Forestales (Forestry Incentives Program)
PINPEP	Programa de incentivos para pequeños poseedores de tierras de vocación forestal o agroforestal (Incentives program for small landholders of lands suitable for agro-forestry)
PoA	Program of Activities (under the UNFCCC mechanism)
PPA	Power Purchase Agreement
PRONACOM	Programa Nacional de Competitividad (National Competitiveness Program)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REDFIA	Red Nacional de Formación e Investigación Ambiental (National Environmental Training and Research Network)
SAT	Superintendencia de Administración Tributaria (Tax Administration Superintendence)
SEGEPLAN	Secretaría de Planificación y Programación de la Presidencia (Planning and Programming Secretariat of the Presidency)
SICA	Sistema de Integración Centroamericana (Central-American Integration System)
SIGAP	Sistema Guatemalteco de Áreas Protegidas (Guatemalan System of Protected Areas)
SITRAN	Superintendencia de Transporte por Carretera (Superintendence of Road Traffic)
STP	Superintendencia de Transporte Público (Superintendence of Public Transportation)
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USG	US Government
UVG	Universidad del Valle de Guatemala
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

INTRODUCTION

This report is the result of analysis performed by an inter-disciplinary team of sector specialists who held two weeks of high-level meetings with entities of the Government of Guatemala (GoG), the private sector and academics on the issue of climate change. The report specifically focuses on existing and required elements for the development of a low emissions development strategy (LEDS) in Guatemala, achieving emission reductions while maintaining economic growth.

The report analyzes the institutional capacity of the Ministry of the Environment and Natural Resources (MARN) and the Secretariat of Planning and Programming of the Presidency (SEGEPLAN) to lead a LEDS program from a technical and planning perspective, respectively. Subsequently, an assessment of the methodologies used in calculating greenhouse gas (GHG) inventories at a macro level is provided. Lastly, for the key sectors (energy, industry, transportation, agriculture, and forestry and land use), opportunities for improvement of the inventories and key opportunities for mitigation are discussed, and steps for the development of an action plan for each sector are proposed.

INSTITUTIONAL CAPACITY

MARN is the institution that has led all climate change initiatives in Guatemala from a technical perspective. The main working entities have been the Inter-Institutional Commission on Climate Change (CICC), the Climate Change Coordination Group (GCI) and the Climate Change Unit (UCC). Reestablishing the ministries' political leadership (particularly of MARN) was one of the needs identified, and in this sense the proposed plan is to: reestablish the CICC, increase the hierarchical level of the UCC to the status of Department and explore new measures to retain qualified personnel within the UCC.

SEGEPLAN is responsible for the formulation of development plans and programs. Within SEGEPLAN, the Environmental and Sustainable Policy Unit is responsible for integrating LEDS-related issues in programming. The institutional assessment of SEGEPLAN for developing LEDS indicates the need for repositioning climate change issues within the current structure in order to effectively integrate climate change initiatives in national planning.

GREENHOUSE GAS INVENTORIES

Among the major challenges identified during the inventories development, two major aspects are most important; first, there is insufficient data on each sector to develop robust inventories. Second, the documentation process during inventory development, including calculation procedures, emission factors and the assumptions used in the document, must be improved. This documentation is critical because it is the starting point for forecasting future emissions, i.e. for the development of a baseline scenario (BAU). In the assessment of mitigation measures (through carbon abatement cost curves), this BAU scenario will be the reference point used to determine the impact of various abatement measures evaluated.

ANALYSIS BY SECTOR

The agricultural sector has the highest emissions according to the 2005 GHG inventory, accounting for 42% of total emissions in Guatemala by carbon dioxide equivalent (CO_2e). Emissions of nitrous oxide (N_2O)

from agricultural soils explain the most of the emissions from this sector (81%), which reveals the need to closely monitor this source of emissions and identify opportunities for reduction. A second identified need is improving the quality and opportunity of agricultural surveys and census, in order to obtain the information required to estimate sector emissions in a more precise manner.

The energy sector has the second highest emissions according to the 2005 GHG inventory, accounting for 28% of total CO_2e emissions in Guatemala. Emissions of the transportation sub-sector explain 49% of emissions of the energy sector, and consequently this sector is analyzed separately. The second greatest source is the electric power industry (23%), followed by manufacturing and construction (14%). In the LEDS framework, a need to promote a shift in the energy matrix by reducing dependence on petroleum-derived fuels has been identified. In this sense, the promotion of geo-thermal power generation by the government and regulating the sector is a key aspect, due to its potential to reduce GHG emissions. Also on a national level, the institutional, regulatory and financial frameworks for energy efficiency must be implemented. Even when some pilot energy efficiency projects have been implemented, specific studies are required to quantify and assess the true potential of the opportunities identified in several sub-sectors, including the residential, industrial and commercial sub-sectors (lighting, refrigeration, air conditioning, engines, etc.).

The transportation sector was responsible for 14% of emissions in 2005, and considering the motor vehicles inventory has doubled between 2005 and 2010, the need to implement mitigation measures in this sector has been identified. In general, there is good access to information on the sector regarding fuel consumption and the number of vehicles, the former from the Ministry of Energy and Mines (MEM) and the latter from the Tax Administration Superintendence (SAT). In terms of key opportunities for mitigation, the following alternatives have been proposed: i) renewal of vehicle fleet and controls on emissions; ii) provide incentives for energy management at commercial fleets; iii) promote change in commuting habits away from private vehicles towards public transportation; and iv) promote the use of bio-fuels.

The industrial processes sector accounts for 3.5% of the country's emissions, and when emissions from electric power and fuel consumed by industry are included, its share increases to 11%. What is interesting about this sector is that almost half of these emissions are produced by a single cement manufacturer, Cementos Progreso, which represents an opportunity for mitigation activities. This company, like many other manufacturing companies, analyzes and documents its emissions, and has its own mitigation plans in place. The private sector is highly capable and can be very receptive to the implementation of mitigation measures in a LEDS process. The action plan suggests coordination with the GoG to find shared interests in the development and implementation of mitigation measures and energy efficiency programs for the industry.

The land use, land use change and forestry (LULUCF) sector has been a net carbon sink in Guatemala, but its capacity for fixing atmospheric CO_2 is rapidly decreasing due to high deforestation rates (loss of 132,000 Hectares (Ha) per year or 3.47% per year of national forest areas). A key opportunity for mitigation is to reduce the rate of deforestation and forest degradation. Achieving this requires stronger forestry governance and land use laws in the framework of consensus-building around common objectives with groups of public and private stakeholders. Additionally, the rising productivity of agricultural land and the implementation of REDD+ mechanisms represent clear opportunities to reduce deforestation. However, it is essential to improve Measurement, Reporting and Verification (MRV) capabilities in order to achieve proper implementation of mechanisms for Reducing Emissions from Deforestation and Forest Degradation (REDD+). Consequently, the policies to reduce deforestation and forest degradation go beyond the institutional scope of the National Forest Institute (INAB) and the National Protected Areas Council (CONAP), and involve institutions as the Ministry of Agriculture, Livestock and Food (MAGA), MARN, SEGEPLAN, the Ministry of Public Finance (MINFIN) and MEM. In this sense, controlling deforestation is much more effective if it is part of a broader LEDS program, which takes into account the various interactions observed between the deforestation process and the socio-economic activities of Guatemala (such as land use, food and energy production), and places value on the various environmental services and products provided by the forests.

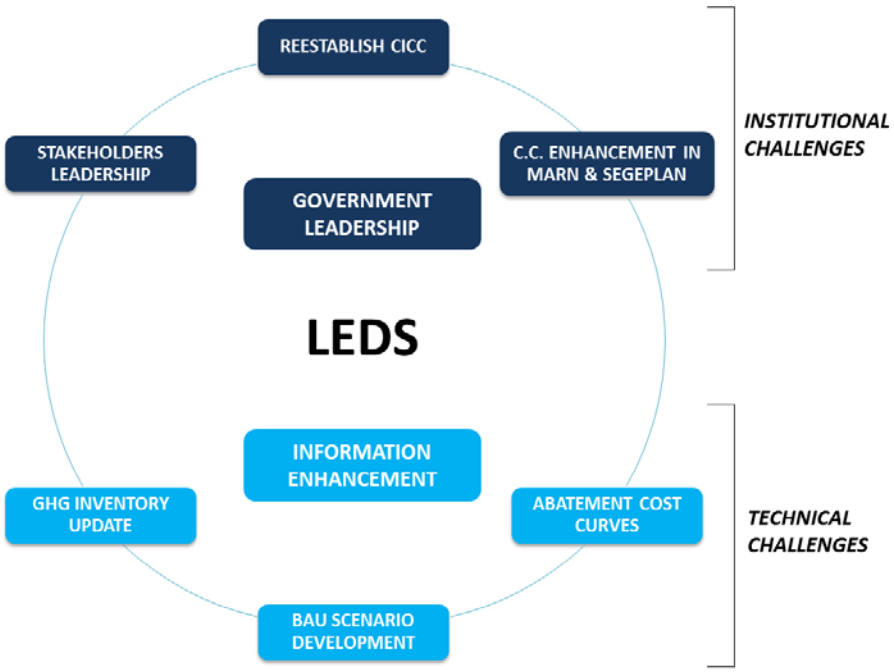
CHALLENGES FOR LEDS IMPLEMENTATION IN GUATEMALA

Several challenges were identified both on the institutional and technical level related to the tools and actions required to develop LEDS in Guatemala (Figure 1):

Institutional challenges

- **Reestablish the CICC**: Reestablish the CICC or otherwise create a new entity with the required authority and attributions to successfully incorporate or modify activities within the different Ministries or government institutions involved directly or indirectly in climate change issues. Leadership of this commission is essential for successful LEDS planning.
- **Take advantage of stakeholder leadership**: The participation of the private sector, universities and civil society during the legislative and planning processes is a key component to obtaining future support and commitment during the implementation of the LEDS abatement measures.
- **Enhance capabilities related to climate change in MARN and SEGEPLAN**: Both institutions must strength the units they have assigned to climate change issues. In the case of MARN, it is advisable to raise the UCC to the status of Department, strengthen the team through technical training and assign greater resources to hire permanent staff. In the case of SEGEPLAN, the Environmental Sustainability and Policies Unit requires additional staffing through permanent employees and should explore alternatives to organizational restructuring to enable the unit to have a greater leadership role in SEGEPLAN planning processes.

Figure 1: Challenges for LEDS implementation in Guatemala



Technical challenges

- **GHG inventory update**: The availability of detailed, quality for calculating of inventories is a major limitation, coordination is needed between MARN and the representatives of the various sectors to

provide or generate the information required to develop inventories by sector with precision and consistency. Regarding the methodology of the inventory, documentation on the process must be improved by documenting the calculations and assumptions that were used, in order to update the inventories while maintaining consistency.

- **BAU scenario development**: In order to develop the BAU scenario (current emission levels, without including mitigation measures), it is necessary to update the GHG inventory and forecast future inventories based on activity data forecast per sector. Each sector must develop and reach a consensus on its growth forecasts in order to calculate the baseline BAU. In this sense the greatest challenge will be to decide which of the existing sector plans, which already include some emissions reduction measures (such as projects for renewable energy and anaerobic digesters), should be considered as a part of the BAU and which will be counted as potential abatement measures.

- **Development of abatement cost curves**: The abatement cost curves are used to display the emissions reduction potential and cost of different abatement measures compared to the BAU scenario. The process of identifying abatement measures should be a participatory process between the government and local stakeholders. The challenge is to reach consensus on the abatement measures between different sectors and representatives with differing priorities. The leadership and the vision of the GoG will play a key role in the identification of measures, their prioritization and implementation.

1.0 INTRODUCTION – FOUNDATIONS OF A LOW EMISSIONS DEVELOPMENT STRATEGY

1.1 STRATEGY IMPLEMENTATION COMPONENTS

In order to define a low emissions development strategy, it is necessary to identify and implement specific actions, policies, programs and plans that promote economic growth while promoting sustainability in the long term. This strategy should arise from and remain in line with the country's development objectives, and should include a reduction of GHG emissions that is measurable, reportable and verifiable.

The objective of the strategy is to achieve transforming growth in the long term with an acceleration of sustainable economic growth capable of adapting to climate variability, while targeting GHG emission reductions in absolute and/or relative terms.

Although there is no single strategy development model that applies to all cases, the components published by the US Department of Energy in the Open Energy website are the following:

A. Institutional organization to address the strategy: An institutional structure and processes for the coordination, development and implementation of the elements of the strategy is required. A plan should be included to accomplish the participation of all key stakeholders. Commitment from high levels of GoG should be clear and visible, and should go beyond the government institutions involved in order to achieve specific results.

B. Analysis tools: One of the requirements to develop a strategy is to have information available on GHG emissions by sector. There should be reliable and appropriately documented inventories of emissions of GHG in order to use this data in other programs that support the strategy.

C. Country development guidelines – The country's development goals and objectives should be clearly defined with a long-term perspective, upon which it is possible to develop a plan of GHG abatement measures.

D. National economic and GHG emissions forecasts – Long-term forecasts (covering one or more decades) showing the expected performance of the economy and the projected GHG emissions year-by-year, using a BAU without including the emissions reduction strategy.

E. Portfolio of prioritized actions – Based on the above analysis, define and analyze policies, measures and technologies that are both aligned with the country's development goals and that contribute to the reduction of emissions (mitigation measures). Based on this information, low-emissions scenarios are developed.

F. Design of measures - communication: Once the measures are selected, detailed implementation mechanisms should be designed, possibly involving representatives of the public and private sectors, academics, non-governmental organizations (NGOs), indigenous communities and other representatives of civil society. During the measure's design, training to companies, institutions and the people will be a key component to present the details and expected benefits of the selected measures and therefore achieve greater commitment.

G. Implementation and monitoring – The commitment of the government and the stakeholders should focus on a specific and detailed program, with clear goals, which should be linked to a financial plan reflected in the country's national budgets and accounts. Mechanisms should be implemented to monitor and measure progress in the implementation of the defined actions.

The following are the main features of LEDS:

- Analytically solid – Replicable, documented and transparent, based on accepted techniques, shared information and rigorous calculations.
- Integral – With a macro vision of the important sectors of the economy, civil society and other stakeholders to ensure coordination among them and of the mitigation measures and the reduction goals established by the Government.
- Long-term orientation – First establish a vision of the goals to be achieved, and then work backwards to set objectives based on what it is estimated can be achieved.
- Implementable – Make sure that the actions and measures can be easily adopted and applied by the government, donors, financial entities and other stakeholders.
- Ensure continuity – Protect the selected strategy through legal or regulatory measures to limit the possibility of future political or interest groups of changing the measures formulated in the strategy at their will.
- Transforming – Capacity to transform the economy or a sector through measures that reduce GHG emissions while promoting growth.

1.2 APPLICATION OF LEDS IN GUATEMALA

The GHG inventories developed by MARN for the years 1990, 2000 and 2005 (see Chapter 2) are the main starting point for the strategy in Guatemala, once the documentation has been updated and reviewed. These documents identify the main priority sectors and the types of GHG emissions that require the greatest attention during strategy implementation.

For Guatemala, the following elements appear to be critical for strategy development:

A. Institutional organization to address the strategy: The laws and rules that regulate the operations of the Ministries and departments that participate directly or indirectly in the strategy must be reviewed, in order to begin developing the strategy based on existing structures at each institution. Along with the review of the existing regulatory framework, the capabilities and human resources available at these institutions should be reviewed to enable their participation in the strategy and to maintain continuity over time. In the particular case of MARN, the institution that will coordinate the strategy, the following should be reviewed, among others: The Internal Organizational Rules, Ministry Resolution 134 – 2003 and government resolution number 253 – 2009. Similarly, in the case of SEGEPLAN, a review is required considering at least the Law of Executive Body Decree 114-97, the Internal Organizational Rules and Government Resolutions 068 - 2009 and 069 – 2011. These

documents define the institutions' responsibilities and establish the roles they can assume during strategy development.

Institutional leadership is a critical issue to obtain the cooperation and active participation of public sector institutions. There must be a clearly defined body with attributions that enable the implementation of specific actions within the Ministries or in other institutions. The following institutions should participate in the development and implementation of the strategy in the case of Guatemala:

- Public Sector: MARN, the Ministry of Communications, Infrastructure and Housing (MICIVI), MEM, MINFIN, the National Electric Power Commission (CNEE), MAGA, SEGEPLAN, Office of the Presidency, National Competitiveness Program, INAB, CONAP.

- Private sector: Cementos Progreso, Private Institute on Climate Change (ICC), Association of Guatemalan Sugar Producers (ASAZGUA), Chamber of Industry of Guatemala, Guatemalan Center of Cleaner Production (CGP+L), the Wholesale Market Administrator, the Trade Association for Rural Enterprise (AGER), the Guatemalan Association of Exporters (AGEXPORT), the American Chamber of Commerce in Guatemala (AMCHAM), the Guatemalan Chamber of Commerce, National Coffee Association (ANACAFÉ), Construction Chamber.

- Academic Sector: Universidad del Valle de Guatemala (UVG), Universidad Rafael Landívar and Universidad San Carlos de Guatemala, through their research centers.

- Non-Government Organizations: Association of Forest Communities (ACOFOP), Association of Cuchumatanes Organizations (ASOCUCH), National Association of Environmental and Natural Resource NGOs (ASOREMA), Foundation for Eco-Development and Conservation (FUNDAECO), Defenders of Nature Foundation, Fundación Solar, the Maya Cultural and Natural Heritage Foundation (PACUNAM), Rainforest Alliance, National Environmental Training and Research Network (REDFIA), Representatives of Indigenous Communities, The Nature Conservancy, the International Union for Conservation of Nature (IUCN), the World Wildlife Fund (WWF).

B. Analytical tools: Develop the analytical tools for decision-making. For example, make forecasts using the current situation as the baseline and design alternative scenarios of economic development and GHG emissions, in order to incorporate these aspects into planning of sustainable national development. It is important to develop an integrated Geographic Information System (GIS) to include official geographic and forestry information and data on other sectors to be shared by the Government and the various users. Additionally, the United Nations Framework Convention on Climate Change (UNFCCC) inventory calculation software has already been incorporated in Guatemala. The next step is to develop the abatement cost curves, an essential tool for prioritizing the strategy's mitigation measures. The sources of information must be clear, traceable and transparent to lend credibility to the results. This allows various parties to replicate the calculations and simulate scenarios using a single methodology.

C. Country development guidelines: Review existing development and growth forecasts and strategies for the country in key sectors such as energy, land use and land use change, agriculture, wastes and industry. Some of the documents to take into account as the basis for the formulation of a low emissions development strategy are Government Agreements, Priorities and Purposes, the 2009 National Policy on Climate Change, the K'atun 2032 program prepared by SEGEPLAN, the INAB Institutional Agenda on Climate Change, the National Strategy for the Sustainable Production and Efficient Use of Firewood, CONAP's Climate Change Agenda for Protected Areas and the Biological Diversity of Guatemala, CONAP's National Strategy for Natural Resource Management

and Conservation in Community Lands, the 2013 – 2027 Energy Policy of MEM, the 2012 Outlook of the Expansion Plans of the CNEE and the National Policy on Cleaner Production, among others.

D. National forecasts of economic growth and GHG emissions: Review the economic and emissions forecasts of the industrial, energy, land use and land use change, agriculture and wastes sectors, and update the national GHG inventory to establish the emissions baseline, identify goals, develop economic models and perform cost-benefit analysis. According to the 2005 inventory, the highest emissions are concentrated in the agricultural and energy sectors, with 46% and 28% of emissions. Special attention should be given to the forestry and land use sector, firstly because emissions from deforestation are growing at an alarming rate, and secondly because this sector is responsible for substantial absorption of CO_2 that helps offsetting emissions from other sectors.

E. Portfolio of prioritized actions: Establish an agenda of actions to incorporate the low emissions strategy in the planning and decision-making process, including consultations with stakeholders and a financing plan. To this end it will be crucial to establish and coordinate the agenda of actions in a participative manner, which will play a key role during the implementation of the strategy. This includes the public and private sectors, academics, NGO's and representatives of indigenous communities, whose commitment is required for success.

F. Design of communications measures: During the design process, education and communications plays a key role in the case of Guatemala. The implementation of pilot projects for demonstrative purposes is an option that communicates the selected mitigation measures in a specific manner. Education and awareness-building among stakeholders will be a key factor to implement successful abatement measures. In this sense, involving the Ministry of Education and the academic sector during design represents an opportunity to communicate the measures to be implemented in schools and colleges.

G. Implementation and monitoring: Execute an implementation plan that translates the strategies of the GoG into action plans, through MARN and SEGEPLAN or a different body with sufficient authority to accomplish implementation from other Ministries. The actions may be aimed at forest conservation; reducing agricultural emissions; formulating and implementing laws, policies, incentives and regulations related to low emissions development; mobilizing financial resources; producing cleaner energy; and/or reducing emissions in the transportation sector. The implementation plan should be developed around existing institutional structures, assigning responsibilities aligned with the internal rules of each institution or Ministry, so as to ensure that the institutions responsible for implementation have the necessary resources.

Among the ongoing initiatives, it is worth mentioning the effort the GoG has initiated with assistance of the Enhancing Capacity for LEDS (EC-LEDS) initiative of the United States Government (USG) in Guatemala, aimed at strengthening specific elements required for LEDS (see text box on the following page).

Guatemala is one of the six countries in Latin America that participates in the EC-LEDS program, along with Mexico, Colombia, Peru, Jamaica and Costa Rica. The development of the LEDS initiative is led by the Government of the participating country, with the support of the USG, through the Department of State and the United States Agency for International Development (USAID).

1.3 REPORT STRUCTURE

This study was prepared jointly with the GoG in the framework of the financial assistance of USAID through the Forest Carbon, Markets and Communities (FCMC) Program, with the objective of performing an analysis of the institutions and sectors involved in LEDS in Guatemala.

This report is the result of an initial analysis performed by an inter-disciplinary team of sector specialists who participated in high-level meetings in Guatemala (with entities of the GoG, the private sector and academics), followed by meetings with the technical personnel and officials responsible for the implementation of initiatives related to climate change in the country.

The report is organized in four major sections presented in 9 chapters. The first section is an institutional assessment of the two entities of the GoG that are set to become the main drivers in the development and coordination of a low-carbon strategy in Guatemala: MARN and SEGEPLAN. This analysis is presented in chapter 2.

A second area focuses on a review of the GHG inventory in terms of its methodology, results and possible improvements for future updates. These comments are found in chapter 3.

Forest Carbon, Markets and Communities Program (FCMC)

USAID has launched the Forest Carbon, Markets and Communities (FCMC) Program, which offers assistance for integral management of natural resources that: a) reduce the causes of deforestation, and b) promote sustainable production in de-forested or degraded areas. FCMC can assist countries that seek to reduce emissions caused by use of land, and supports USAID delegations that implement the USG program to "Strengthen Capabilities of the Development of Low-Emissions Strategies" (EC-LEDS).

Source: FCMC Fact sheet, USAID.

A third area focuses on the sector analyses prepared based on the discussions, information and data gathered during the meetings with the various Guatemalan stakeholders in the energy, industrial, agricultural, transportation, and forestry and land use sectors. One chapter is devoted to each of these sectors (Chapters 4, 5, 6, 7, and 8), describing and evaluating the most relevant aspects of institutional capacity in the sector, availability and access to basic information to develop GHG inventories, the perceived level of coordination between sectors, the main mitigation measures and an Action Plan for the Sector.

The last and fourth area looks at the future, aimed at providing suggestions on the path towards LEDS in Guatemala based on the results found both at the sector level and in cross-section terms. This last chapter 9 summarizes the relevant observations and offers recommendations aimed at strengthening the efforts already made in Guatemala in the context of its commitment to implement GHG mitigation measures in line with economic growth.

The USG EC-LEDS initiative in Guatemala

The Government of Guatemala, through MARN, has already indicated its interest in participating in the EC-LEDS program, with a focus on improving the country's capabilities for a National Strategy for Low-Emissions Development. In this context, a Technical Mission comprised by several USG agencies has already visited Guatemala to make an assessment of opportunities and options.

The next step is to draft and sign a Memorandum of Understanding between both governments and a work plan that: 1) includes the key priorities identified by each key stakeholder; 2) identifies the priorities and activities the country requires on the issue of reducing GHG emissions ; 3) identifies and includes all key stakeholders required to implement the initiative; and 4) develops a plan for a consultations-based process with key partners of the government of Guatemala (e.g. the private sector, NGOs, international cooperation, academics, public utilities companies) in order to develop capacities needed to prepare and implement a National Strategy for Low Emissions Development, supported jointly by the Governments of Guatemala and the United States of America.

2.0 INSTITUTIONAL ASSESSMENT OF GUATEMALA

2.1 INTRODUCTION

This chapter describes the main elements of the institutional environment in which the activities the GoG has undertaken in connection with climate change and LEDS are performed, and which will lead to the implementation of measures to mitigate the effects of GHG emissions.

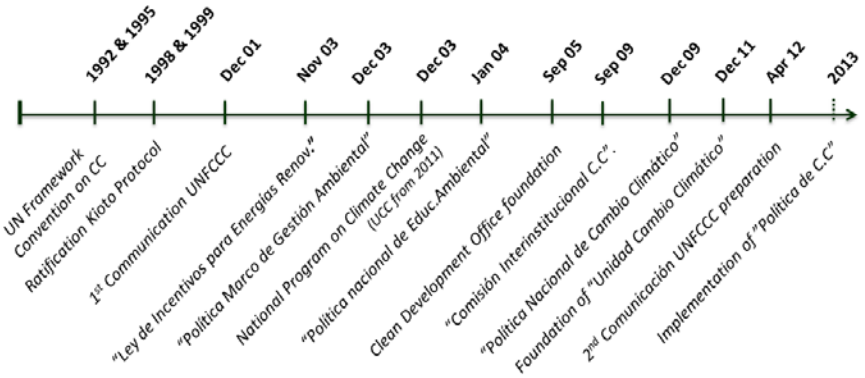
The analysis indicates the general framework of the two main institutions of the GoG that would be the main drivers in developing and coordinating a low-carbon strategy in Guatemala: MARN and SEGEPLAN. MARN, the environmental authority, is the coordinating institution for climate change issues through several bodies, such as CICC and the Cleaner Production Committee, and is responsible for the development of inventories. SEGEPLAN is the institution in charge of planning and programming at a national, regional and municipal level, into which LEDS must be incorporated, and it has the authority to obtain commitments from other Ministries and institutions.

2.2 GOVERNMENT VISION, LEADERSHIP AND ORGANIZATION

The institutional capacity of Guatemala to undertake a LEDS process has been consistently developed on an ongoing basis since 1998, when it ratified the UNFCCC. As a country, Guatemala has taken decisive steps in terms of policy with a long-term vision to fulfill its commitments to the climate change agenda, as shown in Figure 2.

In 2001, Guatemala submitted its First National Communication to the UNFCCC, under the coordination of MARN. The document indicated the first steps taken on adaptation and development of the first inventory of GHG emissions.

Figure 2: Timeline of activities related to climate change



In December of 2003, the National Program on Climate Change was established within MARN with the main objective of fulfilling and monitoring the UNFCCC. In December of 2011, the Program on Climate Change was transformed into the UCC, reporting directly to the office of the Minister and with its own assigned staff. From the very start, the Program and the UCC received substantial support from international donors, and recently a request was submitted to upgrade the UCC's status from Unit to Department.

In September of 2009, with support from the United Nations Development Program (UNDP), the CICC was created, coordinated by the Vice-President of the Republic and reporting directly to the Presidency. The objective of the CICC was to propose specific policies, strategies and actions for climate change adaptation and mitigation to the appropriate bodies. Figure 3 shows the members of the Commission. The leadership of the presidency in the CICC led to the successful diffusion of the agreed policies and strategies among the different government institutions. During the change-over of administrations in early 2012, the CICC ceased to operate, showing the importance of commitment from a higher government body with sufficient authority to demand specific actions from the Ministries.

Figure 3: Inter-Institutional Commission on Climate Change (September 2009)

Members of the Inter-Institutional Commission on Climate Change

Presidency	Ministers	Secretariats	Guest Institutions
1. **Vice-president**	1. Environment and Natural Resources 2. Agriculture, Ranching and Food 3. Energy and Mining, 4. Public Finance 5. Education 6. Public Health and Social Assistance 7. Economy 8. International Affairs 9. Communications, Infrastructure and Housing	1. Planning and Programming of the Republic - SEGEPLAN 2. Executive Coordination of the Presidency 3. Food and Nutritional Security 4. Executive Secretariat of the National Council of Protected Areas 5. Executive Secretary of the National Coordination for the Reduction of Natural or Man-Made Disasters	1. INSIVUMEH 2. INAB 3. Academic Sector 4. Private Sector 5. Civil Society rep. 6. Other public institutions

Notwithstanding the above, the new administration of 2012 has displayed a clear change in the priority assigned to environmental issues and climate change, which was reflected in the new administration of SEGEPLAN and the suspension of the CICC. Until then, these two bodies were the core planning and implementation entities for climate change initiatives on an inter-institutional level.

After the CICC, a new working body was created called the Inter-Institutional Coordination Group on Forests, Biodiversity and Climate Change (GCI). The group is comprised by MARN, CONAP, INAB and MAGA and is responsible for supporting the development of environmental policies in Guatemala. The working group is divided into a high-level committee that works at a governmental policy level that meets every 3 months, and a technical committee that meets on a monthly basis. One of the most remarkable tasks of the GCI has been to move forward the agenda for the implementation of the REDD+ program in the LULUCF sector, particularly the integration of the PINPEP program into the REDD+ program. Since the suspension of the CICC, the GCI has taken on some of its responsibilities; however, there is a difference in authority between the two institutions that prevents the GCI from having the same effectiveness as CICC had to implement measures in other Ministries. It is worth noting that despite the overarching nature of the

Climate Change issue, only MARN, MAGA, INAB and CONAP form part of the GCI; it would be of interest to propose integration with other Ministries such as MINFIN, the Ministry of Economics (MINECO) and institutions such as the National Competitiveness Program (PRONACOM), the Geographic Information Laboratory and the National Statistics Institute (INE).

2.3 LEGAL AND REGULATORY FRAMEWORK

Environmental law in Guatemala is structured in 6 major laws (Figure 4) and numerous decrees and regulations contained in other statutes such as laws on Hydrocarbons, Mining, Education and others that define crimes against the environment.

In February of 2008 work began on development of the National Policy on Climate Change, prepared by MARN (internal work group) with support from civil society, NGO's and the academic sector. Approved in 2009, the institution assigned for its implementation was MARN. Approval of this policy was a clear signal of the government's interest and willingness to actively address Climate Change issues. Soon afterwards work began in the CICC.

Figure 4: Main components of environmental legislation in Guatemala

Law	Decree
1. **Law of Environmental Protection and Improvement**	Decree 68 – 86
2. **Law of Protected Areas**	Decree 4 – 89
3. **Forest Law**	Decree 101 – 96
4. **Law of Promotion of Environmental Education**	Decree 74 – 96
5. **General Hunting Law**	Decree 36 – 04
6. **Law of Promotion of Environmental Awareness-Raising**	Decree 116 – 96

Even when there is a regulatory framework and numerous regulations in place, one of the problems identified is weak enforcement of laws and regulations. The institutional capacity to monitor and supervise is sometimes insufficient to guarantee compliance with the established regulatory framework. Such is the case with MARN, which receives over 7,000 environmental studies every year but only has the capacity to review 1,500, and only issues verdicts on less than 100 cases. Something similar occurs with the case of INAB regarding regulation of forest harvesting: it is estimated that only 20% of dispatch orders issued by INAB authorizing forest harvesting are effectively supervised.

Similarly, although Guatemala has clearly identified the locations where most deforestation and illegal felling of forests is taking place, its capacity to supervise and control these processes and enforce the law has been limited until now.

Bill 4139 on the Guatemalan Law of Climate Change was submitted to Congress in 2010, but is currently

Legal Basis for the National Policy of Climate Change

- Political Constitution of the Republic of Guatemala
- Convention of Biological Diversity
- Framework Convention on Climate Change
- Kyoto Protocol on the United Nations Framework Convention on Climate Change
- Central American Convention on Climate Change
- United Nations Convention to Combat Desertification
- Law of the Executive Body
- Law for the Protection and Improvement of the Environment
- Health Code
- Law of Incentives for Renewable Energy

awaiting its third debate prior to approval. This law would regulate, among other things, emissions of the transportation and power generation sectors. The delay in approval has generated uncertainty in the private sector regarding environmental regulations the GoG will enforce in the short and long term. This may act as a disincentive for investments and new projects in the private sector, which expects clear environmental guidelines from the GoG in order to implement investment and development projects.

2.4 INSTITUTIONAL CAPACITY

2.4.1 Ministry of the Environment and Natural Resources (MARN)

MARN was established in December of 2000 by Congressional Decree 90-2000, "Law for the Establishment of the Ministry of the Environment and Natural Resources". According to decree 114 – 97 MARN is responsible for "formulating and implementing policies related to the environmental sector, as well as for compliance with and enforcement of legislation related to the conservation, protection, sustainability and improvement of the environment and the Natural Resources of the country and the human right to a healthy ecologically balanced environment, with the obligation of preventing pollution to the environment, reducing environmental deterioration and the loss of natural heritage, in order to achieve sustainable development, for the coordination of institutional, social and environmental affairs with the objective of creating a competitive, solidarity-based, equitable, inclusive and participative Guatemala."

As shown in Figure 5, among the government guidelines given by President Otto Pérez Molina to MARN, climate change is of the top priority, which reflects the high level of leadership this Ministry should have on these matters.

Figure 5: Guidelines of the Government of President Otto Pérez Molina

Government Agreement	Government Objectives	Institutional Priorities of MARN
- **Agreement for Transparency, Security and Justice** - **Fiscal Pact** - **Pact for Zero Hunger**	- Democratic Security and Justice - Competitive Economic Development - Productive and Social Infrastructure for Development - Social Inclusion - Sustainable Rural Development	- Climate Change - Protection of Water, Soil and Forests - Strengthening of the Guatemalan System of Protected Areas - Public Participation - Legal Compliance - Green Economies

The government is highly aware of the impacts of climate change on the country's development. Of the six priorities established for MARN, five seek directly or indirectly in adapting to and mitigating climate change. This is partly the result of the threat that climate change poses for food security in the country, and only recently there were serious shortages due to draughts and tropical storms attributed to climate change. Despite this, there is a strong feeling of "lack of political leadership" among the private, academic, NGO and public sectors. The environmental policies developed by this administration do not have the same support they had in the previous administration, and the continuity of entities such as CICC has been compromised under the new administration.

Budget structure

In fiscal year 2013 MARN received a budget allocation of 208 million Quetzals, equivalent to 0.3% of the national budget. As indicated in Figure 6, the resources come from the GoG and international donors such as the Inter-American Development Bank (IADB), the Global Environmental Facility (GEF) and the German development bank (KfW).

With 50% of the resources coming from international donors, there is a dangerous dependency that puts the continuity of certain functions at risk in the event that such funds are no longer available.

Figure 6: Source of budget resources MARN 2013

Source of MARN funds - Fiscal year 2013

National budget	33%
MARN direct income	15%
Cash flow reductions	3%
"Proyecto Reserva de la Biósfera Maya" (Loan and Donation from BID and GEF)	35%
Specific donations (BID, KFW & GEF)	15%
	100%

Source: Meeting with MARN officials, Abril 2013

As shown in Figure 7, the Integrated Environmental Management and the Petén Environmental Development Systems receive the bulk of the operational budget, with 79 and 36.5 million Quetzals respectively. It should also be pointed out that 93 million Quetzals are allocated to the human resources of the Ministry, equivalent to 45% of the total budget and 60% of operating expenses, indicating the substantial portion that is allocated to human resources at this Ministry. Annex 4 shows the distribution of temporary and permanent staff at MARN.

Figure 7: MARN budget allocations - fiscal year 2013

MARN Budget Allocation - Fiscal Year 2013

	Total Allocation Quetzales	%	
Operational Expenses			
Institutional Management	18,091,446	9%	
Integrated Environmental Management System	79,957,897	38%	
Natural Resource Conservation and Protection	3,427,635	2%	
Social & Environmental responsibilitiy and civic participation	5,732,174	3%	45% (93 MM Quetzales)
Petén Environmental Development	36,570,000	18%	
San Jose ecologic school suppport	10,000,000	5%	
Chronic malnutrition prevention	1,304,562	1%	
Total operational Expenses	**155,083,714**	**74%**	
Investment			
Integrated Environmental Management System	2,314,300	1%	
Petén Environmental Development	51,030,000	24%	
Total Investment	**53,344,300**	**26%**	
Total Budget	**208,428,014**	**100%**	

Source Budget approval release, October 2012. "Ministerio de Finanzas Públicas y Moneda"

One of the proposed measures for the next budget cycle of MARN is to increase the assigned budget from 98 million to 500 million Quetzals in order to fulfill the priorities established by the Government (Figure 5).

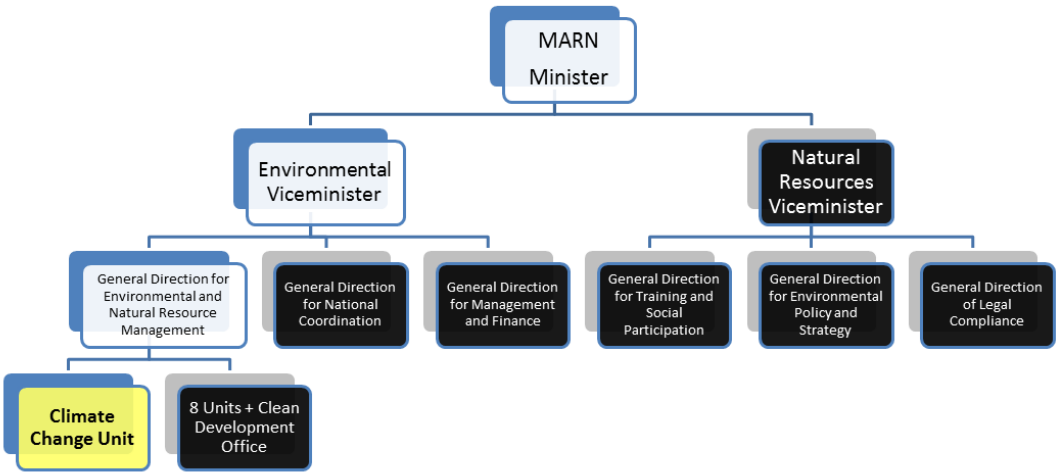
Organizational structure

MARN has a total of 638 employees, 505 of whom were hired as permanent employees and 133 as external consultants. At first sight this appears to be a good mix of permanent and temporary personnel, but in observing Annex 4 one finds that some units are unbalanced in terms of permanent and temporary staff. Such is the case of the Petén Development Program for the Conservation of the Mayan Biosphere, the UCC and the Environmental and Natural Resources Management Department. This is a threat to the effectiveness and quality of the activities performed by MARN, and also shows the need to reinforce the UCC with permanent staff to give continuity to ongoing programs and strategy.

As shown in Figure 8, the operational structure of MARN is distributed into six general departments that operate through a total of 24 work groups including units, offices, departments and a documentation center. Of the General Departments, the ones with most budgetary relevance are the General Environmental Natural Resources Department, with an allocation close to 40% of the Ministry's budget and 124 employees, and the National General Coordination Department, with 20% of the allocated budget and 366 employees, including over 180 delegates distributed in the municipalities.

The yellow inset of the organization chart shows the hierarchical location of the UCC within MARN, which reflects many of the budgetary and organizational limitations indicated by the UCC.

Figure 8: Location of UCC in the MARC organization chart, February 2013



Improving capacity at MARN for supervision and enforcement of environmental plans is a challenge. This responsibility is assigned to the Environmental Auditing Unit, but as of March 2013 this unit had not yet formally started to operate. The strategy would support projects that reduce emissions and promote development, which implies an increase in the number of environmental plans to be submitted to MARN for approval and supervision. It is necessary to formalize and strengthen the Environmental Auditing Unit in order to effectively supervise the growing number of environmental plans and to ensure that the projects remain aligned with the approved environmental plan and with Guatemalan laws and regulations.

The location of the UCC, the supervision challenges and budget restrictions put MARN in a difficult situation, which weakens the Ministry and affects its capacity to effectively lead a LEDS process in Guatemala.

Climate change and strategy within MARN

The UCC was established in December of 2011, replacing the National Program on Climate Change. The administration that created the UCC assigned it to report to the high office of MARN for budgetary and hierarchical effects; however, according to the available organization chart, the UCC is currently at a lower hierarchical level, within the Environmental Management and Natural Resources General Department, reporting to the Vice-Ministry of the Environment (Figure 8).

Figure 9 summarizes the main responsibilities of the UCC established in the Government resolution that created the UCC.

Figure 9: Responsibilities of the Climate Change Unit

Excerpts of responsibilities as per Government Resolution UCC, 497 – 2011
Coordinate efforts and capacities of MARN institutional departments and other institutions and national capacity to adapt to and mitigate climate change.
▪ **Provide orientation for improving economic, social, cultural and environmental practices at the national, regional, departmental and municipal levels, promoting mitigation and adaptation to climate change.**
▪ **Coordinate with the academic sector on research and technology development to make climate change adaptation and mitigation viable and efficient**
▪ **Plan projects and activities that address the issue of climate change and increase knowledge on national impacts of climate change.**
▪ **Lead the Inter-Institutional Commission on Climate change, the Committee of Territorial Adaptation to Climate Change, the Committee on Mitigation of Climate Change, the National Climate Change Roundtables, and the Regional, Departmental and Municipal Climate Change Networks.**
▪ **Generate information on national and industry GHG emissions**
▪ **Generate information of the effects of climate variability and climate change**

Figure 10 shows a list of the staff assigned to the UCC as established in Government resolution 47 – 2011, which created the UCC.

Figure 10: Personnel assigned to the UCC

Personnel Assigned to UCC according to Government Resolution 47 – 2011	
1. **One coordinator**	6. Specialized technician on adaptation to climate change
2. **One secretary**	7. Specialized technician on climate change mitigation
3. **One administrative assistant**	8. Territorial/sector specialized technician
4. **Specialized technician to monitor the United Nations Framework Convention on Climate Change**	9. Bilateral cooperation technician
5. **Specialized technician on national capabilities, science, technology and metrics of climate change**	10. Theme-based technicians
	11. Regional delegation on climate change (territorial/sectors)

According to the Public Information System of MARN, the UCC has 3 permanent and 4 temporary employees. However, during the visit there were only 4 persons at the UCC. As indicated previously, the high number of temporary personnel compared to permanent staff at the Ministry represents a threat for the continuity of climate change programs.

Comparing the personnel who actually work at the UCC to the staff assigned in the government resolution that created the UCC, there is an evident shortage of personnel in the Unit. This may have several causes, among which budgetary issues play a key role, in addition to political and organizational issues within the GoG and MARN. The high number of temporary employees at the UCC, combined with insufficient staffing, makes it difficult to fulfill the demanding responsibilities established in the government resolution. As indicated in the extract of responsibilities shown in Figure 9, there is a heavy workload of responsibilities that does not match the personnel assigned to the Unit.

Within MARN and other institutions, there are specialized groups on climate change issues that lead projects financed by international donors and allow them to make intermittent progress in developing and implementing a National Low Emissions Development Strategy. One of the main obstacles found by MARN was insufficient and imprecise baseline information about the country (maps on land use, forest cover, demographic and agricultural census, etc.), which is essential for the preparation and analysis of GHG inventories. Consequently, MARN's capacity to develop precise inventories depends on the availability of detailed information from various Ministries or institutions representing different sectors. For example, MAGA could develop maps on land use and forest cover including the level of detail required to develop the GHG inventory.

There are several channels of communication between MARN and other government and private institutions that theoretically facilitate the dissemination of environmental policies issued by MARN to the various Ministries and other Government organizations, including:

- CONAP: MARN is the Chair of the National Council of Protected Areas
- Sector Links: MARN has sector-based links with the other Ministries
- MARN delegates in regions and departments
- CICC: Participation along with the other Ministries shown in Figure 3.
- GCI: Technical work and inter-ministry coordination

- Authority for the Sustainable Management of the Hydrographic Basin of Izabal Lake and Dulce River (AMASURLI): A body that reports to MARN

- Authority for Management and Sustainable Development of the Petén Itzá Lake Basin (AMPI): A body that reports to MARN

Opportunities for organizational improvement

A step that has already been identified by the UCC is to increase the status of the UCC from Unit to Department, which would provide greater budgetary flexibility, shorten the hierarchical distance to the higher bodies of the Ministry and potentially improve efficiency. A request has already been formally submitted to the Government and is awaiting approval. The working units of the new department would be:

- Inventories unit
- Vulnerability and adaptation to climate change unit
- Mitigation unit
- Climate change science unit

A second step is to increase capacity to supervise the environmental plans submitted to MARN. To achieve this it may require a budget increase. Regarding the reestablishment of the CICC, inter-ministry coordination and the hierarchical status of the UCC within MARN suggest that proactive leadership is required by the top levels of MARN.

2.4.2 Secretariat of Planning and Programming of the Presidency - SEGEPLAN

The General Secretariat of Planning and Programming is in fifth place in terms of budget allocation among the 16 Secretariats that report to the president's office. Established in 1954 under the name "National Economic Planning Council", it has the following objectives:

- Oversee compliance with legal ordering;
- Formulate and execute the national budget;
- Manage government policies and public investment; and
- Coordinate public administration institutions and international cooperation policies and programs.

All these objectives make the participation and leadership of SEGEPLAN crucial for LEDS implementation.

Budget structure

In budgetary terms, SEGEPLAN has a total allocation of 95.9 million Quetzals for fiscal year 2013, according to the updated budget of January 2013 (Figure 11). This is equivalent to 0.2% of the national budget and 5.1% of the budget assigned to the secretariats that report to the Presidency.

Figure 11: Budget allocation -SEGEPLAN

Budget 2013 - SEGEPLAN (Updated Jan - 2013)		
Item	**Quetzales**	**%**
Personnel	54,217,498	57%
Services	34,294,303	36%
Materials and Supplies	3,514,917	4%
Property & Infrastructure	1,452,200	2%
Cash transfers	2,359,082	2%
Financial Assets	100,000	0%
	95,938,000	

Source: Portal de Información Pública SEGEPLAN, March 2013

Even though the assigned budget for 2013 is 11% higher than 2012, during the 2010-2011 and 2011-2012 fiscal years it increased by over 20%. Similar to the case of MARN, it is distressing to see the proportion of resources provided by international institutions compared to those provided by the government. According to Figure 12, this is a historical trend that has been in place at least since 2009, and there is concern about what would happen if these funds ceased to be available.

Figure 12: Sources of the SEGEPLAN budget

SOURCES OF SEGEPLAN BUDGET YEARS 2009 - 2013 (Quetzales)										
	2013		**2012**		**2011**		**2010**		**2009**	
Loans and Donations	24,360,000	25%	22,322,200	26%	21,830,652	31%	17,256,089	29%	15,107,810	26%
Tax revenue and others	71,578,000	75%	63,645,991	74%	49,633,039	69%	41,801,886	71%	43,590,190	74%
Total budget allocation	**95,938,000**	**100%**	**85,968,191**	**100%**	**71,463,691**	**100%**	**59,057,975**	**100%**	**58,698,000**	**100%**
Annual budget growth	11.6%		20.3%		21.0%		0.6%		-	
Main expenditure items										
Temporary and permanent staff expenses	54,217,498	57%	36,294,535	42%	34,129,263	48%	27,907,726	47%	27,021,209	46%
Externally sourced studies*	17,368,800	18%	33,569,832	39%	24,182,400	34%	10,362,440	18%	10,362,440	18%

** Externally sourced studies: Compises codes 181 - Studies and 189 - Other studies*

Source: "Ejecución Presupuestaria por grupo de gasto y dirección. Portal de Acceso a la Información Pública SEGEPLAN". March 2013

Organizational structure

As shown in Annex 7, SEGEPLAN has 398 employees, 71% of whom have permanent contracts. The Main Office is the largest office of SEGEPLAN, holding the 177 employees, which includes representatives of departmental delegations. The second largest institution is the Sub-Secretariat of Territorial Ordering Planning with 102 employees, followed by the Office of the General Director with 100 employees.

According to the chart shown in Annex 7 and in Figure 13, SEGEPLAN is structured into 4 Sub-Secretariats: Public Policies, Planning and Territorial Ordering, Public Investment and International Cooperation. Under the Secretariat and the Sub-Secretariats there are 15 Departments with their respective units and sub-units.

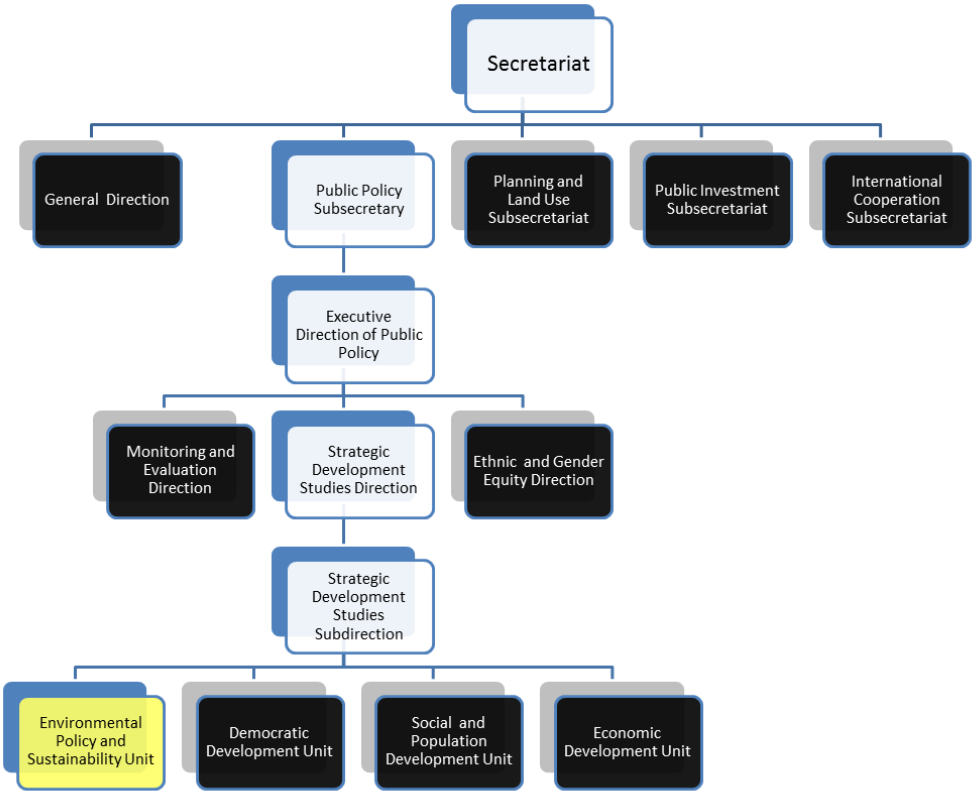
Climate change matters are addressed at the Sub-Secretariat of Public Policies, the Directorate of Strategic Development Studies and the Environmental Sustainability and Policies Unit (Figure 13). Currently the Directorate has three permanent employees and six temporary specialists, of which there is one part-time specialist in environmental policies and sustainability. This staffing level is insufficient and highlights a

shortage of human resources in a key area for strategic planning and programming, and partly explains the lack of government coordination reported by representatives of the public, private and academic sectors during the roundtables held in February of 2013.

Successful execution of a program of the magnitude of LEDS not only requires additional staff; it also requires programs to have the sufficient backing at a high hierarchical level to guarantee implementation both within SEGEPLAN and in other entities.

Additionally, SEGEPLAN has a specific Secretariat for Planning and Territorial Ordering, which plays a key role in fighting deforestation and regulating changes in land use. Apparently this Secretariat has not been successful in its role of coordinating an effective TO policy with MAGA, CONAP, INAB and the municipalities.

Figure 13: Location of the Environmental Sustainability and Policies Unit in the SEGEPLAN organization



Considering the great number of divisions and the wide dispersion of personnel among them, it would seem reasonable from the perspective of strategy development to explore an organizational restructuring of SEGEPLAN, both in general and of the Environmental and Sustainability Policies Unit in particular. As shown in Annex 8, the responsibilities of SEGEPLAN are important and demanding. For this reason it is necessary to explore a new organizational structure to effectively fulfill its responsibilities and prioritize use of available resources.

The program "K´atun, National Development Plan 2012 – 2032" recently prepared by SEGEPLAN and submitted to the National Council on Urban and Rural Development (CONADUR) is precisely the type of initiative required to establish a long-term LEDS plan at the national level. K´atun is a good starting, but it must emphasize and strengthen the leadership that low-carbon development strategies will have in the country over the next decades.

Climate change and the strategy of SEGEPLAN

The Directorate of Strategic Development Studies (DEED) is the area responsible for issues related to climate change within SEGEPLAN. It has one specialist on Environmental Policies and Sustainability, but it is worth noting that there is no unit in charge of leading plans and programs' development processes that includes climate change policy.

The main objective of DEED is to support the Sub-Secretariat of Public Policies and the Institution in general through research, studies and analysis of the context and trends of the political, economic, social and cultural reality that characterizes the behavior of national development, with the objective of learning their causes.

The main objective of the specialist in Environmental Policies and Sustainability is "to support the Director in analyzing, researching and studying the context and trends of political, economic, social and cultural realities from an environmental and sustainability perspective"[1].

It is odd that the issue of climate change has been assigned to DEED, which is primarily responsible for studying, investigating and analyzing various aspects of interest to the Ministry. There is a disparity between the authority of this role and the need to incorporate climate change into planning and programming processes.

The Directorate of Ethnic and Gender Equity, which has the role of integrating the indigenous communities into policy management, plays a central role in LEDS. Active participation of the indigenous communities in the development of public policies, municipal territorial zoning plans and the identification of abatement measures is a key component for the development of a strategy that is representative of all stakeholders.

Opportunities for organizational improvement

As in the case of MARN, SEGEPLAN faces budget limitations that prevent it from hiring and retaining the personnel required to effectively perform its responsibilities. The staff assigned to climate change issues (Environmental Sustainability and Policies Unit) need to undergo a process of:

- Empowerment, review of responsibilities and attributions, both within SEGEPLAN and within the central Government, to enable them to actively participate in the formulation of plans, programs and policies. One possibility would be to increase the hierarchical status of the Environmental Sustainability and Policies Unit to a Directorate; and
- Training of the personnel involved in LEDS planning and analysis.

[1] SEGEPLAN Organization and Responsibilities Manual, http://www.segeplan.gob.gt/mof/

It is possible that the responsibilities of climate change are beyond the scope of DEED, in which case it would be worthwhile to transferring the personnel related to climate change to a new unit with greater authority and direct participation in policy formulation.

One of the challenges identified at SEGEPLAN is the implementation of municipal and development plans. When combined with the limited capacity to review the municipal plans, this leads to a low rate of program implementation. Additionally, there is an apparent disconnection between the plans established by SEGEPLAN and the municipal operating plans. At the regional and municipal levels, the allocation of resources to execute projects seems to be governed by regional and political interests, sometimes straying from the programs established by the central government. This may be because Municipalities are responsible for financing the plans established by SEGEPLAN with their own resources, which involves making a choice between allocating resources to locally developed projects versus projects from the central government. One of the strategies already identified by SEGEPLAN to address this problem is to broaden regional, departmental and municipal participation during the planning process, in order to develop programs that are aligned with the objectives of the municipalities and of the central government. In the case of LEDS, it will be essential to implement a similar scheme of social participation.

As will be discussed in the LULUCF section of this report, the implementation of an effective territorial zoning plan is an essential step towards controlling and reverting deforestation rates. In this sense it may be worthwhile for the Directorate for Planning and Territorial Ordering of SEGEPLAN, working jointly with INAB, CONAP, MARN and MAGA, to propose a bill creating a land use law establishing oversight, monitoring and control. One of the initial tasks in developing this proposal is to identify components that prevent the development and implementation of territorial ordering plans. The proposal is to develop a pilot plan on the implementation of a territorial ordering plan in a specific municipality. New international assistance projects must have local support mechanisms that ensure the continuity of the projects once the assigned international funds are exhausted.

2.5 CHALLENGES FOR THE INSTITUTIONAL SECTOR

2.5.1 Institutional coordination to plan and implement climate change activities

In Guatemala, climate change is perceived as an issue that only concerns the environmental sector, instead of a transversal challenge that impacts the country's social and economic development. As a result, there is little institutional capacity to plan, contract and execute to climate change activities.

Despite the broad legal framework in place in different sectors and ministries, the institutional efforts regarding climate change in Guatemala are centered in MARN, and the effort is diluted in the planning and investment efforts of other sectors and institutions. Since the issue of climate change is directly related to the country's economic and social development, climate change institutional arrangements must be coordinated from the environmental sector, where it can be adopted by the other sectors.

Efforts must be made to strengthen a national institution capable of addressing the issue of climate change in a comprehensive manner, linking all sectors in identifying and implementing appropriate mitigation measures. One way of achieving this having the Presidency of the Republic take the lead in coordinating this initiative, as was done previously with CICC.

There are several mitigation initiatives in Guatemala performed by a few entities and actors that are not always coordinated with each other. For example, during roundtables with the private sector (cement, beverages, etc.,) they mentioned they are already taking steps to reduce their carbon footprint, which have

remained unseen by most public institutions. Also, some representatives of the private sector indicated the planning stages of government environmental initiatives are not sufficiently participative and inclusive.

2.5.2 Importance of the programs

One of the characteristics of the programs that have been developed to date is their low permanence over time and their low visibility in other entities. MARN and SEGEPLAN need to overcome the barriers that prevent them from obtaining the required resources and authority to lead a LEDS process. The international community could assist in this process. Some steps that could support the LEDS execution might include:

- Leadership by the Presidency;
- Reinstitution of the CICC;
- Greater commitment from MARN and SEGEPLAN authorities; and
- Establishing a long-term planning vision.

2.5.3 Management of data and baseline information

It has been observed that the information generated by academic institutions or Ministries is not always compatible, or is created for a specific purpose and is not useful for inter-institutional decision-making, especially from the perspective of climate change. Guatemala has good data analysis capacity at the national level, at institutions such as Rafael Landívar University's Institute of Agriculture, Natural Resources and the Environment (IARNA), UVG, the Geographic Information Laboratory of MAGA, INAB, CONAP, the National Geographic Institute (IGN) and the National Institute of Seismology, Volcanology, Meteorology and Hydrology (INSIVUMEH). These institutions generate information independently and in consortiums, as is the case of the Map of Forest Cover and Land Use. Differences of interpretation are found between the institutions that make it difficult to integrate the information. As a result, there is no cross-sectoral information from the sectors on the threats, vulnerability and economic and financial dynamics derived from climate change.

Responsibility must be assigned for integrating geographic information at the national level with the objective of standardizing official information for the creation of a geographic database to be used as input for planning, programming and research processes. Making information available would support development of the GHG inventories and other analyses related to the LEDS process.

2.5.4 Retention of technical capacity

The retention of qualified climate change specialists is an overarching issue that affects the operation of government institutions. There is a strong tendency for qualified personnel to leave the government and work in the private sector, due to better salary conditions and the stability of a formal work contract. In this sense, one of the trends observed in institutions such as SEGEPLAN, MARN, the Geographic Information Laboratory of MAGA and others is strong dependence on income from projects financed by international donors to hire temporary personnel. According to budget regulations in Guatemala, these funds can only be used for temporary staffing, which in some cases has led to a three-fold increase of personnel hired under the "Temporary Services" item. The problem arises when the funds run out and there is not a budget structure in place to retain the qualified personnel, leading to a reduction of personnel at the institutions to a level that makes it difficult for them to maintain their responsibilities.

3.0 GREENHOUSE GAS INVENTORIES

Guatemala has three GHG inventories for the years 1990, 2000 and 2005. Each inventory includes emissions from the main sectors, i.e. energy (including transportation as a sub-sector), industrial processes, wastes, agriculture and LULUCF. The structure and methodology of the inventories has been maintained year to year, following the Intergovernmental Panel on Climate Change (IPCC) 1996 revised guidelines, the 2003 good practices guidelines for the LULUCF sector and the guidelines for country inventories of Annex 1 of the UNFCCC.

3.1 REVIEW OF THE METHODOLOGY

In order to conduct the inventory for each sector, independent consultants were hired for the energy, industrial processes, agriculture, LULUCF and waste sectors. The consultants were responsible for gathering the data required to develop the inventories. This data-gathering process and the assignment of emissions factors was performed under close supervision of MARN to ensure that the information was official and that the methodologies used were aligned with IPCC indications.

The sector-based information used to calculate the emissions inventory was obtained from the relevant institutions in each sector, which in itself was a challenge because these institutions rarely had the information required to calculate sector emissions in a precise manner. An example is the LULUCF sector, where available maps do not make it possible to establish precisely the types and surfaces of forests in Guatemala. The same occurs in the agricultural sector, where precise the headcounts of cattle for beef and for dairy production is unavailable. Given this lack of information, the estimation of emissions for each sector presents an additional challenge that undoubtedly affects the inventory's precision.

During inventory development, the lack of emissions factors specific to Guatemalan conditions became apparent. Therefore, default emissions factors were taken from IPCC tables. This ensures that the inventory is consistent with IPCC inventory guidelines; although some academic and private sectors argue that these emission factors lack adequate precision and are not representative of the Guatemalan reality.

One of the limitations identified during review of the inventory was the absence of documentation to support the emissions figures in each sector. This prevents updating, improving and comparing the next inventories, and represents an obstacle for the establishment of an emissions baseline for each sector.

Specifically, the absence of a description of the assumptions and methodologies used affect the transparency of the inventories and makes it difficult to develop a long-term emissions baseline, because the relationship between the data on the activities of each sector and their associated emissions is unknown. The following are some specific examples:

- In the case of the agricultural sector and the methane emissions from enteric fermentation, the inventory does not indicate the assumptions used regarding the different groups of animals and no details are provided on whether the cattle is raised for beef or for dairy production.
- It does not specify the proportion of transportation emissions derived from agricultural machinery.

- It is not possible to establish the percentage of wastewater derived from agro-industrial activities in the emissions of the wastes sector.
- In the case of the industrial processes sector, it does not indicate the percentage of clinker used in cement to calculate emissions from this process, which prevents updating the data and comparing it with other inventories.
- In the case of energy, it does not provide a breakdown of emissions arising from burning of fuel in manufacturing and construction, which prevents updating the information with more recent data on this sub-sector.

Other challenges for inventory development include the lack of uncertainty analyses, the absence of a description of quality control criteria (QA/QC), the lack of analysis of key categories in two of the three inventories, and the absence of an improvement plan for future inventories. Similarly, the lack of conversion of the various types of GHG emissions into common units in terms of CO_2e makes it difficult to assess the relative importance of the various gases and sources.

In the LULUCF sector, the estimation of removals by natural forests and emissions from deforestation are highly relevant. The inventories make these estimations, assuming that the total area of forests captures carbon, replacing the areas that have been intervened, which enables growth due to the entry of sunlight and renewal. However, this sunlight growth promoting factor is temporary (it may last between 5 and 10 years until the canopy closes), and consequently it is incorrect to consider it to be permanent.

This error of confusing natural sigmoid growth of a forest as an ecosystem with the growth that arises from human intervention is very common in developing countries, which also seems to be case in Guatemala. This is a significant error because it makes the LULUCF sector appear to be a powerful sink. Normally the countries apply the 2003 IPCC good practices guidelines, which calculates carbon absorption from growth and subtracts losses from extraction, firewood gathering and disturbances (fires, pests, tornados). Under these assumptions Guatemala is shown as an important net sink, when it is highly likely that gross removals are actually lower than those calculated (in some tropical countries the areas in use are below 4% of the total area). Even if in this case the method of gains minus losses was used, as well as the IPCC emission factors, these are not altogether accurate because in the case of selective tree harvesting, no other significant emissions are considered, such as those associated with the damage caused to the forest during logging and the construction of paths and roads.

Additionally, the 2005 inventory does not report CO_2e due to deforestation in the emissions column, but it subtracts the removals, thereby reporting partial gross emissions and total net removals of CO_2e, which is inconsistent. Consequently, as shown in Figure 16, CO_2e of 12,553.7 Gigagrams (Gg.) are reported, instead of the actual 20,817.9 Gg.

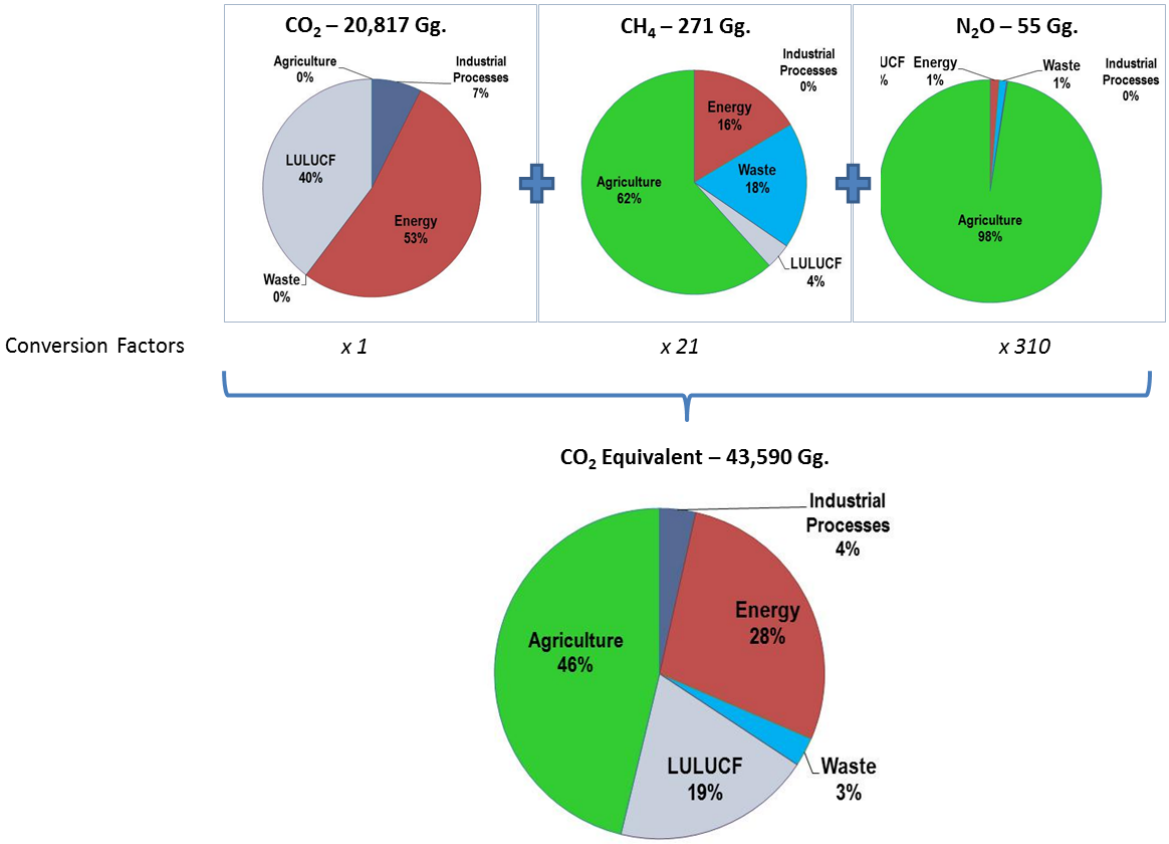
In general, the available inventories do not provide enough information to replicate the reported figures in a reliable manner, which translates into lack of transparency and creates various levels of uncertainty in the various sectors. As indicated in other sections of this report, the greatest uncertainty is related to the agriculture land use and forestry sectors. Comparatively, the uncertainty level is lower in the energy sector because of the type of information available on final energy consumption in the country. However, there is no access to the specific assumptions used for the GHG emissions calculations. The assumptions and other supporting materials should be available at MARN, which could eventually be used to improve the understanding of the 2005 inventory and build better inventories in the future.

3.2 ANALYSIS OF RESULTS

The emissions reported in the GHG inventory for the year 2005 are presented in terms of Giga grams of CO_2, methane (CH_4) and N_2O for the energy, agriculture, industrial processes, LULUCF and wastes sectors. Even though this is the method recommended by the IPCC for submission of results, for LEDS purposes it

will be necessary to visualize the information in terms of CO_2e to standardize the impact of the various GHGs. Figure 14 clearly illustrates the visual difference when GHGs are standardized as CO_2e.

Figure 14: Conversion of 2005 GHG inventory into CO_2 equivalent



In the transformation process, the volume of CO_2, CH_4 and N_2O emissions are multiplied by their respective conversion factors to obtain the CO_2e volumes indicated in Figure 15. By transforming the GHG emissions of the 2005 inventory into CO_2e, the attention is focused on the agricultural sector, which accounts for 46% of total CO_2e emissions in the country. N_2O emissions from agricultural soil account for 81% are emissions from this sector.

Figure 15 summarizes the emissions of the three inventories, in terms of carbon dioxide equivalent (CO_2e) for the years 1990, 2000 and 2005. The transformation of the emissions into CO_2e enables standardizing the effect of CH_4 and N_2O emissions and facilitates comparison of the emissions of each sector. In 1990 and 2000 there were substantial increases in emissions of CO_2 and N_2O, which increased three-fold and two-fold, respectively. CH_4 emissions experienced slower growth of 15% between 1990 and 2000. As shown in Figure 14 and Figure 15, the agriculture and energy sectors contribute the greatest amount of CO_2e emissions with 46% and 28% respectively.

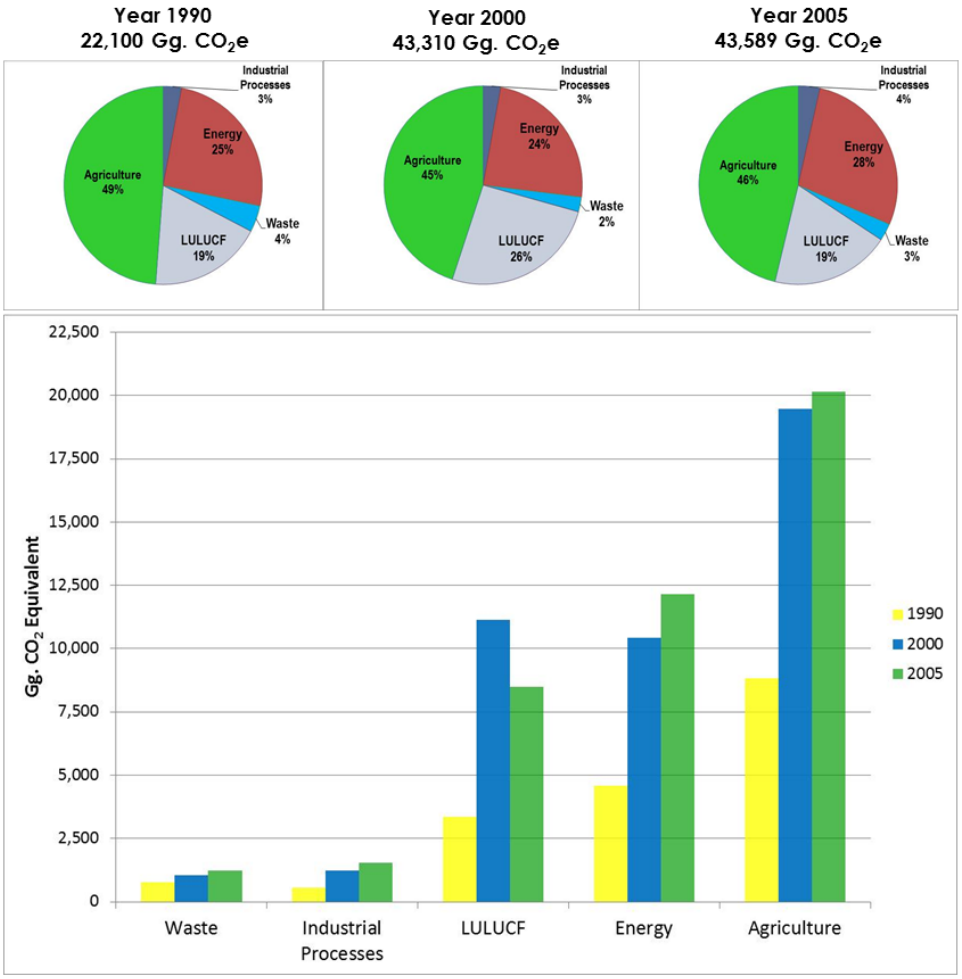
The sector that contributes the most emissions in the three inventories is agriculture, especially in the 2005 inventory. Even though in terms of CO_2e the main GHG is CO_2, it is worth noting that nitrous oxide explains 35% of emissions in 1990 and 39% in 2005. The CO_2e emissions table in Figure 15 shows a strong increase in emissions between the years 1990 and 2000 compared to the minimal increase in emissions between the years 2000 and 2005.

In the case of the agricultural sector, N_2O emissions increased substantially between 1990 and 2000, but between 2000 and 2005 they remained practically the same, even though between 1999 and 2003 the

agricultural land surface decreased by 35% according to the 2005 inventory (See Annex 1). This may be due to a change in the assumptions, emissions factors or the methodology that was used; in any case the cause of the stagnation of emissions between 2000 and 2005 is unclear. The documentation that supports the inventory figures is insufficient to trace back the assumptions and data that led to these figures and to understand the results, which affects the credibility and transparency of the inventory.

According to the GHG inventory data for the years 1990, 2000 and 2005, the LULUCF sector has been a net sink of CO_2e in Guatemala. Based on the series of the three inventories, the capacity to fix atmospheric CO_2 is being rapidly lost due to the high rates of deforestation and the reduction in the area covered by forests capable of removing CO_2. If this trend continues, Guatemala will become a net emitter of CO_2 in the short or medium term, a trend that can be observed in Figure 16.

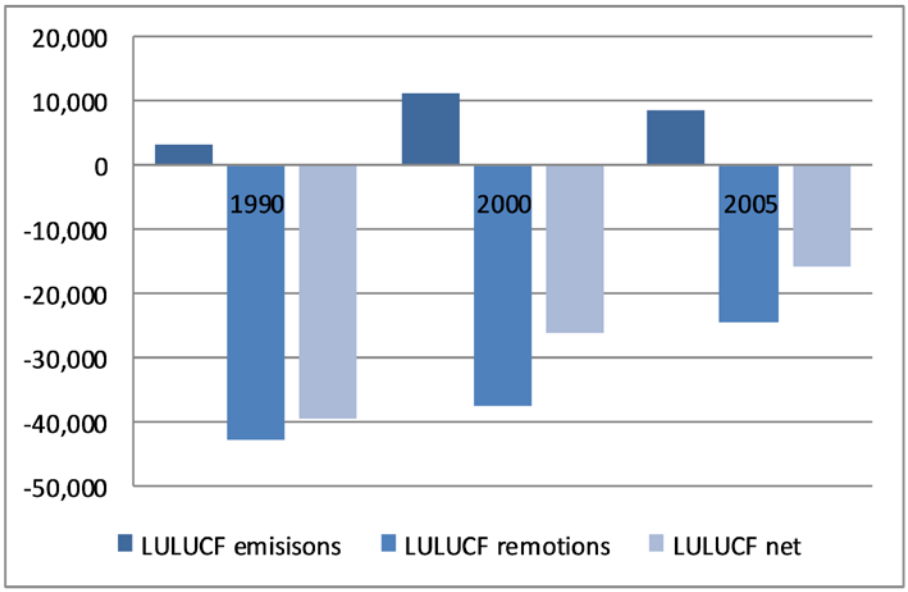
Figure 15: Historic GHG emissions



3.3 RECOMMENDATIONS AND IMPROVEMENT OF INVENTORIES

One of the main obstacles identified for the development of the inventories is insufficient sector-based information. In this sense it would seem reasonable to establish mechanisms of coordination between MARN and the Ministries and institutions that represent the various sectors (MAGA, MEM, INAB, etc.), including the data required to calculate emissions of each sector.

Figure 16: Evolution of emissions, removals and net emissions of the LULUCF sector in Guatemala – Gg. CO_2e



Guatemala needs to strengthen capacity to improve the quality of its inventories according to the principles of UNFCCC, i.e. inventories that are transparent, precise, complete, consistent and comparable. There are substantial synergies between improving inventory development capacity and the ability to identify and evaluate mitigation measures, develop and implement Nationally Appropriate Mitigation Actions (NAMAs), propose programs in the REDD+ framework and other mitigation actions that require MRV as a key element (see Annex 12).

Capacity building goes beyond training technicians, and is instead, institutional development and the promotion of systemic approaches is the key factor. The roundtable to coordinate GHG inventories and the MRV activities in this sector, eventually through the GCI, could be an alternative that would make it possible to evaluate and support the successful implementation of a LEDS program.

In terms of reliability of the GHG inventory, it is advisable to review and use the UNFCCC principles as a framework to guide improvements in future inventories, so as to achieve full compliance. There principles are:

- Transparency: The assumptions and methodologies used must be clearly presented in order to facilitate reproduction of the inventories.
- Precision: Levels of uncertainty in the inventory must be reduced to the minimum possible level.
- Exhaustiveness: All the sources and gases included in the IPCC 1996 Guidelines need to be analyzed, including other specific sources of relevance to the country.
- Consistency: The inventory must be consistent in all elements and for all the inventory years.

- Comparability: The estimation of emissions and removals must be comparable between countries.

In this context it is also advisable that each of the sections required by IPCC be documented with the highest level of detail possible under a standardized structure per sector that might include the following:

- Description of the calculation methodology;
- Details on the information sources used including a description of the assumptions and statistical analyses to generate data that was unavailable directly;
- Detailed description of the calculations including the emission factors used.
- Conclusions; and
- Suggestions for improvements for of future inventory development.

Another suggestion to make the inventory analyses more robust is to compare the growth and/or evolution of the sectors to the emissions trends in the same sector. Emissions from sectors are closely associated with their growth, and as a result this type of analysis will make it possible to identify differences, inconsistencies and divergences between the sector inventories and growth. The recommendations to improve inventories are summarized in Figure 17.

Figure 17: Recommendations to improve inventories

The following are some of the main ways to improve GHG inventories:

1. **Improve documentation on the assumptions, emissions factors, activity data and methodologies used to calculate emissions and removals.**
2. **Include an analysis of key categories for all the inventories with and without LULUCF.**
3. **Include and describe a quality control and assurance system (QA/QC).**
4. **Include uncertainty analysis for the data and the calculations of emissions and removals.**
5. **Work with other Ministries to establish an inventories improvement plan.**
6. **Perform and report emissions recalculations retroactively to the baseline year to improve data comparability.**
7. **Work with the LULUCF sector to incorporate the sources of emissions and absorptions that were not included in previous inventories.**
8. **Attach the calculation sheets provided by UNFCCC to perform the calculations of GHG emissions and removals.**

3.3.1 Improve inventories in the energy sector

In the energy sector there is a good level of certainty on national generation and energy consumption statistics. The CO_2e values included in the 2005 inventory are similar in size to those reported by other international sources, which indicates that the level of uncertainty for this sector is relatively low. One of the proposed improvements for the inventory is to improve the supporting documentation on the calculations that were made, in order to make it possible to perform reviews of past and future inventories and to compare with other documents.

3.3.2 Improving inventories in the transportation sector

Specifically in the transportation sector, it is advisable to work on incorporating the fleet technology. By making simple assumptions it is possible to reach a better approximation based on the responsibility of the emissions by different categories of vehicles. This type of disaggregation will make it possible to establish more focused emission reduction measures in the future.

3.3.3 Improving inventories in the LULUCF sector

In the LULUCF sector, improvements should focus on: i) activity data, improving the precision of the quantification of the areas under the different categories of land use and under transition between categories (for example, forest to grasslands); and ii) generate specific emission factors for the country in order to be able to report emissions and removals under a Level 2 of the IPCC Good Practices Guidelines for LULUCF, to make sure that removals or emissions are neither over- nor under-estimated. It is additionally advisable to review the estimation methodologies, assumptions, annual growth values and emission/removal factors for the GHG flows in the forests of Guatemala. It is of top priority to use more precise estimations in the case of carbon absorption by Guatemalan forests, which play a key role as carbon sinks. Lastly, the comparability of the various existing maps on land use and forest cover must be improved.

3.3.4 Improving inventories in the agricultural sector

The redesign of information-gathering processes will be a key component in future GHG inventories, abatement curves and strategies. A review of the census-taking and survey processes between MAGA and INE seems to be one of the key aspects. In particular, it will be necessary to incorporate a detailed survey of the livestock and agro-industrial sectors covering in detail the production of pigs, milk, cattle for beef, sugar and palm oil mills. This survey must include detailed information on production in each sector, and must also record manure management procedures. Even though emissions associated with agricultural machinery and the treatment of agro-industrial wastewaters are included in the energy and wastes sectors, respectively, it would be interesting to have this information broken down in these two sectors. This would make it possible to assess the impact of measures in agricultural sectors emissions broken down into the agricultural sector, energy and wastes. This will also enable having sufficient information to present GHG emissions in the most precise manner possible for these sectors in the next inventory.

In order to improve inventories in the agricultural sector, the breakdown and explanation of the calculation of emissions from the soil are a fundamental requirement to adequately follow up on this source of emissions. According to the information provided in the 2005 inventory, CO_2e emissions from soil account for 37% of total emissions from Guatemala. Since N_2O is not the greatest source of GHG identified in the country, it is critical to understand the assumptions that explain this number, such as the volumes and types of fertilizers used, the number of bovines and the areas planted with rice.

3.3.5 Improving inventories in the manufacturing and industrial sectors

The lack of details to support the figures of the 2005 inventory makes it difficult to identify specific mitigation measures in the manufacturing sector. However, a series of energy efficiency measures will be a key factor. Unlike the efficiency measures recommended in the energy sector, the actions should be focused on a combination of on-site diagnostics, personnel training and financing to implement profitable improvement measures in the short term.

In the industrial processes sector, future inventories should provide a breakdown of the emissions for each category in the sector, to identify specific measures for specific industries, such as the case of cement.

4.0 ENERGY SECTOR

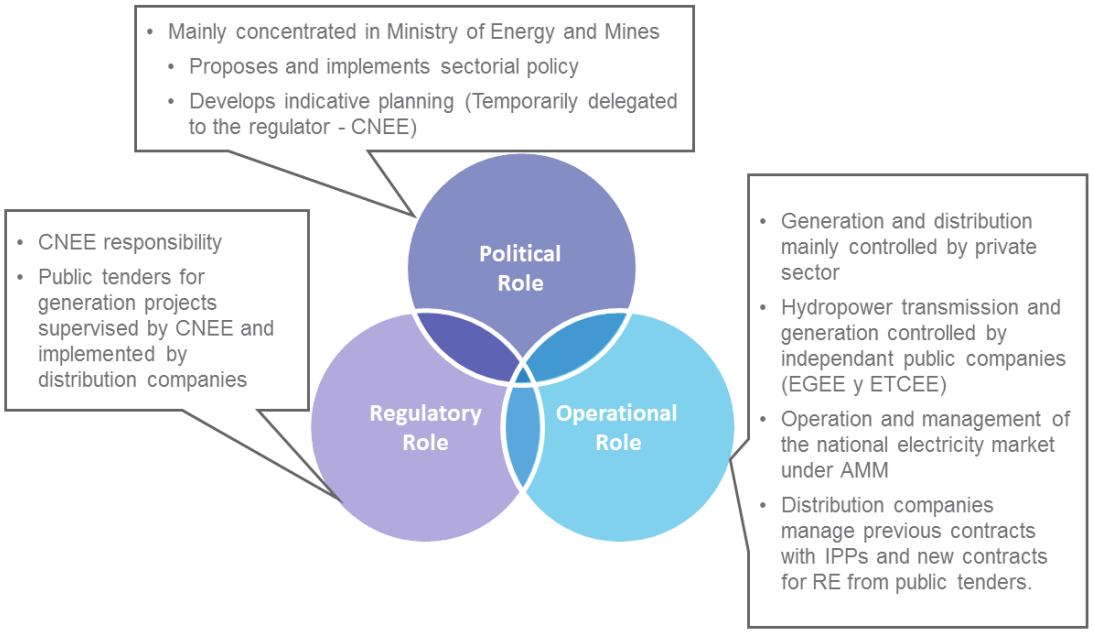
4.1 INSTITUTIONAL CAPACITY

This section describes the general framework of GoG institutions that play a role in the direction, supervision and monitoring of the energy sector, focusing on those that produce, update and maintain the data and information used as inputs to calculate GHG inventories for the energy sector in Guatemala.

4.1.1 Institutional framework of the electric power sub-sector

In the 1996 reform of the electricity sector in Guatemala, established through the General Law on Electricity (Decree 93-96) and subsequent regulations issued in 1997, a vertical separation of the national electric power company was made. As indicated in figure 18, the regulatory and operational policies were separated, concentrating the responsibilities in MEM (under the General Electricity Directorate), CNEE, the Administrator of the Wholesale Electricity Market (AMM), the main government electric power transmission company ETCEE and the public and private power generators (EGEE – large hydro).

Figure 18: Institutional organization of the electric power sub-sector

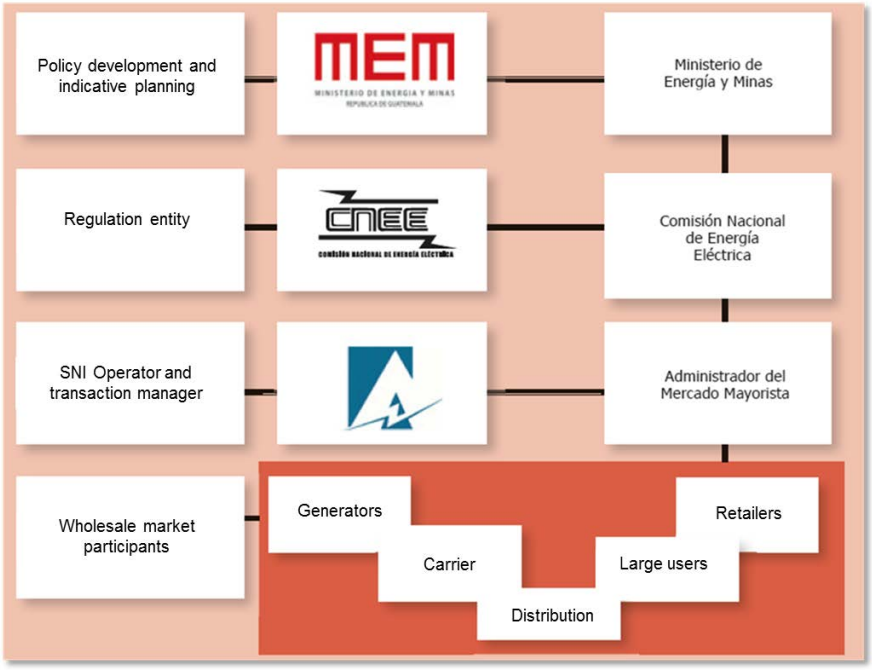


MEM is the government body responsible for formulating and coordinating government policies, plans and indicative programs related to the electric power sub-sector and the laws and its regulations enforcement.

CNEE is responsible for establishing rules and regulations and is functionally autonomous in exercising its powers. CNEE establishes the rates and quality of the transmission and distribution services and is responsible for ensuring that competitive conditions prevail in the wholesale electricity market.

AMM is responsible for the operation and administration of the National Grid System. It is a private entity responsible for coordination and delivery of electric power in the national electrical system, guaranteeing security and supply of electric power, setting of spot market prices and executing purchase and sale transactions in the wholesale market. Figure 19 shows the main roles of these and other players in the electric market.

Figure 19: Main players in the Guatemalan electric power market



In general, MEM performance has been negatively affected by the budgetary restrictions of the GoG. MEM's responsibilities are only partially fulfilled (such as indicative planning was temporarily assigned to the CNEE due to the lack of resources at MEM). Additionally, budgetary and procedural aspects hinder the facilitator role the General Electricity Directorate is intended to fulfill regarding registration and issuing of authorizations for renewable energy projects. For these reasons, efforts need to be initiated or continued to structure the mechanisms, train the personnel and provide the infrastructure required to fulfill its legal obligations.

4.1.2 Institutional framework of the hydrocarbons sub-sector

MEM is the authority for the fossil fuel and mining sector; it supervises the contracts of oil and gas operations and exercises periodic control over the quality of the fuel sold in the country. MEM takes samples at import reception centers, storage plants, refineries and own-consumption by public and private entities. Regarding mining activities, MEM is the body responsible for issuing new exploration and mining licenses.

Through MEM, the government supervises issues related to liquefied petroleum gas. MEM oversees issues related to industrial safety and the environment, the inventories of liquefied petroleum gas and derivative products at storage and distribution facilities, and supervises portable liquefied petroleum gas cylinder manufacturing plants to ensure compliance with mandatory safety standards prior to their sale.

Most exploration, mining and commercialization activities in the petroleum and mining sector are performed by private companies, primarily using international finance.

4.1.3 Sector policies and evolution of the energy matrix

Through MEM, the GoG has been establishing energy policies that include specific targets to reduce the use of liquid fuels in the power generation matrix. For example, the Energy Policy approved in 2007 established that a minimum 60% of demand for electric power generation should be met through renewable energy by 2022.

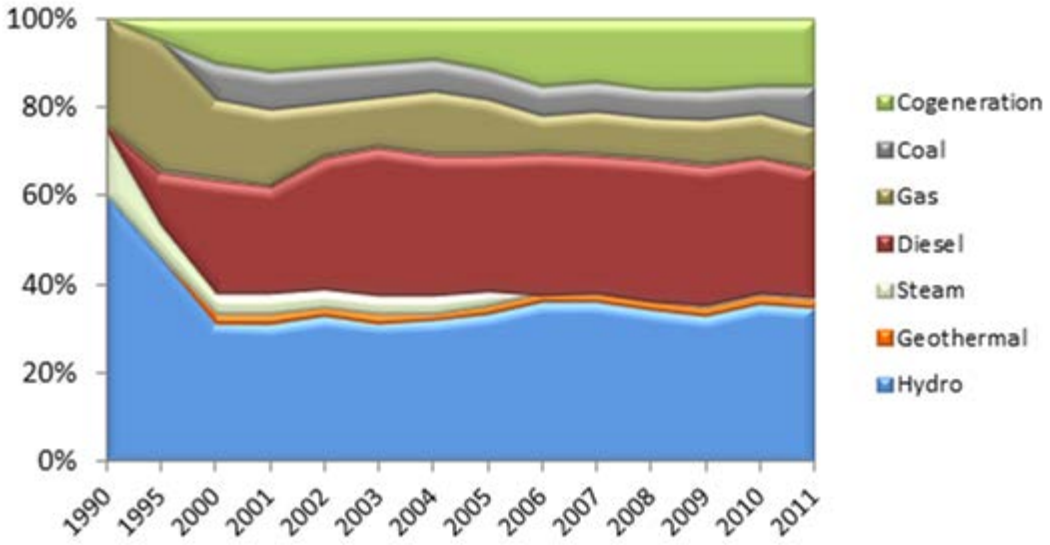
The most recent Energy Policy for 2013-2027, announced in March of 2013, reestablishes this directive of the use of renewable energy for power generation. The first strategic focus of this new energy policy, "security of supply and competitive prices", establishes the goal of having 80% of power generation sourced from renewable energy by 2027. Other actions established in this first strategic focus include updating studies on the potential for renewable sources in the country.

As shown in Figure 20, generation was dominated by large hydro-electric plants in the 1990s. Between 1990 and 2000 there was a substantial increase in thermal generation as a result of the electrical crisis, during which Power Purchase Agreements (PPAs) were signed with private investors that generated power based on fossil fuels. But since the mid-2000s the trend has reverted with the entry of geo-thermal, hydraulic and bio-mass generation plants.

2013-2027 Energy Policies– Strategic Focus Points

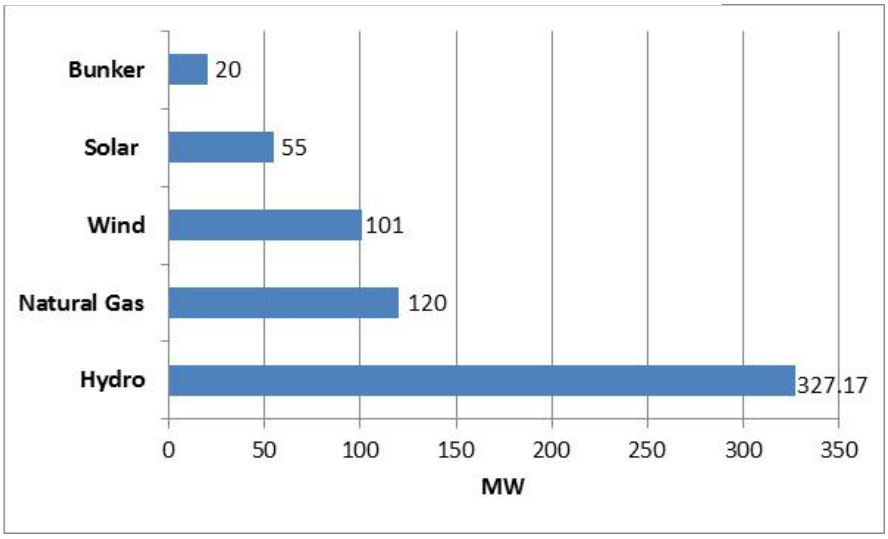
1. Security in electricity supply at competitive prices (Includes promotion of renewable sources)
2. Security of fuel supply at competitive prices
3. Exploration and exploitation of oil reserves aimed at national self-sufficiency
4. Energy savings and efficiency
5. Reduction in the use of firewood in the country

Figure 20: Composition of the energy matrix in Guatemala 1990-2011



Recently, public bidding processes were successfully completed to reduce the use of fossil fuels and promote generation with renewable sources. As a result of the latest bidding process, announced in November of 2012, long-term contracts were awarded to 28 renewable energy generation projects with close to 480 MW of installed capacity, as shown in Figure 21.

Figure 21: Public bid awards for renewable projects



4.2 AVAILABILITY AND ACCESS TO INFORMATION

Availability and access to information to calculate the latest GHG inventory of the energy sector seems adequate in terms of compliance with the minimum requirements and guidelines of the IPCC. However, details on how the emissions of the energy sector were calculated are not available and were not included in the report. It was only possible to make an analysis on the aggregate levels of GHG emissions. In this sector, the key information used as input for inventory calculations was the 2005 Energy Balance, developed by MEM.

4.2.1 Information on the inventory of the main GHGs in the energy sector

Because the data of the 2005 national inventory are presented in Gg. of each GHG, it is not possible to draw conclusions on the importance of each sector for each GHG (CO_2, CH_4, N_2O). A conversion to CO_2 equivalent was performed, as shown in Figure 22, using the corresponding global warming factors of the IPCC approved by the UNFCCC (CO_2 = 1; Methane (CH_4) = 21; Nitrous oxide (N_2O) = 310) .

Figure 22: The energy sector in the GHG inventory

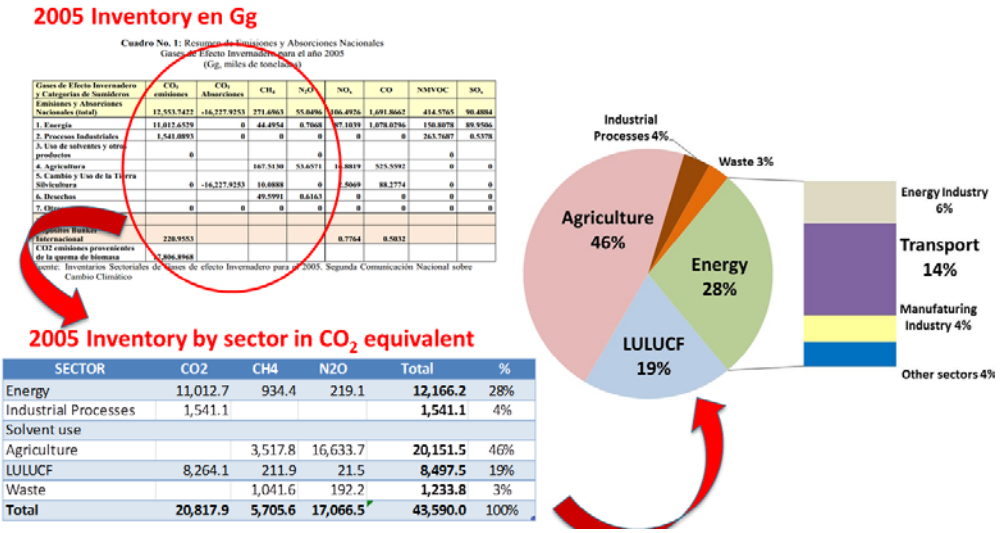
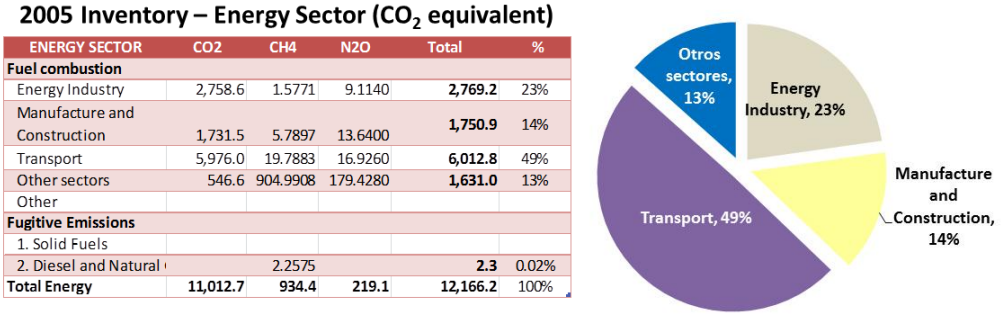


Figure 22 shows that agriculture has the greatest impact, based on CO_2e, , accounting for 46% of total emissions, followed by the energy sector with 28% and the land use change sector with 19%. In this context the transportation sub-sector is responsible for 14% at the national level.

A similar exercise shown in Figure 23 focuses only on the energy sector, and indicates that of the 28% of total emissions at the national level, the transportation sector is responsible for 49%, followed by the electric power sector, with 23%. This implies that the transportation sub-sector has the greatest potential for mitigation impact at the national level. For this reason, an entire chapter of this report has been devoted to analyzing this sub-sector. In this context the electric power sub-sector (energy industry) is not in first place, though its importance should not be minimized. In this sub-sector, many actions have yet to be implemented that would help reduce emissions, as discussed below, including rebalancing the power generation matrix, the promotion of geo-thermal energy, and energy efficiency measures.

Figure 23: Breakdown of energy sector emissions



4.3 COORDINATION WITH OTHER SECTORS

The procedure used by MARN for the energy sector was to retain a specialized consultant to execute and coordinate all data collection activities, development of calculations and analysis of results. In terms of the

coordination in the development and calculation of the GHG 2005 inventory for the energy sector (including the electric power industry, petroleum refining, manufacturing and construction and transportation), we make observations in two areas:

Public sector stakeholders: In the case of the interaction between the Government entities associated with the energy sector, the only coordination performed was with the departments of MEM responsible for developing the 2005 energy balance: the General Energy Department (DGE) of MEM and the Hydrocarbons Department of MEM. There was a minimum level of coordination as required to obtain and verify the data for the electric power, transportation, and petroleum sectors.

Private sector stakeholders: Apparently there was not adequate coordination and verification of data with the manufacturing and construction industries, given that they are not mentioned in the inventory report.

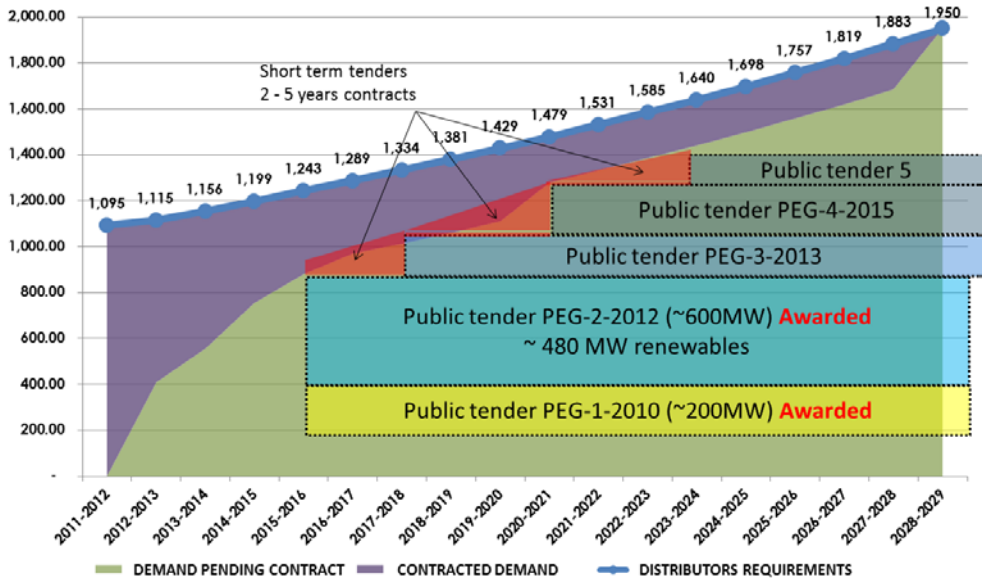
4.4 KEY OPPORTUNITIES FOR MITIGATION

In the energy sector there is great potential to mitigate GHG emissions, both on the generation side and in electricity consumption. The most important opportunities are discussed below.

4.4.1 Energy matrix based on renewable resources

In the electric power sub-sector, one of the major opportunities for GHG mitigation continues to be the diversification and make-up of the power generation matrix, by moving away from dependence on liquid fuels and promoting the installation of generation capacity using renewable resources, primarily hydroelectric, geo-thermal, solar and wind power. Figure 24 illustrates how the GoG has been using the mechanism of public bids to award long-term generation contracts, including substantial participation from renewable energies. These bidding processes are expected to continue to meet demand as indicated in Figure 24. An aspect that should be highlighted and that is already affecting small and mid-scale hydroelectric power generation in Guatemala is social inclusion during project design and implementation. Community and participative development in towns and indigenous communities is becoming one of the most important activities in the development of renewable projects, to avoid or minimize opposition from these social groups during implementation.

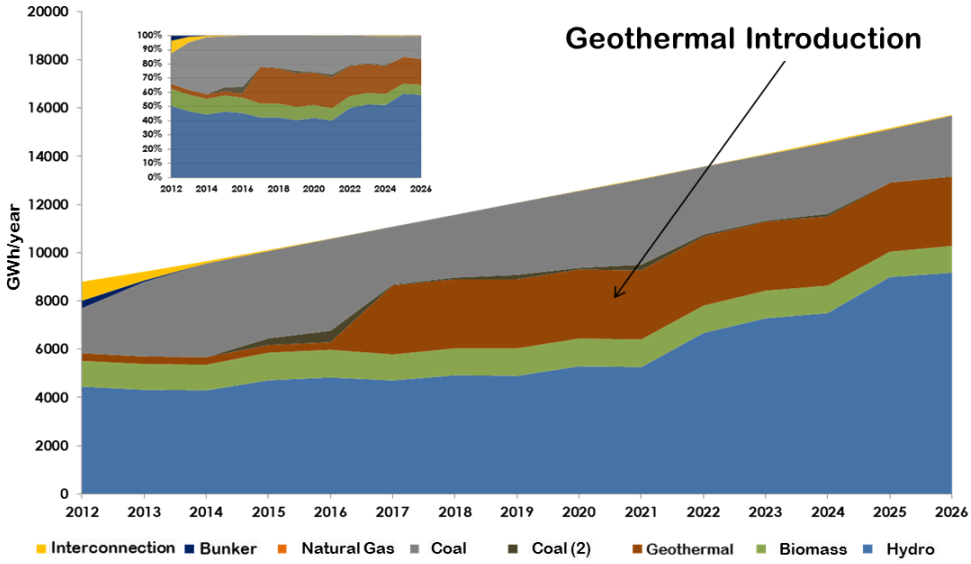
Figure 24: Public bidding plan to expand generation capacity



4.4.2 Provide incentives to use Geo-Thermal energy

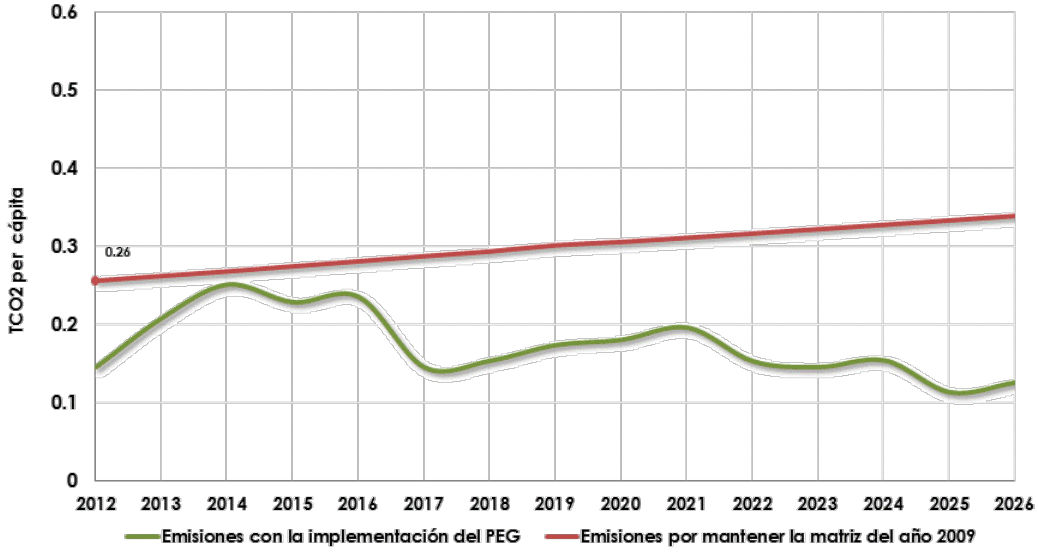
Guatemala has substantial geo-thermal resources available with a large potential impact on the diversification of the country's energy matrix. The latest forecast on the expansion of the electrical system included in the 2012-2026 indicative generation plan shows that under the baseline scenario there is a substantial opportunity to develop geo-thermal energy and to increase hydroelectric generation in the long term, as shown in Figure 25.

Figure 25: Geo-thermal energy - baseline scenario of the expansion program



This baseline scenario assumes the development of nearly 300 megawatts (MW) of geo-thermal generation capacity in the country in three separate blocks starting in 2017. The effect of this scenario in terms of emissions is highly positive because geo-thermal generation would help substitute non-renewable sources, and the consequent reduction in emissions would be substantial as shown in Figure 26.

Figure 26: CO_2 emissions of the electrical sector according to the baseline scenario of generation expansion included in the latest indicative plan



4.4.3 Energy efficiency measures

Current situation

At the national level, MEM and CNEE have structured and reached a consensus on an energy efficiency bill with IADB funding that is currently being prepared by the ministries for submission to Congress for approval. The proposal was the result of the need for an integral energy efficiency plan to promote energy savings and efficiency in all sectors. Through this proposal, the GoG seeks to create an entity and a fund exclusively devoted to the implementation of energy efficiency measures. The main components of this integral plan have already been identified, and it is expected that once the bill is passed into law the new institution will develop a detailed plan for future implementation. The main components of the bill are shown in the inset to the right.

Main Components of the proposed Energy Efficiency Law:

- Creation of the National Commission for Energy Efficiency (CNEE), as a technical body of MEM;
- A comprehensive energy efficiency plan to be developed and implemented by CONEE;
- The energy efficiency fund (FODEE) as an administrative financial mechanism to promote technical investment, training, communications and research programs and projects; and
- Other Mechanisms to promote efficient use of energy such as standardization, certification, accreditation and labeling of energy-using equipment to propagate information to consumers, as well as development of efficient technologies in the market; guidelines for public acquisitions, creation of an energy information system and a national award as an incentive and means for promotion and development on this matter.

Source: Promotion of energy efficiency in Guatemala as one of the focus points of the national energy policy, CNEE, Feb 2013

In order to promote an effective energy development strategy in the country, it was necessary to create a technical body with functional and financial autonomy. This body would formulate, execute and update an integral energy efficiency plan, issue technical standards on the matter, and establish mechanisms to arrange the resources required for investment in projects and programs that promote energy efficiency to the social and economic benefit of the country.

Even though an integral energy efficiency program has not been implemented in Guatemala, analyses have been developed on specific energy efficiency measures (public lighting, residential lighting, etc.), which have in fact led to performance of modest pilot projects at the national level with various levels of success. The selected technologies that were implemented in these nine pilot projects at the business and residential level were lighting, air conditioning and improved stoves. Figure 27 gives an idea of the magnitude of the investment in these projects and the short period of recovery of the investment in each case.

Figure 27: Examples of energy efficiency projects

No.	Proyecto	Monto de Inversión US$	Descripción	Ahorros Esperados US$/año	Reducción esperadas kWh/año
1	McDonals	$23,700	Sustitución de equipo de aire acondicionado	$12,557	73,818
2	Taco Bell	$2,196	Sustitución de luminarias	$4,502	14,434
3	Organismo Judicial	$1,138	Sustitución de luminarias	$4,429	20,033
4	Confederación Deportiva de Guatemala	$12,234	Sustitución de luminarias	$25,741	63,572
5	Universidad San Carlos	$30,806	Sustitución de luminarias	$12,996	70,910
6	Universidad del Valle	$25,000	Instalación de paneles fotovoltaicos	$2,653	11,802
7	Camara de Industria	$10,161	Sustitución de luminarias	$9,829	49,960
8	Fundación Solar	$25,000	Instalación de estufas ahorradoras		Red. 30%leña
9	Ministerio de Energía	$15,500	Sustitución de luminarias	$23,210	80738
	TOTAL	$145,735		$95,917	

The approach of some of these efforts and others described below has been to reduce peak demand at the national level, which is highly pronounced. Figure 28 shows the typical curve in Guatemala, and even though the load curve changes every day, its shape remains fairly constant throughout the year, with a peak in the evenings. Consequently, any measure that reduces or shifts the peak will also reduce the need for new generation infrastructure. According to CNEE, this peak is mainly caused by residential, public and commercial lighting and the use of appliances such as TVs. Energy efficiency measures focused on these areas will clearly help reduce demand, thereby eliminating or delaying commissioning of additional power plants.

Efficient public lighting

According to preliminary analyses performed by CNEE, public lighting is inefficient and is one of the areas where energy efficiency measures could have a substantial impact. Public lighting in Guatemala features include:

- A stock of almost 402,000 lamps installed in 2009, of which 83% are inefficient (see following figure);
- Providing the service is the responsibility of the Government through the municipalities;
- There are no standards on public lighting; and
- CNEE can authorize the inclusion of public lighting costs in electric bills

Figure 28: Profile of electricity demand in Guatemala

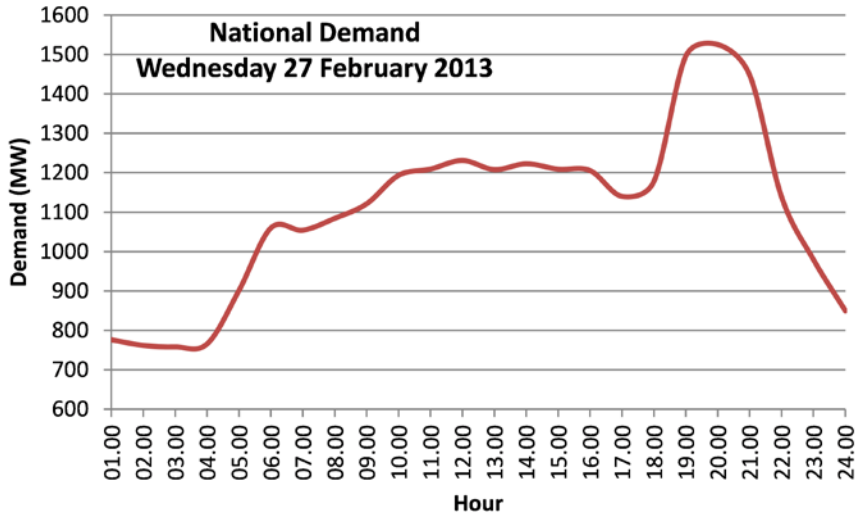
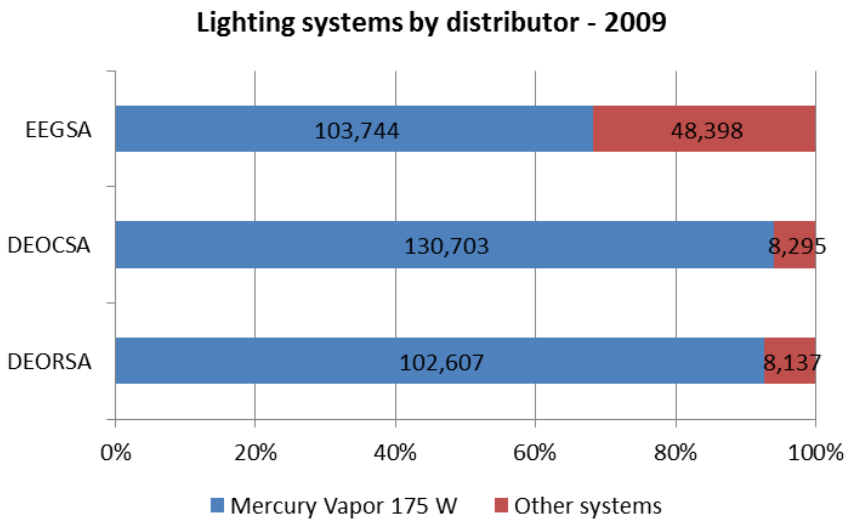


Figure 29: Public lighting by distributor



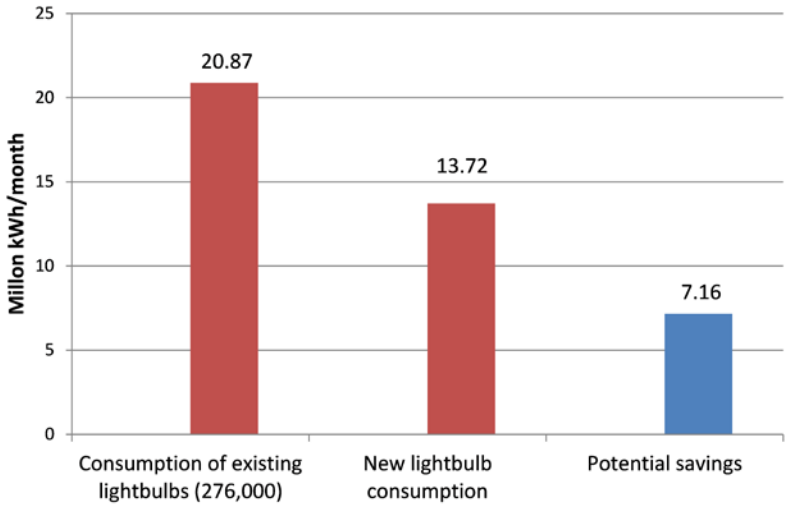
The CNEE assessment focused on the replacement of mercury vapor lamps for high-pressure sodium vapor lamps of 100 W. Even though currently the latest LED technology is beginning to enter the market, its costs are significantly higher. These preliminary analyses by the CNEE indicate that if 276,000 lamps were replaced, energy savings would total around 34%, which represents nearly 7.16 million kWh/ month in public lighting, as shown in Figure 30.

Residential lighting

Preliminary studies by CNEE have established that the substitution of residential lights at the national level could also lead to energy efficiency with substantial impact on demand.

The limited information available indicates that it would involve nearly 3 million households changing 5 normal light bulbs for energy-saving bulbs of 20W at an estimated cost of US$ 22 million dollars. The energy-saving light bulbs would be acquired through public bidding processes and the electricity distribution companies would be responsible for charging for them in the monthly electricity bill.

Figure 30: Estimation of electricity savings using efficient public lighting systems



Substitution of refrigerators

Another measure that has been proposed is the substitution of 50,000 refrigerators with over 10 years of use. The cost of the investment is estimated at US$ 15 million dollars, but there are no detailed studies on the potential. This measure has also been proposed for the Central American region by The Economic Commission for Latin America (CEPAL) and other regional entities as an option to be considered in the medium and long term.

4.5 ACTION PLANS BY SECTOR

Based on the stage of development of the energy sector, the inclusion of the following actions should be considered for the implementation of GHG mitigation measures to achieve a substantial reduction in national emissions:

- Power generation: Maintain current guidelines for the sector of promoting renewable energy and monitor the progress made to remove any obstacles or barriers that may arise.
- Increase opportunities for distributed renewable generation in Guatemala: Strengthen regulatory and technical aspects to promote the development of distributed generation to enable selling electricity even if the source and the client are connected to different distribution companies.
- Promote development of geo-thermal generation: Focus regulatory and other efforts on developing power generation based on geo-thermal resources.
- Energy efficiency: Perform studies on energy efficiency potential to quantify and determine the size of real opportunities that exist in the various sub-sectors of the country, including residential, industrial and commercial (lighting, refrigeration, air conditioning, engines, etc.)
- Energy efficiency: Improve available information on the country's energy resources to develop a policy that promotes energy efficiency and savings.
- Energy efficiency: Evaluate and propose certification and standardization arrangements for energy-saving appliances and equipment.

5.0 MANUFACTURING SECTOR

For the purposes of this study, the manufacturing processes sector involves emissions associated directly with productive processes, according to IPCC definitions. However, this section also discusses emissions associated with energy consumption by industry, trade and services. Even though their emissions are reported in different sectors of the national inventory (as will be discussed in section 5.4), the structure of energy consumption and the strong presence of the private sector make this sector an important starting point both for the improvement of emissions inventories and for the promotion of mitigation measures.

5.1 INSTITUTIONAL CAPACITY

Since manufacturing is almost completely managed by the private sector, its institutional capacity lies within a series of voluntary associations that cluster together and support various interests. These associations may be used to improve data quality, raise awareness and promote actions related to low emissions activities in Guatemala. Here is an outline of the most important associations:

Chamber of Industry of Guatemala (CIG): Largest association with over 1000 industrial members, of which 10% are considered large, 30% medium-sized and the rest small. It comprises 43 chambers that group together companies from specific industrial sub-sectors.

Chamber of Commerce of Guatemala (CCG): This association groups together different kind of businesses, and according to its mission, "represents the defense, representation and protection of business." It has 18 chambers for various types of products or businesses, as well as 21 departmental branches and 12 municipal associations. CCC also has representatives in the board of directors of several government institutions.

AMCHAM: Promotes investment and trade between USA and Guatemala through its almost 500 members. AMCHAM activities include training, advisory, promotion and other services.

AGEXPORT: Promotes Guatemalan exports and offers services related to competitiveness, access to markets, market development and technical support services.

AMM: This entity oversees the efficient operation of the wholesale electricity market in the country, and supervises the security of electricity supplies. Its members or "agents" include large electricity consumers (consuming over 100 kW), i.e. the largest companies of the productive sector.

CGP+L: Technical consulting institution covering energy and environmental activities, it has primary capabilities for GHG emissions inventories development. It is supported by CIG and is located in the same building. CGP+L has good access and knowledge of the productive sector.

ASAZGUA: This association brings together the largest sugar producers. Its objective is to increase capacity for sugar production, distribution and commercialization, and support local governments strengthening, among others.

In addition to those listed above, there are other association (like the Agricultural and Construction Chambers) that could also support LEDS efforts. All these associations provide an excellent communications channel with individual companies, as well as analytical and institutional capacity that these groups could eventually contribute during the development of a national low-emissions development effort.

5.2 AVAILABILITY AND ACCESS TO INFORMATION

In the manufacturing sector, two key issues have been identified with regards to information availability and access:

1. On a macro level, the only source of information available is the National Energy Balance, which aggregates energy consumption by the productive sector in only two figures: one for industry and the other for trade and services. The only detail available is a breakdown by type of energy or fuel, which in most cases does not help estimate consumption by industrial sub-sectors.
2. At the company level, information on energy consumption is disperse and is not available in some cases where records are not kept. Companies are not required to report energy consumption nor their emissions. There is no way of determining consumption by sub-sector or industry. CGP+L has information on energy consumption, but only for the companies it has worked with. The only exception is the case of AMM, which publishes purchases and sales of electricity between all market agents on an annual basis including the small number of industrial companies that participate in the wholesale market.

The fact that there is only one cement producer (Cementos Progreso) in Guatemala represents an opportunity because all the electricity and fuel consumed by the cement industry is concentrated in a single company. This contributes to defining the emissions of industrial processes (see section 5.4). Greater exchange of information and improved communications between the government and Cementos Progreso could be very useful, especially because an agreement has not yet been reached with regards to the methodology to calculate emissions from this sector in the national inventory.

In the national inventory, the productive sector is directly and indirectly represented in three items: i) emissions from industrial processes; ii) emissions from energy consumption in the manufacturing and construction industries; and iii) emissions of the trade and institutional sector, and part of other sectors, also in terms of energy. Additionally, part of the emissions from the public electricity and heat generation in the energy industry are also the responsibility of this sector in terms of electricity consumption.

Figure 31 shows the emissions of industrial processes exclusively, without including energy consumption. CO_2 emissions are summarized on the left, while emissions of non-methane volatile organic compounds (NMVOC) are shown on the right. No additional discussion is provided regarding NMVOC, because there is no supporting data, and their conversion into CO_2e depends on the mix of volatile compounds. It will eventually be necessary to review the assumptions used for emissions associated with paving, because these seem to be high compared to other countries inventories.

Figure 31: Annual emissions from manufacturing processes

INDUSTRIAL PROCESSES	CO2e	NMVOC	TOTAL CO2	%
Cement Production	1,414.3		**1,414.3**	92%
Lime production	118.1		**118.1**	8%
Sodium carbonate production/use	8.7		**8.7**	1%
Road asphalting		230.2		
Glass production		0.3		
Food and beverages production		33.3		
Total	**1,541.1**	**263.8**	**1,541.1**	100%
Total national emissions (2005)		**414.6**	**43,590.0**	
Percentage from Industrial processes		64%	3.5%	

Figure 31 shows that emissions from the industrial processes sector account for 3.5% of the total country emissions in tons of CO_2e.

Figure 32 shows a broader calculation of the emissions from the productive sector, including industrial processes and emissions from electricity and fuel consumption. This figure also takes into account the emissions of the industrial sector that are accounted under the energy sector (see Figure 23), to clearly illustrate the substantial impact that mitigation measures can have in the industrial sector.

Figure 32 has two columns; the "CO_2e/year" column (based on the national inventory), and the "allocation" column indicating the percentage of total emissions of the energy sector that are directly attributable to this sector (based on the Energy Balance of Guatemala 2010). The productive sector accounts for 11% of national emissions, which highlights the relevance of this sector, compared to the 3.5% of emissions derived from the industrial processes solely.

Figure 32: Total emissions of the manufacturing sector

SECTOR	CO2e/yr.	ALLOCATION	TOTAL	%
Industrial Processes	1,541.1	100%	**1,541.1**	32%
Energy Industry (industrial electricity)	2,769.2	33%	**913.9**	19%
Energy Industry (comercial electricity)	2,769.2	22%	**609.2**	13%
Manufacturing/Construction (thermal)	1,750.9	100%	**1,750.9**	36%
Institutional commerce (térmico)	25.6	100%	**25.6**	1%
Total Emissions from the Productive Sector			**4,840.7**	100%
Total national emissions (2005)			**43,590.0**	
Percentage from the productive sector			11%	

From the perspective of mitigation measures implementation, there is an additional analysis that has a substantial impact and shows the way ahead. Figure 33 shows the same analysis as Figure 32, but only for the industrial sub-sector of mineral products, which is practically a single company: Cementos Progreso. This company produces all the cement and a large percentage of the limestone of Guatemala, accounting for 4.7% of the national emissions. Consequently, it is essential to analyze this company's. The first two lines show emissions from the production process, derived from Figure 31. The next two lines show Cementos Progreso's emissions associated to energy consumption (currently accounted for in the energy sector of the GHG inventory) for cement and limestone production.

Figure 33: Cementos Progreso Emissions of 2005

CP Emissions Calculations	CO2e/yr.	Base for calculations
Cement Production	1414.3	CP is the only cement producer in the country
Lime production	59.1	CP produces 50% of the lime
Electricity consumption	69.2	CP consumes 2.5% of the national power generation
Fuel consumption	525.3	CP consumes 30% of the total industrial thermal energy
Total emissions attributed to CP	**2067.9**	
Total national emissions (2005)	43,590.0	
Percentage of CP from total national emissions	4.7%	

The numbers used on Figure 33 are based on certain assumptions. The figures of both cement and limestone production emissions used in the 2005 inventory (the first two lines derived from Figure 31, and the two following lines from Figure 32), in terms of percentages of energy consumption are estimations (based on estimated annual production and average specific consumption of the cement industry), and are open to discussion. Cementos Progreso is developing its carbon footprint, which is nearly 20% lower than the total emissions of Figure 33. In observing Figure 33, the following conclusions arise:

- Cementos Progreso is responsible for almost 5% of total national GHG emissions, which is equivalent to almost half the emissions of the entire productive sector in the country.

- Cementos Progreso can play a key role in developing a low emissions strategy in Guatemala.
- It is essential for the government to maintain open communications and to transparently share data and information with this company.

It is important to note that Cementos Progreso has been attentive to GHG emissions in the context of sustainable development. For example, it has made maximum use of natural pozzuolana to substitute clinker, and has managed to lower emissions per ton of cement by over 15% since 1990. As indicated earlier, Cementos Progreso is working on establishing its carbon footprint according to international standards. Lastly, it is implementing reforestation projects by planting 1.5 million trees per year (an activity that possibly explains part of the difference in emissions calculated by the company and the estimations of this study).

5.3 COORDINATION WITH OTHER SECTORS

The manufacturing sector is integrated into and requires coordination with several other sectors, as described below:

- The greatest coordination is required with the energy sector, as presented in Chapter 4. As explained in the previous section, all data from the productive sector (except emissions of industrial processes) are derived from the energy sector.
- When productive sector companies have their own transportation fleets, it will be necessary to coordinate with the transportation sub-sector. Since the emissions from the transportation sub-sector belong to the energy sector, this coordination will only be necessary when the time arrives to implement mitigation measures in the industrial sector.
- Eventually agro-industrial activities that are not covered by the energy sector should be added to the productive sector – for example, industries that use biomass.

From another perspective, there is a key opportunity for integration and coordination between the private sector and the public sector. In several conversations with representatives of the private sector, they demonstrated willingness to support government policies as long as regulations are clear and consistently defined. This is a condition the sector requires in order to engage in long-term projects without facing uncertainty, inconsistency or changing policies.

5.4 KEY OPPORTUNITIES FOR MITIGATION

There is a long track record of successful experiences globally that could be applied in the case of cement production in Guatemala. In fact, Cementos Progreso has already analyzed and studied many of these measures. One of the most common, the substitution of different types of waste for the fuel used in ovens, has already been implemented. Cementos Progreso estimates that this substitution currently represents approximately 5% of fuel, and that it may reach 15% in coming years. More importantly, the company has identified certain obstacles (prices, access to waste) that will possibly require government intervention or support to achieve substitution rates higher than 15%.

5.5 ACTION PLAN FOR THE SECTOR

Based on the review and analysis of the inventory, we recommend the following activities as the next steps for LEDS in Guatemala:

- Implement and promote a well-structured program of diagnostics on energy efficiency in the industry (and implementation in trade, as described in section 4.5.3), supported by

communications materials, training activities, and most importantly, visits to the plants and on-site measurements.

- Design an implementation strategy for energy efficiency measures, especially with financial support for profitable projects.
- Combine the lessons learned in the diagnostics program, the baseline emissions and international experience to develop mitigation curves and estimate the potential cost impact of emissions reductions, and compare them with similar results in other sectors.
- Contribute to the review of the cost analysis of mitigation measures and participate in inter-sector planning to be carried out as part of LEDS preparation.
- Provide means for coordination between MARN and Cementos Progreso with several objectives: review the 2005 inventory data; review the carbon footprint developed by CP; and eventually list and prioritize possible mitigation measures in the cement and limestone production sector.

6.0 AGRICULTURAL SECTOR

The agricultural sector comprises annual crops such as maize and kidney beans, perennial crops such as sugar cane and coffee, and livestock operations such as raising bovine or swine animals for meat. This chapter analyzes the existing institutional platform of this sector and the information available in the framework of LEDS development.

6.1 INSTITUTIONAL FRAMEWORK

MAGA is the institution responsible for promoting rural and agricultural development in the country, and developing capabilities among producers to reach sovereignty, food security and competitiveness in national and international markets. Some of the priorities identified during meetings with MAGA include a strong need to improve the country's food security and to prevent soil erosion processes that compromise the country's agricultural productive capacity. Both challenges are closely related to the processes of emissions reduction and mitigation of the impacts of climate change.

The organizational structure of MAGA includes 5 institutions that are of special interest for strategy development:

1. IGN and the Geographic Information Laboratory: Both institutions manage official geographic information at a national and sectorial level in terms of national cartography, use of land, forest cover, agricultural areas and hydrographic basins, among others. Both institutions have information platforms that are essential for strategy development, given that they provide the baseline information used to develop and update the GHG inventories for the LULUCF and agricultural sectors, in addition to territorial ordering plans.
2. The National Council on Agricultural Development (CONADEA), the National Development Fund (FONADES) and the National Fund for the Reactivation and Modernization of Agricultural Activities (FONAGRO): The objective of these institutions is to reactivate and modernize agriculture through financial support programs and technical assistance for producers, and act as coordination, information sharing, outreach and consultation entities for the agricultural sector in Guatemala. FONADES is responsible for the "Family Agriculture" program that benefits 650,000 small farmers with fertilizers and technical assistance provided at a municipal level.

Despite the efforts of institutions such as MAGA, INAB and MARN, deforestation and desertification processes and the expansion of the agricultural frontier have accelerated, highlighting the serious problem of land use in Guatemala. Deforestation is growing at an alarming rate, subsistence crops such as maize and beans are found on visibly eroded steep hillsides with low productivity, while industrial crops are grown on flat lands. Considering deforestation growth, it is urgent to perform an in-depth review of the territorial ordering development processes at the national, regional and municipal levels, particularly the role and participation of municipal level representatives. It is also essential to establish effective enforcement mechanisms to ensure compliance with the established land use plans.

6.2 AVAILABILITY AND ACCESS TO INFORMATION

The sources of activity data for the agricultural sector included in the 2005 inventory are mainly agricultural censuses and surveys performed by INE in coordination with MAGA. The emissions table of the agricultural sector was developed using this information, combined with the IPCC standard emissions factors. The emission sources included in the inventory are digestive fermentation, manure management, rice plantations, prescribed burning of savannah, agricultural wastes burning in the countryside and emissions from agricultural soils.

As shown in Figure 34 and Figure 35, emissions from agricultural soils accounts for 37% of total emissions in Guatemala and 81% of the emissions of the agricultural sector in terms of CO_2e. According to the inventory, these emissions are derived from nitrification and de-nitrification processes, in addition to indirect emissions derived from lixiviation and atmospheric fixing of nitrogen. However, no information is included on the assumptions used to calculate emissions of different soil types, land areas or data on nitrogen-based fertilization.

Figure 34: Distribution of emissions, transformed to carbon dioxide equivalent, CO_2e

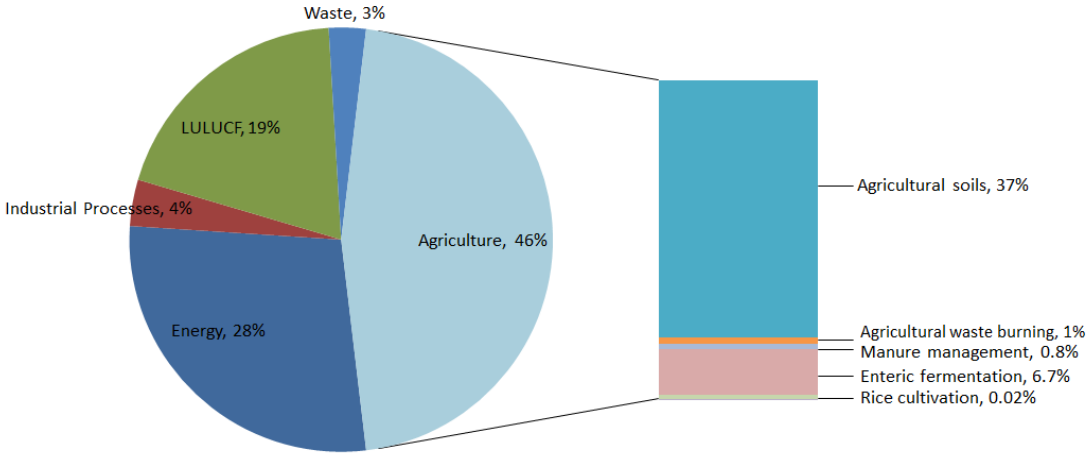


Figure 35: Emissions of the agricultural sector in CO_2 equivalent

AGRICULTURAL SECTOR	CH4	N2O	Total	%
Enteric fermentation	2,920		**2,920**	14%
Manure management	109	222	**331**	2%
Rice cultivation	8		**8**	0%
Agricultural soils		16,267	**16,267**	81%
Burning of savannah	177	32	**209**	1%
Agricultural waste burning	304	112	**417**	2%
Total Agriculture	**3,518**	**16,634**	**20,151**	100%

It is important to note that the emissions reported for the agricultural sector do not include emissions related to the operation of agricultural machinery or the treatment of wastewater at sugar or palm oil mills. The above was performed according to IPCC recommendations, but this methodology of emissions accounting does not provide a full spectrum of the agricultural sector emissions. The GHG inventories do not include information on the contributions of agricultural activities to the emissions allocated to the transportation sub-sector and the waste sector, which makes it impossible to consolidate an overall figure for the sector and to identify opportunities for emissions reductions in these three fronts simultaneously.

One of the obstacles found during the development of the emissions inventory for the agricultural sector was the absence of updated and reliable statistical information. The latest agricultural census was taken in 2003 and has not been updated due to budget restrictions. In the years 2005, 2006, 2007, 2008 and 2011 agricultural surveys were developed, but substantial differences were found between the figures of the agricultural census and the surveys, generating confusion among information users. One of the identified causes for discrepancies is the inclusion of back-yard cattle in the census and the exclusion of this item in the survey, which is relevant considering that 30% of cattle in Guatemala is in this category.

Figure 36 shows the reported area coverage for the five most important crops during the 2007 – 2008 season, comparing the information reported by INE and MAGA.

Figure 36: Comparison of agricultural areas reported by INE and MAGA for the 2007-2008 season

	Unit	Environmental Statistical Annuary INE - 2010	Agriculture in Figures 2011 MAGA	Difference %
Maize	Ha	581,795	721,680	24%
Sugar Cane	Ha	304,175	215,999	- 30%
Coffee	Ha	242,033	248,999	3%
Beans	Ha	181,431	224,000	23%
Yellow Maize	Ha	115,409	135,548	17%

The lack of consistency shown in Figure 36 adds greater uncertainty to the calculation of emissions of the agricultural soil sub-sector, which accounted for 37% of total CO_2e emissions in the country in 2005. This means that the emissions reported for the agricultural soil sub-sector have a high level of uncertainty, which may lead to incorrect strategic decisions and improper selection of mitigation measures.

The selection of emissions factors is in itself a challenge because the specific emission factors for Guatemalan conditions are unavailable, and most of the time the information available is not enough to provide proper orientation during IPCC default emission factors selection. For example, the same emissions factors were assumed for prairies and agricultural plantations[2]. A second example is the assumption that different types of maize crops in different areas of the country have similar emission factors, which ignores different soil preparation and fertilization practices and flooding during the rainy season, which leads to substantial variations of emissions for each case. A third example is cattle emissions ; since there is no information available on races, categories of animals, purpose, weight and feeding diets of the animals, the consultant in charge was forced to select emission factors based on assumptions that were not adequately recorded in the documentation on the 2005 inventory.

6.3 COORDINATION WITH OTHER SECTORS

Coordination between INE, MAGA and MINFIN is critical in order to improve the quality of information on the agricultural sector. It is required to formulate and redesign the agricultural surveys and to update the census information consistently with the required level of detail. A second obstacle found was the budgetary

[2]According to conversations with the consultant responsible for the agricultural sector inventory.

restrictions; in this sense it is necessary to review the budget allocations for these activities jointly with MINFIN in order to establish a census schedule in the short and the long term.

In LEDS development, cooperation between the public and private sectors seems to be one of the greatest challenges for this sector. The most important agricultural associations in Guatemala such as ASAZGUA, ANACAFÉ, AGEXPORT, among others, must adopt a leading role during the strategy design. They are key representatives of the private sector and have the capacity to implement mitigation measures in a diligent manner in their respective industries.

As in the LULUCF sector, close collaboration between MAGA, SEGEPLAN, MARN and IGN will be required to effectively implement a land use plan. To reach this goal it would be interesting to explore cooperation schemes with other NGO's and representatives of the academic sector involved in this subject, in particular UVG and Universidad Rafael Landívar, among others.

6.4 KEY OPPORTUNITIES FOR MITIGATION

Emissions from the agricultural sector are closely linked to the LULUCF sector, given that the expansion of the agricultural frontier is often at the expense of lands covered by forest. From this perspective, land use planning plays a key role in the agricultural sector emissions. The lack of effective land use plans in rural municipalities leads to additional expansion of the agricultural frontier at the expense of forest cover. This translates into plantations of annual crops such as maize or beans in soils of class VI or higher, which are not suitable for crops of this type. The presence of these annual crops on steep hillsides leads to erosion, causing organic matter and soil structure loss. The lack of an effective land use plan leads to annual crop growth in soils that are unsustainable in the long term, reducing the capacity of these soils to sustain forests, thereby worsening deforestation.

As shown in Figure 34, emissions of agricultural soils account for 37% of total CO_2e emissions in Guatemala. This sub-sector represents a key opportunity for emission mitigation, which may be achieved by training farmers on plantation and fertilization techniques.

There is a wide range of agro-industrial technologies available that would represent abatement measures with substantial impact for Guatemala, such as solar water pumping systems, anaerobic digester systems and efficient lighting. In this sense, close cooperation with CGP+L represents an opportunity to implement abatement measures that in addition to reducing emissions, also provide direct benefits to the companies.

In terms of LEDS at MAGA, strengthening the unit in charge of climate change issues is one of the first issues to be addressed. It is also necessary to involve the Vice-Ministry of Rural Economic Development, the Vice-Ministry in Charge of Petén Matters, the Regional Coordination and Rural Extension Coordination Department, the Cooperation, Projects and Trust Funds Department, and the Geographic, Strategic and Risk Management Department's two units: a) Geographic Information Laboratory and b) Risk Analysis, Strategic Information and Management.

During LEDS development, it might be interesting to broaden the "Family Agriculture" and "My Safe Harvest" programs led by MAGA through FONADES. Currently these programs provide fertilizers and technical assistance at the municipal level. One of the aspects that could be strengthened in these programs is the propagation of good agricultural practices and the incorporation of new techniques that reduce GHG emissions associated with fertilizer use (N_2O during application) and prevent soil erosion. Initiatives like these are directly aligned with the strategy's objectives because they increase agricultural productivity and reduce GHG emissions.

6.5 ACTION PLAN FOR THE SECTOR

An important challenge for the agricultural sector is the development and implementation of a land use plan based on a consensus that balances the expansion of agro-industrial plantations, family subsistence crops and

forest areas. One of the components to be taken into account during this process is redesigning and strengthening the enforcement processes on a national and municipal level. Only with a solid enforcement system will it be possible to effectively revert deforestation trends that threaten the country. Along with enforcement, mechanisms must be established to review and monitor the territorial ordering plans so as to identify and incorporate any required changes, and record them in official land use maps that can be used by other institutions.

A mitigation measure worth exploring is the expansion of the technical training programs offered by MAG's "Family Agriculture" program, as well as the fertilization support program "My Safe Harvest". Broadening and strengthening the scope of these training programs will help increase productivity, reduce emissions associated with crops and reduce erosion problems. Increased productivity will reduce the pressure to plan new areas through deforestation. Also, increasing yields contributes to the country's food security and reduces the products carbon footprint.

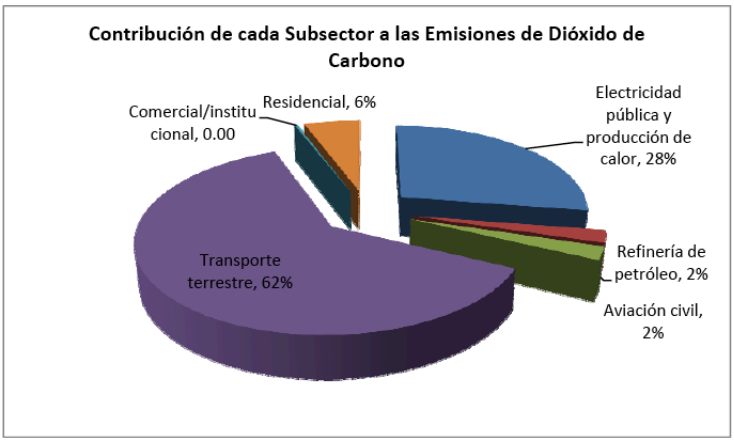
One of the alternatives proposed by agricultural associations is the implementation of a positive enforcement system that not only enforces compliance with laws and regulations, but that also recognizes the efforts of companies that engage in clean production and/or emissions reductions programs. In this sense it is important to recognize that there is an international trend and consumer pressure in favor of sustainable production of agricultural products such as sugar and palm oil. Consequently, promoting sustainable production of agricultural products not only helps reduce emissions, but may also become an advantage for positioning Guatemalan products in international markets.

7.0 TRANSPORTATION SECTOR

7.1 INSTITUTIONAL FRAMEWORK OF THE TRANSPORTATION SUB-SECTOR

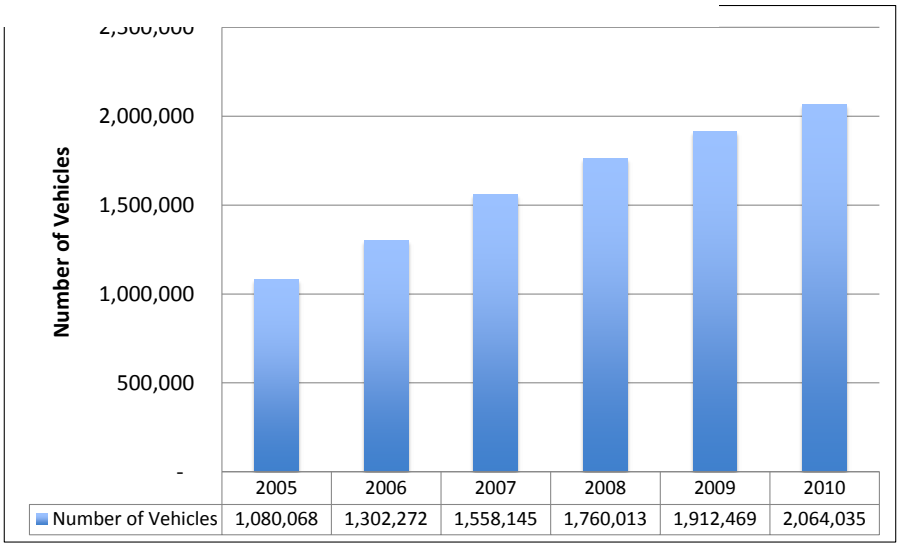
Chapter 3 mentioned that transportation is the sub-sector with the greatest potential in the energy sector. Transportation is responsible for 62% of the carbon dioxide emissions in the energy sector, followed by electric power and heat production accounting for 28% as shown in Figure 37.

Figure 37: Emissions from the energy sector



The report "Profile and characterization of the motor vehicles fleet in Guatemala year 2005" prepared by MARN shows that the fleet of motor vehicles doubled in 2010 compared to 2005, demonstrating the importance of current and future transportation emissions (Figure 38). In 2010, 84.68% of vehicles were gasoline-powered, 13.77% used diesel fuel and 1.55% used other fuels.

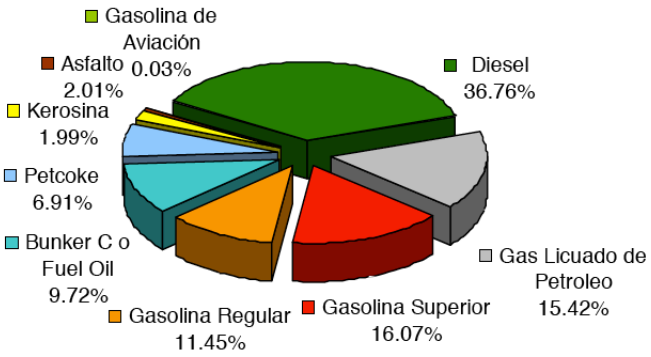
Figure 38: Evolution of the number of vehicles from 2002 to 2010



It is also important to note that all the fuels are imported petroleum products (Figure 39), diesel fuel being the most important. According to the "Hydrocarbon Statistics, first quarter of 2012" report prepared by the Ministry of Energy and Mines, diesel represents the greatest share of fuel imports with 2,656,781 barrel (Bbls) equivalent to 36.76% of the total, followed by liquefied petroleum gas with 1,165,837 Bbls, equivalent to 16.12% and extra gasoline with 1,161,703 Bbls, equivalent to 16.07%.

Figure 39: Imports of fuel in Guatemala

PRODUCTO	VOLUMEN (Bbls)
Diesel	2,656,781
Gas Licuado de Petroleo	1,165,837
Gasolina Superior	1,161,703
Gasolina Regular	827,360
Bunker C o Fuel Oil	734,980
Petcoke	499,677
Kerosina	143,853
Asfalto	35,769
Gasolina de Aviación	2,220
TOTAL	**7,228,177**



Even when the stock of diesel-powered vehicles is smaller compared to the gasoline-powered fleet, consumption of diesel fuel is substantial, which indicates a higher level of activity for the diesel fleet used for business activities. Also worth noting is the high consumption of liquefied petroleum gas (it includes

generation of energy in industrial processes), which may be related to residential and business consumption, and not necessarily to transportation.

The institutional framework is not well-defined for the transportation sub-sector; however within MICIVI there is a Vice-Ministry of Transportation that includes the General Transportation Directorate (DGT). DGT has the responsibility of supervising existing fleets of vehicles and new vehicles coming into the country, licensing purposes and non-urban transportation control.

Annex 9 shows the organizational chart of MICIVI, which includes the Vice-Ministry of Transportation, and Annex 10 shows the organizational chart of the General Directorate of Transportation.

Urban public passenger transport is managed by the Municipality of Guatemala, where several departments coexist, such as the Superintendence of Public Transportation (STP), the Metropolitan Transportation and Traffic Regulatory Authority (EMETRA) and the BRT Transmetro system. Annex 11 shows the overall organizational chart of the Municipality of Guatemala.

The objectives of the Hydrocarbons Department of MEM, which reports to the Vice-Ministry of Mining and Hydrocarbons, include publishing statistics for the fossil fuel sub-sector, making them available to the public and investors and maintaining oversight and control over fuel quality and quantity specifications for the fuels sold in the commercialization chain.

Lastly, MARN, through the UCC, is responsible for quantifying motor vehicle emissions and for issuing emissions standards for new and existing vehicles. However, the only regulation issued in the last 5 years has been a limit on importing vehicles that are over 10 years old.

MARN is currently developing several initiatives to improve emissions control policies through inspection and maintenance check-ups on fleets and the calculation of inventories of local emissions of pollutants by fleet, broken down by type of vehicle and technology.

7.2 AVAILABILITY AND ACCESS TO INFORMATION

The information used to develop the GHG inventory was the minimum required to comply with IPCC requirements, which is having reliable information available on fuel consumption related to transportation.

MEM has a very good statistical database. Figure 40 shows consumption of petroleum and petroleum products from 2002 to January of 2013. It shows that regular gasoline consumption grew by 29% between 2005 and 2012, extra gasoline consumption grew by 9.3% in the same time period and diesel consumption grew by 8.7%.

Figure 40: Consumption of petroleum products in Guatemala

CONSUMO DE PETROLEO Y PRODUCTOS DERIVADOS DE PETROLEO
PERIODO 2002-2013
(Unidad de Volumen: miles de barriles)

CONCEPTO/ AÑO	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GLP	2,428.20	2,665.45	2,752.89	2,699.33	2,784.01	2,973.66	2,913.47	2,701.41	2,809.56	3,010.21	3,226.90	291.42
Gasolina Aviación	17.43	16.44	16.78	16.32	19.38	16.81	15.70	15.06	14.08	14.20	14.50	1.49
Gasolina Superior	4,534.90	4,404.65	4,389.27	4,495.34	4,740.49	4,988.90	4,709.09	5,090.79	4,924.60	4,726.78	4,914.35	408.56
Gasolina Regular	2,384.51	2,261.90	2,334.51	2,496.74	2,555.86	2,678.93	2,784.44	3,216.85	3,242.09	3,222.41	3,129.80	287.99
Kerosina	623.36	643.48	702.31	610.87	605.96	729.25	699.34	601.02	606.58	573.41	608.87	51.85
Diesel	8,104.20	8,216.85	7,794.89	8,549.72	8,719.93	9,272.93	8,108.71	9,284.94	9,250.20	9,309.59	9,301.47	863.77
Bunker C o Fuel Oil	5,466.73	5,745.63	4,316.45	4,098.53	4,788.88	6,146.77	5,025.21	6,315.44	3,610.51	4,106.88	3,986.50	167.12
Asfalto	228.51	463.17	359.23	339.39	383.73	420.08	275.65	457.38	257.38	276.13	266.89	12.21
Crudo Nacional	562.96	721.85	597.01	483.42	457.01	556.52	386.16	587.88	485.79	563.31	536.88	39.54
Orimulsión	0.00	0.00	1,691.33	1,809.05	497.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PetCoke	0.00	0.00	795.24	1,086.44	1,137.26	1,160.25	972.03	1,088.95	965.93	1,077.14	928.83	97.52
TOTALES:	**24,350.80**	**25,139.42**	**25,749.91**	**26,685.14**	**26,690.34**	**28,944.10**	**25,889.79**	**29,359.70**	**26,166.71**	**26,880.08**	**26,914.97**	**2,221.45**

NOTA: DATOS DEL AÑO 2013 HASTA ENERO
ORIMULSION SE EMPEZO A CONSUMIR A PARTIR DEL AÑO 2004
NOTA1: ORIMULSIÓN SE DEJO DE CONSUMIR DURANTE EL AÑO 2006

In order to develop inventories with greater disaggregation by technology (IPCC Tier 2 and Tier 3), it is necessary to use existing information on the stock of vehicles from the SAT database. This information is broken down as follows:

- Type of fuel (Gasoline, Diesel and others)
- Vehicle category (12 vehicle type categories)
- Department

There is no detailed information on transportation variables (modal partitions, kilometers traveled per year, etc.) or information related to technology (emission standards, use of catalytic converters, etc.).

IPCC emissions reporting categories – Tier 1, 2 and 3
According to IPPC terminology on reporting GHG emissions, there are three categories that are used depending on the level of detail of the information available to calculate emissions. The simplest category is "Tier 1" and it typically uses default emission factors provided by IPCC and basic activity data with low levels of disaggregation. As more elaborate emissions calculation methodologies are incorporated for a specific technology, region or country, and more detailed information on the industry is included, it moves up to "Tier 2" and later "Tier 3" as greater levels of detail and disaggregation are included, which may sometimes involve calculation methods different from those proposed by IPCC.

Figure 41 shows substantial growth in residential consumption of 35.8% between 2005 and 2010, whereas transportation energy consumption grew by 9.7% in the same period. The data displayed in the energy balance are consistent with the trends indicated in the inventory.

Figure 41: Energy consumption in KBEP by sector

7.3 COORDINATION WITH OTHER SECTORS

Despite its high volume of GHG emissions and energy consumption in the country, the transportation sector has little to no coordination with other sectors. Moreover, coordination between actors within the sector is minimal; for example, the only relationship between MICIVI and the Municipality of Guatemala is the transfer of funds in the amount of 35 Million Quetzals per month to subsidize urban passenger transport, with no monitoring of efficiency in the use of the resources.

CGP+L offers training on efficient driving for private cargo transportation fleets, which might be a source for cooperation and coordination between sectors.

7.4 KEY OPPORTUNITIES FOR MITIGATION

The potential for mitigation in the sector is uncertain given the low amount of information available on transportation variables. However, considering the growing stock of vehicles, it can be assumed that the trend in Guatemala is similar to that of other Latin American cities: an accelerated switch from public to private transportation.

In the case of cargo transportation, the sector is highly dispersed into small trucking companies with one or two trucks per owner. The driver is responsible for everything, including driving, negotiating freight rates and performing basic maintenance on the vehicle. In these cases energy efficiency and emissions are not a top priority, and consequently any energy efficiency program needs to be implemented through associations.

In terms of stock, 512,834 vehicles were over 20 years old in 2011, equivalent to 25% of the total. The average age of the fleet is approximately 14 years. In general, older vehicles have lower average efficiency than new ones.

7.4.1 Renewal of stocks of vehicles and emissions control

The only restriction for importing a vehicle into Guatemala is that it must be less than 10 years old. This restriction is highly insufficient because it promotes the use of obsolete technologies in terms of emissions control and energy efficiency.

MARN is developing a proposal to restrict motor vehicle emissions called "Regulation to Control Emissions of Gases and Pollutant Particles from Land Automotive Vehicles". This regulation proposes the establishment of emissions control tests to monitor the maintenance status of vehicles in use.

In general, the objective of the test is to monitor emissions through two procedures used internationally: a static test for vehicles that operate on an Otto cycle (gasoline and gas) and a free acceleration test for vehicles operating in a diesel cycle. The intention of these tests is to control the engine conditions and the basic components that reduce emissions, such as catalytic converters.

These kinds of initiatives, with a stricter definition of requirements for new and used vehicle imports, would promote the renewal of vehicle fleets and a reduction of emissions per unit. This is only possible if better fuel quality levels can be assured. For example, the Guatemalan standard for diesel imports is 5,000 parts per million (PPM) of sulfur content, which does not promote the entry of new technologies. It is necessary to define jointly with MEM a new quality standard for diesel fuel and gasoline in Guatemala, in line with new technologies.

7.4.2 Provide commercial fleets incentives for energy management

Based on the experience of developed countries, and what has been observed in Mexico and Chile, it is possible to achieve substantial fuel savings in fleets if basic energy management concepts are applied. An energy management program includes the following actions for fleets:

- **Efficient driving** consists of a series of driving techniques that if applied consistently produce savings of about 10% of consumption.
- **Technical service** consists of basic maintenance procedures to be periodically performed before each trip, such as checking tire air pressure, checking that all mechanical components are in working order, that there are no leaks, etc. This achieves savings of around 5%.
- **Aerodynamic improvements:** Involves the installation of top and side deflectors aimed at improving the aerodynamic coefficient of inter-city trucks. These measures produce savings of between 9 and 15% at an average speed of 90 km/h.

- **Fleet and driver management**: In more advanced systems, vehicles and drivers are monitored using GPS systems to achieve integrated fleet management with the objective of reducing unnecessary non-commercial kilometers. Savings vary depending on management capacity.

CGP+L intends to include commercial fleet energy management in its future plans, as an extension of its offerings.

The objective of this initiative is to promote these practices in commercial fleets in order to achieve savings in consumption. It is observed that the stock of diesel vehicles is very small compared to gasoline-power vehicles, but because they are primarily commercial vehicles their fuel consumption is much greater according to MEM statistics.

7.4.3 Promote change in commuting habits from private vehicles to public transportation

It has been proven internationally that one of the best means to achieve reduced emissions in passenger transportation is to provide efficient, reliable and safe public transportation systems. Cutting down on private vehicle use achieves large savings in energy consumption and emissions, as highlighted in Figure 42.

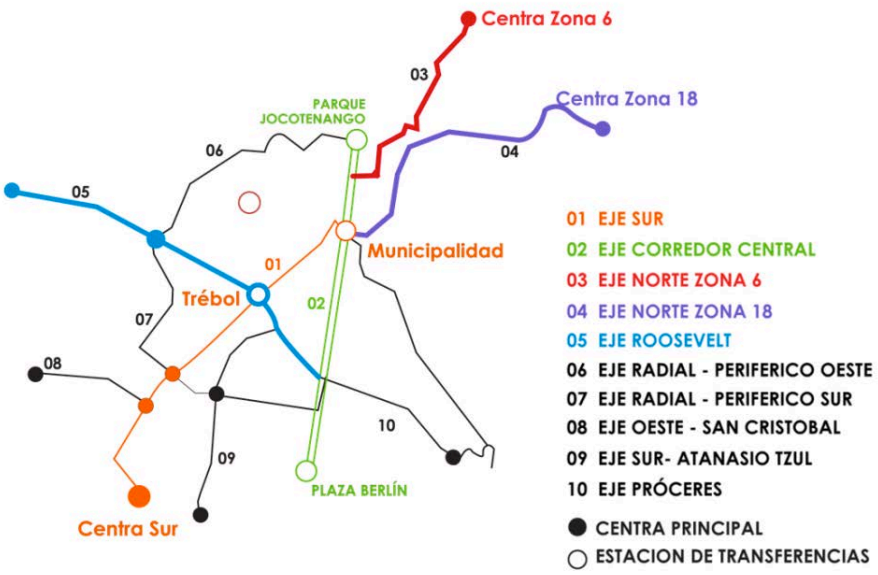
Figure 42: Poster to substitute private transportation for public transportation

For the last five years the Municipality of Guatemala has been operating Transmetro, a project to promote the change in modality.

Transmetro is an integrated mass transport system with the objective of improving people's quality of life, urban mobility and congestion in Guatemala City. In its first stage it restructured the public transportation routes (old system) based on the Metropolitan Development Plan. The Master Plan of Transmetro, which began to operate in 2007, is indicated in Figure 43.

The project was designed based on a central corridor, following the structure of systems such as Transmilenio in Bogotá or the transportation system of Curitiba. The first stage is a central corridor covering 12.5 kilometers, with 86 articulated buses and 42 stations. The system carries about 250,000 passengers per day.

Figure 43: Public transportation routes in Guatemala City



Transmetro represents an opportunity to reduce emissions, and has worked without operational problems for 5 years[3]. The project is considered a master plan for transportation. It is a measure with a defined structure for city-wide implementation, and the only barrier for expansion is political. It is important to note that nearly 30% of the Guatemalan population lives in the Metropolitan Area of Guatemala City (approximately 5 million inhabitants), so the impact of Transmetro is highly relevant for the sector.

7.4.4 Use of bio-fuels

Since 1985 law 17-85 has been in effect in Guatemala with the objective of incorporating bio-fuels in the fleet. The drop in oil prices, operational difficulties and lack of planning led to the non-application of the law. Some of the revoked benefits of this law were a tax exemption on imports and a 0% VAT rate.

Currently Guatemala produces both ethanol and biodiesel, and to a lesser extent bio-gas. There are 5 distilleries that produce 200 million liters per year on average, the raw material for which is molasses, a sub-product from sugar cane. Currently 80% of traditional and carbureting ethyl alcohol is exported to Europe and the United States; in Guatemala it is not used as fuel for vehicles.

In 2011 gasoline consumptions was 1,300 million liters per year, which means that ethanol supplies were equivalent to 15% of consumption, enough to supply the market with a gasoline blend to obtain E10 or E15.

Based on the above, the reactivation of Law 17-85 with any required amendments represents an important opportunity to mitigate GHG emissions in the transportation sector. There is an established industry that will most likely continue to be driven by domestic and international markets, and enough ethanol is produced to meet domestic demand (E10 or E15).

7.5 ACTION PLAN FOR THE SECTOR

An action plan for the transportation sub-sector must involve the institutions mentioned previously in this chapter. In general, each Ministry has the capacity to develop a national transportation policy.

[3]According to Transmetro statistics.

Firstly, MICIVI through the Vice-Ministry of Transportation has all the powers required to supervise vehicle registration, and is strongly focused on safety devices such as lights and brakes. MICIVI is currently working on the creation of the Road Transport Superintendence (SITRAN), whose primary function is to formulate public policies on road transportation, road safety and protection of the environment regarding road issues. The Vice-Ministry of Transportation through DGT has the authority to perform on-road supervision.

Also, MEM has the authority to define new regulations for imported fuels. This Ministry, through the Central American Integration System (SICA) is currently in regional talks to improve the quality of the fuels imported to the region, and one of the first steps will be to establish diesel fuel with 500 PPM of sulfur content. Another opportunity that MEM could promote is the reactivation of Law 17-85 to reduce emissions in this sector.

MARN, in its capacity of environmental authority, is gathering the information required to develop regulations on the use of older vehicles in poor condition. It is essential that MARN coordinate with MEM to establish a fuel improvement plan, and with MICIVI to include vehicle emissions in the control duties of that Ministry.

As part of the action plan for the sector, a NAMA represents an important option to obtain international financing for mitigation actions. According to www.nama-database.org there are 4 NAMAs related to transportation in Latin America: cargo transportation in Mexico, electric vehicles and Transit Oriented Development in Colombia, and Green Zone transport and a plan to prepare for electro-mobility in Chile. In the case of Guatemala, the possibility of replicating one of the NAMAs proposed in other Latin American countries should be considered. Other options, such as promoting the use of bio-fuels, could also be considered.

Lastly, in urban centers it is essential that MARN promote the development of integrated transportation systems such as Transmetro to change commuting habits and offer an alternative to the exponential growth of the stock of motor vehicles.

8.0 FORESTRY AND LAND USE SECTOR

8.1 INSTITUTIONAL FRAMEWORK

This chapter describes the main institutions associated with the forestry and land use sub-sector that participate directly or indirectly in the development of GHG inventories.

The three Guatemalan public sector institutions most involved in the forestry, land use and land use change sub-sectors are MAGA, INAB and CONAP.

Academic institutions that have worked substantially on studying changes in land use and especially in forest cover should also be included: Universidad Rafael Landívar through the Agriculture, Natural Resources and Environment Institute and UVG.

Several NGOs associated with this sector work actively on deforestation issues, in particular the Rainforest Alliance, WWF and Defenders of Nature.

MAGA

MAGA is the agricultural sector ministry, established through 114-97 Decree of the Congress of the Republic. Its objective is to achieve progressive and permanent progress in the quality of life of its prioritized subjects, and of rural populations through equitable access to and sustainable use of production resources, means of production, natural goods and environmental services to achieve sustainable integral human development in rural areas.

Its 2013 budget totals 1,564 million Quetzals, equivalent to approximately US$ 209 million. It has an annual operating plan (AOP) for 2013, prepared in consultation with SEGEPLAN and MINFIN, in the framework of results-oriented planning.

The Zero Hunger and Family Agriculture plans are considered MAGA's top priorities, particularly with populations in conditions of poverty and extreme poverty, which give this Ministry a strong social emphasis.

Family agriculture is important from the perspective of the sustainable use of forests and the reduction of deforestation; according to MAGA close to 40% of family farmers has direct access to forests through community ownership, municipal or returnee groups. Any improvement in the productivity of land use in this sector can reduce pressure on the forests and the intensity of Guatemalan emissions for food production. But according to MAGA (AOP 2013), family agriculture "is inefficient in terms of access to credit and technical markets, has deficient infrastructure and a low level of access to basic services".

Overcoming Guatemala's food deficit and poverty will require an increase in food production. A LEDS program should evaluate options for Guatemala to increase food yields per surface, with lower intensity of GHG emissions per unit of product while reducing pressure on the forests. The reduction of emissions

intensity is one of the approaches promoted by institutions such as the Global Research Alliance on Agriculture Emissions (GRA) and FAO, through their proposals on Climate-Intelligent Agriculture[4].

One of MAGA's major objectives is to "define jointly with MARN the national territorial ordering and land use policy and promote decentralized administration for the execution of this policy; this policy shall oversee the establishment and application of a system of legal regulations that clearly defines the rights and responsibilities associated with holding, using and exploiting in general such properties while they remain under the government's domain." This is a highly relevant aspect for a LEDS policy in Guatemala, which should also be coordinated with SEGEPLAN and CONAP. It should be kept in mind that Guatemala does not have a territorial ordering law in place.

Other decentralized institutions that are associated with MAGA are INAB, the Agricultural Science and Technology Institute (ICTA), the Cadastre Information Registry (RIC) and the Lands Fund (FONTIERRA).

Special Unit for Climate Change Execution - MAGA

In 2011 MAGA (Ministry Resolution No. 157-2011) created the Special Unit for Climate Change Execution with the general objective of "promoting through Ministry entities the adaptation of the Guatemalan agricultural sector to climate change, taking into account the scenarios and effects of climate change on various production activities. It has scheduled the following activities: provide training and technical upgrading for the adaptation to and mitigation of climate change of agriculture; develop studies, research and feasibility studies; perform monitoring and assessments applied to the adaptation to and mitigation of climate change in agriculture, assisting the Departmental Offices of the Ministry and the National Agricultural Extension System", among others. To date this system has only one technical employee, which seems inconsistent with its ambitious objectives.

The Geographic Information Laboratory is a key area to be strengthened within MAGA because of the importance of remote monitoring of land use and forest cover. This laboratory has the required technical capabilities, particularly its management team, but it strongly lacks equipment and resources to cover operational expenses. As a result, it is making very slow progress on a work program that is very important for the strategy, and the task has not been assigned greater priority in MAGA plans. It has participated –with varying degrees of depth – in the development of forest cover change maps in association with INAB, CONAP, UVG and URL, producing results that are not always consistent or harmonized. It has currently prioritized working on cartography of soil and reclassification of lands according to land use, which is relevant for a territorial ordering process.

MAGA is a key institution, not only for a low emissions development strategy in agriculture, but also for the sustainable use of forests and reducing deforestation. MAGA is directly related with the agents involved in these processes; therefore its participation in the GCI is essential.

INAB

INAB is the government entity responsible for forests in Guatemala. Figure 44 describes its main characteristics and objectives, and Figure 45 shows the incentive programs INAB currently has in operation.

[4]Climate-intelligent Agriculture is defined as agriculture that sustainably increases productivity and resiliency (adaptation), reduces/eliminates greenhouse effect cases (mitigation) and at the same time contributes to attained national objectives on food security and development.

Figure 44: National Forest Institute

INAB – NATIONAL FOREST INSTITUTE
• **Reports to MAGA** • **Autonomous and decentralized government entity** • **Direction and competent authority on forestry matters** • **Objectives:** - **Reduce deforestation;** - **Promote reforestation;** - **Increase forest productivity;** - **Promote public and private investment in forestry activities; and** - **Preserve the country's forest ecosystems.**

Forestry Incentives Program (PINFOR) and the incentives program for small landholders of lands suitable for agro-forestry (PINPEP) together are valuable instruments, but they only counteract a small part of forest cover loss. A LEDS initiative would require increasing the impact of these measures substantially.

In 2013 INAB plans to focus on the reduction of illegal logging, strengthening of links between forest and industry, and protection of water sources in the upper areas of river basins and riversides to protect existing forests.

Figure 45: INAB incentive programs for the reforestation and preservation of forests

PINFOR – Forestry Incentive Programs	PINPEP – Program of incentives for small landholders suitable for forests and agro-forestry
Objective: Encourage land owners to reforest and maintain forests and deforested lands - Program began in 1998 and ends in 2016 - Target to reforest 285,000 ha and manage 650,000 ha of forests Between 1998 and 2012 PINFOR assisted 4,889 reforestation projects for a total of 112,342 ha and 2,888 forest management projects for a total of 216,235 Ha. In 15 years PINFOR has achieved 40% of the goal and it only has 4 years remaining to complete the rest.	Objective: Encourage reforestation or forest conservation for owners of less than 15 Hectares - Initially financed by Netherlands - The program pays for seeds or natural forest management costs - Highly compatible with the REDD+ program Between 2007 and 2012 PINPEP provided incentives for 19,281 Ha, mostly (79%) to provide protective management to natural forests. PINPEP may become an important tool to resolve the problem of the unsustainable use of firewood.

CONAP

CONAP is an autonomous government entity that reports directly to the Presidency of the Republic through MARN. It is the maximum entity for the direction and coordination of the Guatemalan System of Protected Areas (SIGAP) and it has jurisdiction over the entire national territory.

CONAP members are MARN (which chairs it), MAGA, Center of Conservation Studies at San Carlos University (CECON-USAC), National Institute of Anthropology and History (IDAEH), National Association of Municipalities (ANAM), a delegate from NGO's involved in natural resources and the environment registered at CONAP, and the Guatemalan Tourism Institute (INGUAT). The main objectives of CONAP are to encourage and facilitate the conservation and improvement of Guatemala's natural heritage, including the conservation of biodiversity; organizing, directing and developing the SIGAP; and establishing a national fund for the conservation of nature with resources derived from internal and external cooperation.

The Executive Secretariat is responsible for executing CONAP policy decisions and carrying out its action plans; the Secretary is appointed directly by the President of the Republic.

The annual budget is close to $11 million, which is considered insufficient to fulfill their commitments, which involve the management of 320 protected areas and almost one third of the country's total area. The main problems of CONAP are governance of protected areas and the absence of territorial planning.

REDD+ is viewed by CONAP as an opportunity to invest in protected areas, given that currently 60% of its budget is spent on salaries and the remainder on expenses. REDD+ could contribute additional resources to maintain the PA, mainly for training, investment in infrastructure and to finance the master plans (All protected areas have master plans, but no resources to implement them).

According to studies by IARNA, even though deforestation rates are higher in the protected areas than outside of them, deforestation in these areas would be even greater if they were not protected. In any case it is evident that any initiative to reduce deforestation must target the problems monitoring and controlling the protected areas. This becomes even more important considering that nearly 53% of the forests in Guatemala are in protected areas. Community management of protected areas such as the Mayan Biosphere Reserve demonstrates the benefits that can be obtained from well-managed forest concessions and administrative decentralization.

8.2 AVAILABILITY AND ACCESS TO INFORMATION

In Guatemala there are numerous studies that provide information to build a LEDS program; however, these studies do not always offer the required level of detail, and therefore must be elaborated upon, updated and above all integrated into a national information platform.

The following are some of the main shortcomings of information for a LEDS program in the LULUCF sector:

- Statistical information with quality, consistency and timeliness problems. For example, the information provided by INE does not provide the required level of detail and is inconsistent.
- The information on changes in land use and vegetation cover is dispersed among different GIS laboratories and is not consistent. There seems to be little coordination and therefore duplication of efforts occurs. In order to implement a LEDS program in the LULUCF sector, Guatemala must have a central monitoring system of referenced based on remote sensors and field data. Capabilities need to be combined in order to reach a critical volume. This system would be the foundation for the GHG inventory, the MRV and the REDD+ programs.
- There are missing national data and calibrated models to estimate GHG emissions and removals in forests and other land uses for IPCC Level 2 or 3, taking into account all sources and carbon reservoirs, and minimizing current uncertainties.
- The need for a second national forest inventory.

8.3 COORDINATION WITH OTHER SECTORS

A successful LEDS plan in the LULUCF sector requires effective coordination with the agriculture (MAGA) and energy (MEM) sectors, based on interactions on certain issues such as land use change. In other words, INAB, CONAP and MARN need to coordinate with MAGA, MEM and SEGEPLAN, because LEDS implies long-term planning and territorial ordering. The coordination could be extended to INE to produce the statistics required for planning, monitoring and evaluation.

Based on the previous coordination experiences around specific tasks, such as the coordination that was created in the GCI, it seems essential to undergo an institutional redesign and create ad-hoc institutions capable of generating the coordination and leadership required for a successful LEDS program.

Coordination and leadership are therefore considered key success factors for LEDS, and the EC-LEDS phase should address and consolidate these aspects.

8.4 KEY OPPORTUNITIES FOR MITIGATION

Guatemala has displayed a sustained loss of forest cover and of the carbon density of its forests. In the five year period 2006-2010, gross losses hit a record of 132,000 Ha per year. This represents a 3.47% annual loss rate of national forest areas. Consequently, a first key opportunity for mitigation is to reduce the deforestation rate.

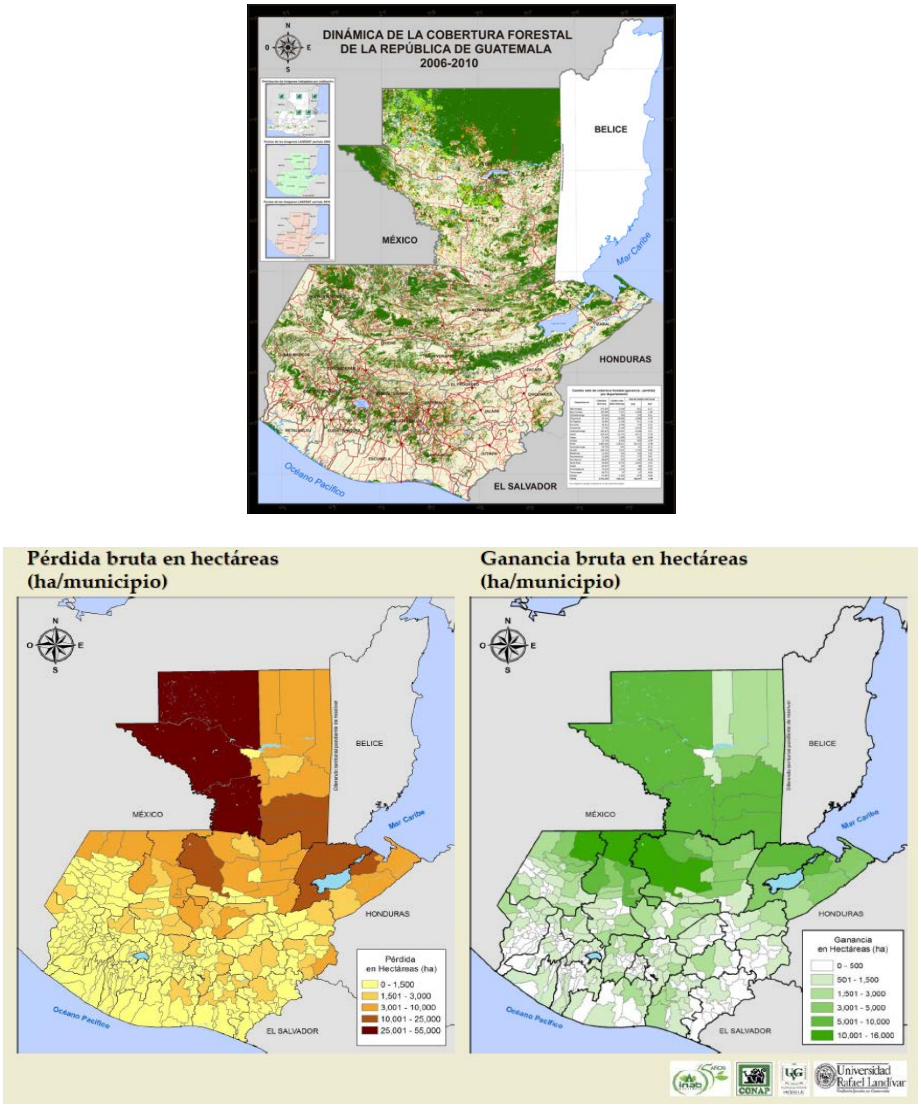
A very high proportion of loss of forests occurs in areas legally protected by SIGAP, which demonstrates the institutional weakness of SIGAP-CONAP. A successful strategy for the reduction of deforestation implies reaching a consensus diagnostic on the main and underlying causes of this phenomenon, and identifying the agents involved.

Top priority alternatives to reduce emissions in the land use and forestry sector:

1) Reduce the deforestation rate by controlling illegal logging and unsustainable management.
2) Promote sustainable development of forests to prevent degradation.
3) Monitor and control fires.
4) Promote sustainable extraction and use of firewood.
5) Promote assisted regeneration of deforested areas, especially in Protected Areas.
6) Promote plantations in deforested areas and those highly susceptible to erosion.
7) Increase production and productivity of food in agricultural lands and pastures.
8) Make progress in territorial zoning laws.

Deforestation and degradation of forests are complex situations caused by several factors. Several opinions and reports (e.g., the Environmental Profile of Guatemala 2010-2012, prepared by IARNA) indicate that in Guatemala the causes of deforestation are different depending on the region, and are related to large extensions of land taken over by drug trafficking activities, settlements from internal migration of rural communities, the expansion of certain crops (oil palm and others), illegal logging, forest fires and expansion of cattle ranching. It could also be assumed that an underlying cause is the weak role of the government and the lack of control and oversight of large areas of the national territory. Figure 46 illustrates the type of cartographic information available for this sector.

Figure 46: Example of cartography available for the LULUCF sector



One of the requirements to reduce deforestation rates is strengthening the role of government, in the framework of dialogues and consensus-building around objectives with public and private stakeholders.

Reducing pressure on the forests, while increasing productivity of agricultural lands and grasslands, would also seem essential in a country with high demographic rates, high levels of poverty and food and energy security risks. As a result, the policies for reducing deforestation and forest degradation go beyond the institutional capabilities of INAB and CONAP, and involve institutions such as MAGA, MARN, SEGEPLAN and MEM.

In addition to reducing deforestation, a second key opportunity is to minimize forestry practices that degrade forest resources by promoting forest restoration and sustainable forestry management. Given that land is considered deforested only when forest land becomes land without a forest, forest degradation processes and their associated carbon emissions are not taken into account. A third opportunity is to increase the reforestation rate of deforested lands and promote assisted forest regeneration.

Extraction of firewood is another source of pressure on the forests. The collection of dry branches and dead trees is a sustainable use of the forest. However, a certain percentage of firewood consumption comes from felling forests. Control of this type of extraction is beneficial from the perspective of emissions, but as clearly expressed by the government in several interviews; firewood is a basic energy source for a very high percentage of households (over 60%) and has deep ancestral roots. As a result, it is not possible to propose limitations on the use of firewood without developing sustainable supplies and without promoting more efficient use (for example in kitchens with efficient combustion).

Lastly, forest fires, generally intentional, account for a significant amount of emissions, especially in some years. Therefore strengthening of forest fire alarm and control systems is as another significant opportunity for LEDS in the forestry sector.

8.5 ACTION PLAN FOR THE SECTOR

The forestry sector poses major challenges as well as opportunities for LEDS in Guatemala. It is essentially about reducing deforestation rates and the degradation of forests and promoting an increase in existing and new forest carbon stocks.

To this end it is essential to strengthen forestry governance and the main public institutions directly involved in the issue (INAB, CONAP, MARN and MAGA, coordinated in the framework of the GCI, along with SEGEPLAN), also involving the private sector and rural communities.

In this context of governance strengthening it is important to consider the National Forestry Plan of Guatemala.

Guatemala has made progress in generating information about the causes of deforestation. However, there is a consensus that more specific information is required in the different regions of the country to further quantify the losses, as well as geo-spatial analysis and participative evaluation of the main and underlying causes and agents of deforestation.

Some necessary actions include:

- Territorial planning, including strengthening of SIGAP and CONAP;
- Environmental monitoring and control;
- Promotion of sustainable productive activities;
- Involvement of the private business sector;
- Development of technical baseline information, including GIS, databases and collection of data at monitoring stations;
- Education, training and communications;
- Access to international cooperation;
- Participation of civil society and social inclusion; and
- Creation of capabilities to take advantage of the opportunities that arise from REDD+, including the development of MRV capabilities.

In forest lands it would be possible to:

- Promote sustainable forestry management and the valuation of wood and non-wood products and ecosystem services;
- Strengthen governance in protected areas, particularly those threatened by deforestation;
- Improve fire alarm and control systems;
- Fight illegal logging;
- Valuate socio-cultural and environmental diversity;

- Analyze the viability of a system of payments for environmental services; and
- Continue working and to leverage opportunities to access the REDD+ mechanism

In non-forest lands it would be possible to:

- Promote an increase in productivity in agricultural and grass lands;
- Promote reforestation and assisted regeneration based on territorial ordering criteria;
- Leverage programs such as PINFOR and PINPEP to create forests that provide firewood in a sustainable manner; and
- Develop initiatives that take advantage of incentives derived from access to the carbon market (markets regulated under UNFCCC and voluntary market under standards such as VCS), through projects and Programs of Activities.

A component of a sector-based action plan is preparation for REDD+. Guatemala has begun to raise support and has prepared a Readiness Preparation Proposal (R-PP), which was submitted in 2013 to the Forest Carbon Partnership Facility (FCPF) of the World Bank and to the United Nations REDD+ Programme (UN-REDD). The R-PP has four main components: (1) Organization and Consultations, (2) Evaluation of Land Use, Forestry Policy and Forest Governance, (3) Development of a Baseline Scenario, and (4) Design of a Monitoring System.

9.0 THE PATH TOWARDS LEDS IN GUATEMALA

9.1 GOVERNMENT LEADERSHIP AND INSTITUTIONAL STRENGTHENING

The existing institutional structure and experience in Guatemala has high potential and good foundations for LEDS development. Since the ratification of the UNFCCC in 1992, the UCC is the institution that has been taking the lead on most climate change activities. Despite the qualifications and experience of the UCC, it needs to be refocused to continue performing its activities. They especially need to improve coordination with other Ministries on availability and quality of information for each sector. Other aspects that could also be improved are the methodologies used during GHG inventories development, analysis of the impacts of and adaptation to climate change, and technical support to institutions involved in climate change.

One of the challenges found at the government level is the need to broaden the consultation and participation process within other Ministries and sectors of the country. Information on the sectors must be transparent to reach consensus during the strategy development and actively involve stakeholders. The objective is to ensure that the relationship between MARN and the other stakeholders improves; leading to increases in the quality and quantity of information needed during GHG inventory development. This will improve access to detailed information on emissions per sector and provide a platform to analyze abatement measures targeted at specific sub-sectors. During the strategy development phase, it will be necessary to merge all these efforts. In this regard, the most evident challenge will be reaching a consensus on the methodologies to be used among the various institutions to make cross-sectorial use of the generated information.

As a complement to MARN, SEGEPLAN plays a key role in national planning and programming and is a major protagonist for strategy development. The participation of SEGEPLAN in the strategy development process is important in terms of hierarchy, because it has the authority to formulate programs at the national, regional and municipal levels. The two greatest challenges identified are related first with the hierarchical level of the Environmental Sustainability Policies Unit, and secondly with the performance of the Sub-Secretariat for Territorial Ordering:

- The unit within SEGEPLAN that has been assigned the climate change issue, which reports to the Strategic Development Studies Directorate, should be transferred to one of the directorates directly involved in the planning process, in order to ensure that the policies of SEGEPLAN effectively incorporate the LEDS component.
- SEGEPLAN has a specific Sub-Secretariat for Planning and Territorial Ordering that would seem appropriate for preparing a bill establishing a territorial ordering plan that includes enforcement and control with an emphasis on issues of deforestation and changes in land use. As mentioned in Chapter 2, there is a lack of coordination between land use plans and supervision.

Lastly, it is worth highlighting that PRONACOM is another institution that could explicitly support SEGEPLAN in its role as LEDS promoter. During the planning and programming process, cooperation between PRONACOM and SEGEPLAN will enable broadening the scope of the plans and programs beyond the public sector to reach the private sector through measures that could be coordinated through the Ministry of the Economy.

The **National Competitiveness Program (PRONACOM)** is the institution assigned by the government to promote competitiveness by working with the public and private sectors. Located in the Ministry of the Economy, its objective is to "*facilitate inter-institutional efforts and alliances between sectors to improve competitive conditions related to the business environment, promote national and foreign investment to contribute to the decentralized development of Guatemala*". During the development of the strategy, the scope of private sector policies becomes a key component to successfully implement the selected mitigation measures. In this sense, PRONACOM, with its public-private focus, could become a key member of the GCI or CICC to facilitate the penetration of the measures at the sector level.

9.2 ACCESSIBILITY OF DATA AND INFORMATION

During LEDS development, it is essential to have reliable and updated sources of information with their corresponding uncertainty analyses. It is also necessary to have data available that enables the development and updating of abatement curves, which will facilitate the identification of abatement measures to be implemented during the strategy. In this regard, the first step to be taken is to review the three existing GHG inventories and to update the GHG inventory to a more recent year such as 2010 or 2012, with updated emission factors and activity data.

One of the challenges identified during the meetings with institutions is to define what baseline information will be used by these institutions as platform to develop their research work. The type of information required is used directly or indirectly in the analyses by sector, and includes maps with municipal and property boundaries, forest cover, types of soil and demographic information.

It is also necessary to develop and coordinate the implementation of an action plan that enables calculation of emission factors specifically for Guatemala, in order to prepare and move to "Tier 2" emission reports. The top priority emission factors in Guatemala include emissions from agricultural soil, cement production, sugar cane production, and especially carbon absorption rates for the different types of forests found in Guatemala.

In the specific case of projects financed through international cooperation agencies, it would seem reasonable to include a step to "officialize" the information developed in coordination with the appropriate government institution for the corresponding sector. This would promote consolidation of newly generated information with previously available data, leading to the creation of a public information system that is complete and congruent.

The communication of information and results, e.g., pilot projects, is a key tool to publicize the impact and results that can be expected from the abatement measures to stakeholders. Such is the case of the energy efficiency measures of CGP+L, whose open policy regarding costs and benefits associated with the implementation of projects has enabled it to increase its scope to new industries and population sectors.

INE should strengthen its capacity to include the information required for the development of the climate change agenda in national surveys and censuses. For example, animal race and sex in agricultural censuses and redefining sampling parameters in agricultural surveys to provide the information required for GHG inventory development, baseline emission scenarios and abatement cost curves. It would be interesting to explore synergies between the information collected by INE and the information of other institutions such as Banco de Guatemala, INAB and/or CONAP, with the objective of obtaining more solid results that will help reduce perceived uncertainty in many sectors.

During LEDS development, it is advisable to develop an emission abatement marginal cost curve. It is necessary to identify in detail the volume of emissions for each sector and sub-sector where abatement measures are to be assessed. For example, to analyze the use of anaerobic digesters in the swine sub-sector, the main production parameters must be available, including a description of the current status of manure

management and the assumptions that were used to calculate the emissions reported in the inventory. Only then it will be possible to establish the current situation of emissions prior to installation the system, which can be compared to the technical data of the proposed technology in order to establish the abatement potential. This information will be the basis for the development of abatement curves.

9.3 INDICATIVE ACTION PLAN

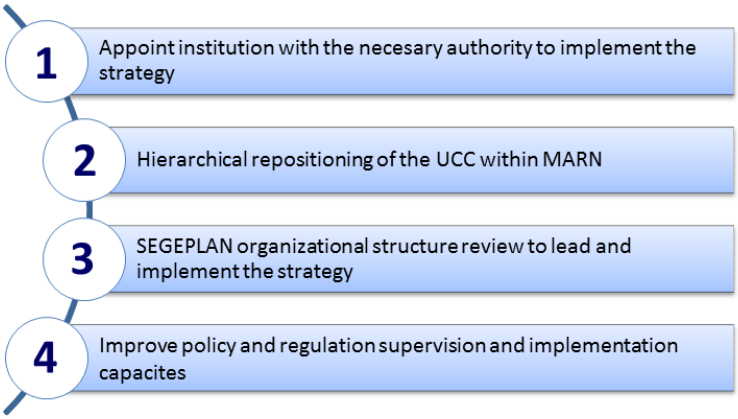
The top priority actions identified in the context of LEDS have an institutional and a technical component:

Indicative institutional action plan

Figure 47 summarizes the following recommended steps as part of an institutional action plan.

1. Appoint or assign an existing government coordination entity with enough authority to take the lead on climate change issues; this unit should have the authority to demand specific actions from Ministries and other government institutions. A structure led by the Vice-President of the Republic, as was the case of the CICC in 2011, worked effectively and could be replicated.
2. Reposition the UCC within MARN to increase resource access and flexibility, to effectively provide technical support to other institutions.
3. In the case of SEGEPLAN review the organizational structure to ensure that the LEDS component is effectively incorporated in government plans and programs.
4. Improve the capacity to manage, execute and oversee existing environmental policies to ensure regulatory compliance.

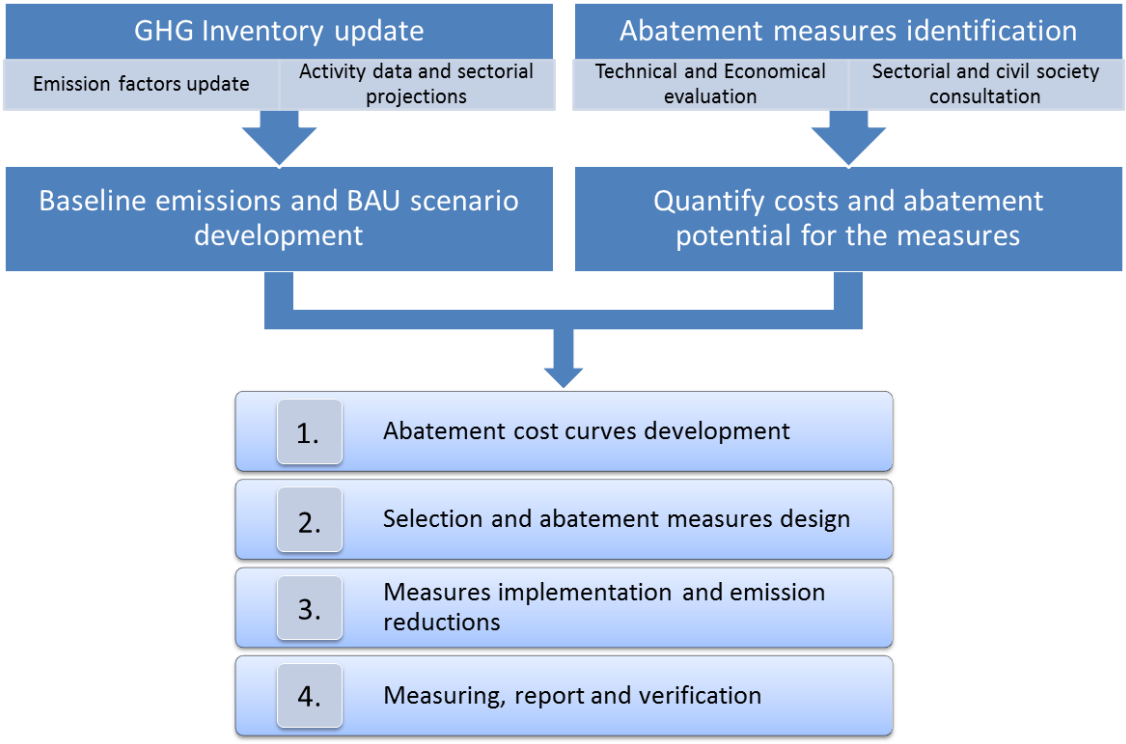
Figure 47: Indicative institutional action plan



Indicative technical action plan

Figure 48 shows an outline of the indicative action plan at the technical level for strategy development. Two major requirements have been identified in parallel: the need to update the inventory and the need to identify abatement measures for developing emissions marginal cost curves.

Figure 48: Indicative LEDS action plan



1. **GHG Inventory Update**: For this, it will be necessary to retroactively review the documentation of the GHG inventories for the years 1990, 2000 and 2005 to clarify the methodology for calculating of emissions and maintain consistency in the updated version of the inventory. In combination with the above, it will be necessary to formalize periodic procedures for gathering information at the national level and establish a solid program that transcends possible changes in government administrations and institutional priorities.
    - Develop emission factors specifically for the activities that are most relevant for emissions, i.e. forestry and land use, agriculture, sugar cane and main agricultural crops, cement production and electric power generation; and
    - Obtain activity data for each sector including development forecasts so as to estimate the emissions of each sector. Whenever possible take steps towards more precise emissions calculation methods (Tier 2).
2. **Develop, propose, discuss and reach a consensus on an emissions baseline and a BAU scenario**. The government, jointly with the private sector, academics, NGOs, representatives of indigenous communities and other civil society institutions must reach a consensus on a realistic forecast of the behavior of each sector. The forecast development scenario for the future combined with the associated emission factors are used to develop the BAU scenario.
3. **Abatement measures**: Perform a study to identify potential abatement measures for Guatemala.
    - Establish compliance with technical, economic and political requirements;
    - Propose, identify and reach a consensus on the economic scenario to be used for the evaluation of the mitigation measures using the emissions abatement cost curves;
    - Define the desirable Internal Rate of Return (IRR) for the private sector to invest in projects associated with the strategy, and use this parameter for comparisons; and

- Develop a social and sectorial consultation process for each of the identified measures to ensure that social conditions are favorable for implementation.

4. **Quantify potential and cost**: For each of the measures identified, calculate the CO_2e abatement capacity based on the real potential of emission reductions compared to the current BAU emissions forecast.
5. **Develop Abatement Marginal Cost Curves** through a combination of the BAU scenario and the new emissions scenario associated with the implementation of the abatement measures.
6. **Select and design the abatement measures:** Identify those with the greatest potential for abatement, the most economically favorable, and reach a consensus of the measures to be implemented with stakeholders. Design the implementation mechanisms by means of a participative process led by the government.
7. **Implementation of emissions reduction measures**: Implement the selected abatement measures with stakeholder involvement. They may include mechanisms such as Programs of Activity (PoAs) or NAMAs (Annex 13), to take advantage of carbon financing. It should be mentioned that in this stage of PoAs or NAMAs the action plan can be moved forward. There are measures of recognized effectiveness and profitability, so it is not necessary to wait for the development of steps 1 through 7 of the national baseline and the corresponding abatement curves. It would be interesting to explore some NAMA projects from the outset, which would also make it possible to broaden the analysis associated to the development of abatement curves.
8. **MRV**: Monitoring, reporting and verification measures should be included in the design stage in order to follow up on the mitigation measures that were decided to be implemented.

NAMAs (National Appropriate Mitigation Actions) **and PoAs** (Programs of Activities) are key mechanisms to be taken into consideration during strategy implementation. Both mechanisms allow incorporation of several individual projects under a single NAMA or PoA, thereby reducing costs and implementation time for individual projects. The identification and promotion of a portfolio of NAMAs and PoAs identified by public and private agents can represent a focus point from which to coordinate the specific activities of the LEDS Program in Guatemala. It would be useful to publicize Guatemalan mitigation efforts and will facilitate access to resources for the formulation and implementation of the projects of greatest interest and impact. See Annex 13.

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ANNEX 1: CHANGES IN LAND COVER AND USAGE 1999-2003

Cuadro 12. Cambios en la cobertura y uso de la tierra, en el periodo 1999 a 2003

	Tierras forestales	Praderas	Tierras agrícolas	Asentamientos	Otras tierras	Humedales	Cambios a agua	Superficie final
Tierras forestales	3,037,245.56	356,634.10	656,268.75	3,113.95	14,689.59	169,345.81	9,753.86	**4,247,051.61**
Praderas	916,665.93	1,288,387.85	1,496,445.91	5,847.27	11,230.53	44,882.99	5,326.51	**3,768,786.99**
Tierras agrícolas	434,606.39	381,639.36	1,631,333.05	5,661.09	6,809.21	8,242.74	1,687.08	**2,469,978.92**
Asentamientos	0.00	0.00	0.00	114,187.51	0.00	0.00	0.00	**114,187.51**
Otras tierras	2,632.12	1,716.41	4,059.25	216.21	4,095.50	63.20	109.75	**12,892.44**
Humedales	39,814.68	15,622.53	10,506.79	1.81	4,407.68	24,773.01	4,611.10	**99,737.60**
Cambios a agua	0.00	0.00	0.00	0.06	0.00	0.00	176,264.87	**176,264.93**
Superficie inicial	**4,430,964.69**	**2,044,000.23**	**3,798,613.75**	**129,027.91**	**41,232.51**	**247,307.75**	**197,753.16**	**10,888,900.00**
Cambio NETO	**-183,913.08**	**1,724,786.75**	**-1,328,634.83**	**-14,840.40**	**-28,340.07**	**-147,570.15**	**-21,488.23**	**10,888,900.00**

Fuente: Inventarios Sectoriales de Gases de efecto Invernadero para el 2005. Segunda Comunicación Nacional sobre Cambio Climático

ANNEX 2: GHG INVENTORY: YEAR 2005

Inventario Nacional de Gases de Efecto Invernadero Año Base: 2005 Guatemala

Cuadro No. 2: Emisiones y Absorciones Nacionales
Gases de Efecto Invernadero para el año 2005
(Gg, miles de toneladas)

Gases de Efecto Invernadero y Categoría de Sumideros	CO_2 emisiones	CO_2 absorciones	CH_4	N_2O	NO_x	CO	NMVOCs	SO_x
Emisiones y Absorciones Nacionales (Totales)	**12,553.7422**	**-16,227.9253**	**271.6963**	**55.0496**	**106.4926**	**1,691.8662**	**414.5765**	**90.4884**
1. Energía	**11,012.6529**	**0**	**44.4954**	**0.7068**	**87.1039**	**1,078.0296**	**150.8078**	**89.9506**
A. Quema de Combustibles	11,012.6529		44.3879	0.7068	86.9366	1,077.7786	149.0787	87.3570
1. Industria energética	2,758.5557		0.0751	0.0294	7.8052	0.5554	0.1652	26.0067
2. Industria Manufacturera y Construcción	1,731.4869		0.2757	0.0440	5.0960	31.2080	0.4954	15.2271
3. Transporte	5,976.0400		0.9423	0.0546	58.4555	329.2880	62.3967	7.9153
4. Otros sectores	546.5703		43.0948	0.5788	15.5799	716.7272	86.0214	38.2079
5. Otros	0		0	0	0	0	0	0
B. Emisiones Fugitivas	0		0.1075		0.1673	0.2510	1.7291	2.5936
1. Combustibles sólidos			0		0	0	0	0
2. Petróleo y Gas Natural			0.1075		0.1673	0.2510	1.7291	2.5936
2. Procesos Industriales	**1,541.0893**	**0**	**0**	**0**	**0**	**0**	**263.7687**	**0.5378**
A. Producción de Minerales	1,541.0893				0	0	230.4809	0.5378
B. Industria Química								
C. Producción de Metal	0		0	0	0	0	0	0
D. Otras Producciones	0		0	0	0	0	33.2878	0
G. Otros	0		0	0	0	0	0	0
3. Uso de Solventes y de otros productos	**0**			**0**			**0**	
4. Agricultura			**167.5130**	**53.6571**	**16.8819**	**525.5592**	**0**	**0**
A. Fermentación Entérica			139.0409					
B. Manejo de Estiércol			5.1897	0.7154			0	
C. Cultivo de Arroz			0.3640				0	
D. Suelos Agrícolas				52.4746			0	
E. Quema prescritas de sabanas			8.4332	0.1044	3.7719	221.3702	0	
F. Quema de residuos agrícolas en el campo			14.4852	0.3627	13.1100	304.1890	0	
G. Otros			0	0	0	0	0	
5. Cambio de Uso de la Tierra y Silvicultura	**0**	**-16,227.9253**	**10.0888**	**0.0694**	**2.5069**	**88.2774**	**0**	**0**
A. Cambios en Bosque y otras reservas de biomasa leñosa	0	-24,193.1484						
B. Conversión de Bosques y Sabanas	8,264.1355	0.0000	10.0888	0.0694	2.5069	88.2774		
C. Abandono de Tierras Manejadas		-264.2183						
D. Emisiones y Absorciones de CO_2 del suelo	0.0000	-34.6941						
E. Otros	0	0	0	0	0	0		
6. Desechos			**49.5991**	**0.6163**	**0**	**0**	**0**	**0**
A. Disposición de Desechos sólidos en la Tierra			45.7636		0		0	
B. Disposición de Agua de Desechos			3.8355	0.6163	0	0	0	
C. Incineración de Desechos					0	0	0	0
D. Otros			0	0	0	0	0	0
7. Otros	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Items de Memo								
Depósitos Bunkers Internacionales	**220.9553**		**0.0017**	**0.0071**	**0.7764**	**0.5032**	**0.0605**	**0.0699**
Aviación	220.9553		0.0017	0.0071	0.7764	0.5032	0.0605	0.0699
Marino	0		0	0	0	0	0	0
Emisiones de CO_2 provenientes de la Quema de Biomasa	**17,806.8968**							

Fuente: Inventarios Sectoriales de Gases de efecto Invernadero para el 2005. Segunda Comunicación Nacional sobre Cambio Climático

ANNEX 3: EVOLUTION OF GHG EMISSIONS

Evolution of GHG Emissions in Guatemala - 1990, 2000 and 2005
(Normalized to Gg. CO_2 Equivalent*)

			CO_2 Gg CO_2	CH_4 Gg CO_2e	N_2O Gg CO_2e	TOTAL Gg CO_2e	Evolución entre 1990 - 2005
Energy	Años	1990	3,700	722	161.2	**4,584.0**	**265%**
		2000	9,343	874	209.8	**10,426.6**	
		2005	11,013	934	219.1	**12,166.2**	
Industrial Processes	Años	1990	545	0	0.0	**544.7**	**283%**
		2000	1,236	0	0.0	**1,235.7**	
		2005	1,541	0	0.0	**1,541.1**	
Agriculture	Años	1990		2,727	6,104.2	**8,831.5**	**228%**
		2000		2,742	16,729.4	**19,471.1**	
		2005		3,518	16,633.7	**20,151.5**	
LULUCF	Años	1990	3,245	103	10.5	**3,357.9**	**253%**
		2000	10,742	349	35.5	**11,127.1**	
		2005	8,264	212	21.5	**8,497.5**	
Waste	Años	1990		638	143.8	**782.0**	**158%**
		2000		871	178.2	**1,049.3**	
		2005		1,042	191.1	**1,232.6**	

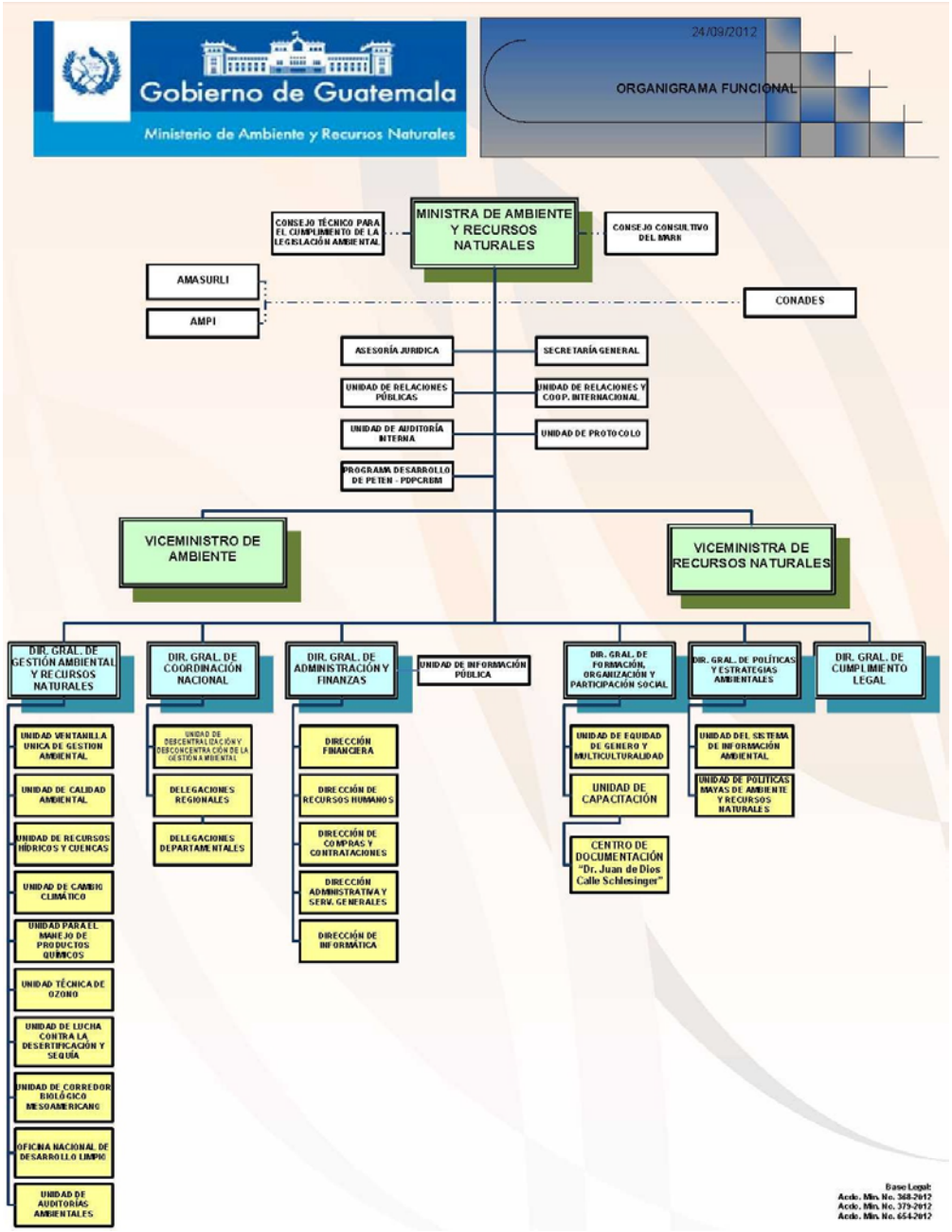
TOTAL	**Años**	**1990**	**41%**	**7,490**	**23%**	**4,191**	**35%**	**6,420**	**18,100.1**
		2000	**49%**	**21,321**	**11%**	**4,836**	**40%**	**17,153**	**43,309.8**
		2005	**48%**	**20,818**	**13%**	**5,706**	**39%**	**17,065**	**43,588.9**

ANNEX 4: DISTRIBUTION OF PERMAMENT AND TEMPORARY STAFF AT MARN

STAFF COMPOSITION WITHIN THE MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES (MARN)

	Permanent Staff		Advisors and Consultants		Total	
	Number	%	Number	%	Number	%
MINISTERIAL OFFICE	**43**	**54%**	**37**	**46%**	**80**	**12.5%**
OFICINA DEL DESPACHO SUPERIOR	4	100%	0	0%	**4**	**0.6%**
ASESORIA JURIDICA	11	61%	7	39%	**18**	**2.8%**
UNIDAD DE RELACIONES Y COOPERACION INTERNACIONAL	1	33%	2	67%	**3**	**0.5%**
UNIDAD DE RELACIONES PUBLICAS	5	83%	1	17%	**6**	**0.9%**
UNIDAD DE PROTOCOLO	1	50%	1	50%	**2**	**0.3%**
UNIDAD DE AUDITORIA INTERNA	8	89%	1	11%	**9**	**1.4%**
SECRETARIA GENERAL	1	33%	2	67%	**3**	**0.5%**
PROGRAMA DE DESARROLLO DE PETEN PARA CONSERVACION DE LA RESERVA DE LA BIOSFERA MAYA	0	0%	21	100%	**21**	**3.3%**
DELEGACION DEPARTAMENTAL DE PETEN (AMPI)	6	100%	0	0%	**6**	**0.9%**
PROYECTO CCAD/USAID/DR-CAFTA	0	0%	1	100%	**1**	**0.2%**
CONADES	6	86%	1	14%	**7**	**1.1%**
ENVIRONMENTAL VICEMINISTRY	**413**	**84%**	**80**	**16%**	**493**	**77.3%**
OFICINA DEL VICEMINISTRO DEL AMBIENTE	3	100%	0	0%	**3**	**0.5%**
DIRECCION GENERAL DE GESTION AMBIENTAL Y RECURSOS NATURALES	40	56%	32	44%	**72**	**11.3%**
UNIDAD DE CAMBIO CLIMATICO + PROGRAMA NACIONAL DE CAMBIO CLIMÁTICO	4	40%	6	60%	**10**	**1.6%**
UNIDAD DE RECURSOS HIDRICOS Y CUENCAS	12	75%	4	25%	**16**	**2.5%**
UNIDAD DE CBM (CORREDOR BIOLOGICO MESOAMERICANO)	3	75%	1	25%	**4**	**0.6%**
OFICINA NACIONAL DE DESARROLLO LIMPIO	1	50%	1	50%	**2**	**0.3%**
UNIDAD DE CALIDAD AMBIENTAL	1	100%	0	0%	**1**	**0.2%**
UNIDAD DE PRODUCTOS QUIMICOS	9	82%	2	18%	**11**	**1.7%**
UNIDAD DE LUCHA CONTRA LA DESERTIFICACION Y LA SEQUIA	2	50%	2	50%	**4**	**0.6%**
UNIDAD TECNICA DE OZONO	1	100%	0	0%	**1**	**0.2%**
VENTANILLA UNICA DE GESTION AMBIENTAL	2	100%	0	0%	**2**	**0.3%**
ARCHIVO DE GESTION AMBIENTAL	1	100%	0	0%	**1**	**0.2%**
DIRECCION GENERAL DE COORDINACION NACIONAL + DELEGACIONES REGIONALES Y DEPARTAMENTALES	236	98%	5	2%	**241**	**37.8%**
DIRECCION GENERAL DE ADMINISTRACION Y FINANZAS	4	67%	2	33%	**6**	**0.9%**
UNIDAD DE INFORMACION PUBLICA	0	0%	2	100%	**2**	**0.3%**
DIRECCION DE RECURSOS HUMANOS + CLINICA MEDIA	16	76%	5	24%	**21**	**3.3%**
DIRECCION FINANCIERA + (CONTABILIDAD, INVENTARIOS, PRESUPUESTO Y TESORERIA)	12	71%	5	29%	**17**	**2.7%**
DIRECCION DE INFORMATICA	5	50%	5	50%	**10**	**1.6%**
DIRECCION ADMINISTRATIVA Y SERVICIOS GENERALES	55	92%	5	8%	**60**	**9.4%**
DIRECCION DE COMPRAS Y CONTRATACIONES + UNIDAD ALMACEN	6	67%	3	33%	**9**	**1.4%**
NATURAL RESOURCES VICEMINISTRY	**49**	**75%**	**16**	**25%**	**65**	**10.2%**
OFICINA DEL VICEMINISTRO DE RECURSOS NATURALES	2	100%	0	0%	**2**	**0.3%**
DIRECCION GENERAL DE POLITICAS Y ESTRATEGIAS AMBIENTALES	5	45%	6	55%	**11**	**1.7%**
UNIDAD DE SISTEMA DE INFORMACION AMBIENTAL	0	0%	2	100%	**2**	**0.3%**
DIRECCION GENERAL DE FORMACION,ORGANIZACION Y PARTICIPACION SOCIAL	19	83%	4	17%	**23**	**3.6%**
UNIDAD DE EQUIDAD DE GENERO Y DE MULTICULTURALIDAD	3	100%	0	0%	**3**	**0.5%**
CENTRO DE DOCUMENTACION "DR.JUAN DE DIOS CALLE	0	0%	1	100%	**1**	**0.2%**
DIRECCION GENERAL DE CUMPLIMIENTO LEGAL	20	87%	3	13%	**23**	**3.6%**
	505	**79%**	**133**	**21%**	**638**	**100.0%**

ANNEX 5: MARN ORGANIZATIONALCHART



ANNEX 6: DISTRIBUTION OF PERMANENT AND TEMPORARY STAFF AT SEGEPLAN

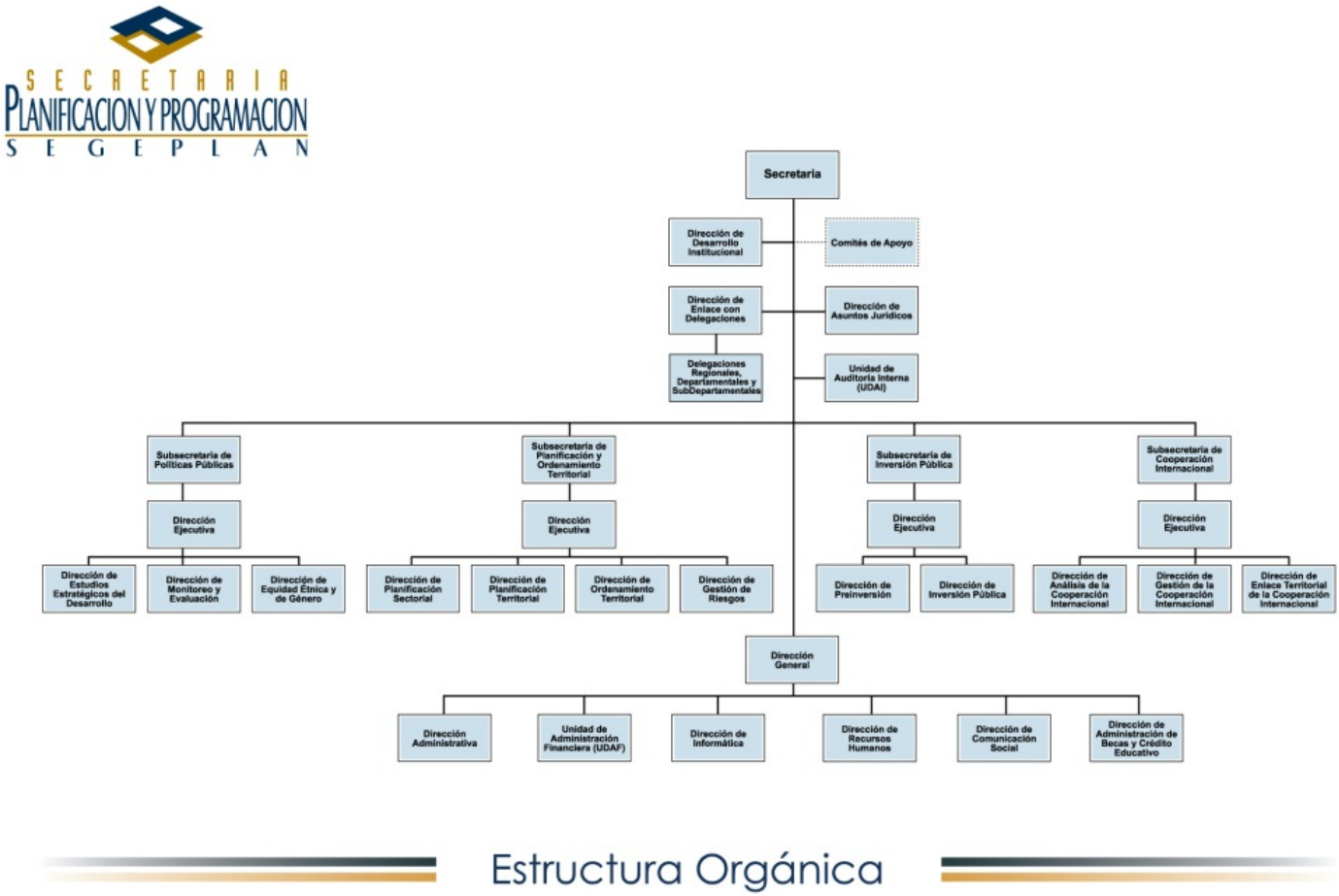
STAFF COMPOSITION OF THE PLANNING AND PROGRAMMING SECRETARIAT OF THE PRESIDENCY (SEGEPLAN)

	Permanent Staff		Temporary Staff		Total	
	Number	%	Number	%	Number	%
SEGEPLAN MAIN OFFICE	**107**	**91%**	**10**	**9%**	**117**	**29%**
OFICINA DEL DESPACHO SUPERIOR	6	75%	2	25%	8	2%
DIRECCIÓN DE DESARROLLO INSTITUCIONAL	6	46%	7	54%	13	3%
UNIDAD DE AUDITORIA INTERNA	5	100%			5	1%
DIRECCION DE ASUNTOS JURIDICOS	4	80%	1	20%	5	1%
UNIDAD DE ACCESO A LA INFORMACION	2	100%			2	1%
DIRECCIÓN DE ENLACE CON DELEGACIONES	3	100%			3	1%
DELEGACIONES DEPARTAMENTALES	81	100%			81	20%
PUBLIC POLICY SUBSECRETARIAT	**12**	**48%**	**13**	**52%**	**25**	**6%**
OFICINA SUBSECRETARIA DE POLITICAS PUBLICAS	2	22%	7	78%	9	2%
DIRECCION EJECUTIVA DE LA SUBSECRETARÍA DE PÚBLICAS PÚBLICAS	1	100%			1	0%
DIRECCION DE ESTUDIOS ESTRATÉGICOS DEL DESARROLLO	3	50%	3	50%	6	2%
DIRECCION DE EQUIDAD ÉTNICA Y DE GÉNERO	3	100%			3	1%
DIRECCION DE MONITOREO Y EVALUACIÓN	3	50%	3	50%	6	2%
PLANNING AND LAND USE SUBSECRETARIAT	**26**	**25%**	**76**	**75%**	**102**	**26%**
OFICINA SUBSECRETARÍA DE PLANIFICACIÓN Y ORDENAMIENTO TERRITORIAL	4	24%	13	76%	17	4%
DIRECCION EJECUTIVA DE LA SUBSECRET. DE PLANIFIC. Y ORD.TERRITORIAL	2	100%			2	1%
DIRECCION DE PLANIFICACIÓN TERRITORIAL	6	12%	43	88%	49	12%
DIRECCIÓN DE PLANIFICACION SECTORIAL	10	91%	1	9%	11	3%
DIRECCION DE GESTION DE RIESGOS	1	13%	7	88%	8	2%
DIRECCIÓN DE ORDENAMIENTO TERRITORIAL	3	20%	12	80%	15	4%
PUBLIC INVESTMENT SUBSECRETARIAT	**30**	**88%**	**4**	**12%**	**34**	**9%**
OFICINA DE LA SUBSECRETARÍA DE INVERSIÓN PÚBLICA	6	67%	3	33%	9	2%
DIRECCIÓN EJECUTIVA DE INVERSIÓN PUBLICA	2	100%			2	1%
DIRECCION DE PREINVERSION	6	86%	1	14%	7	2%
DIRECCION DE INVERSION PUBLICA	16	100%			16	4%
INTERNATIONAL COOPERATION SUBSECRETARIAT	**20**	**100%**	**0**	**0%**	**20**	**5%**
OFICINA DE LA SUBSECRETARÍA DE COOPERACIÓN INTERNACIONAL	2	100%			2	1%
DIRECCIÓN EJECUTIVA DE SUBSECRETARIA DE COOPERACIÓN INTERNACIONAL	2	100%			2	1%
DIRECCION DE ENLACE TERRITORIO DE LA COOPERACIÓN INTERNACIONAL	2	100%			2	1%
DIRECCION DE GESTION DE LA COOPERACION INTERNACIONAL	10	100%			10	3%
DIRECCIÓN DE ANALISIS DE LA COOPERACIÓN INTERNACIONAL	4	100%			4	1%
GENERAL DIRECTION	**86**	**86%**	**14**	**14%**	**100**	**25%**
OFICINA DIRECCION GENERAL	3	75%	1	25%	4	1%
DIRECCIÓN DE COMUNICACIÓN SOCIAL	2	33%	4	67%	6	2%
DIRECCION DE ADMINISTRACIÓN DE BECAS Y CRÉDITO EDUCATIVO	8	100%			8	2%
DIRECCION ADMINISTRATIVA	9	100%			9	2%
UNIDAD DE SERVICIOS GENERALES	20	100%			20	5%
UNIDAD DE TRANSPORTES Y SEGURIDAD	14	100%			14	4%
DIRECCIÓN DE RECURSOS HUMANOS	13	93%	1	7%	14	4%
UNIDAD DE ADMINISTRACIÓN FINANCIERA	12	60%	8	40%	20	5%
DIRECCION DE INFORMATICA	5	100%			5	1%
	281	**71%**	**117**	**29%**	**398**	**100%**

* Permanent Staff = Codes 11 and 2, Temporary staff codes 29,18,52 and 61

Source: SEGEPLAN Public Information Platform, March 2013

ANNEX 7: SEGEPLAN ORGANIZATION CHART

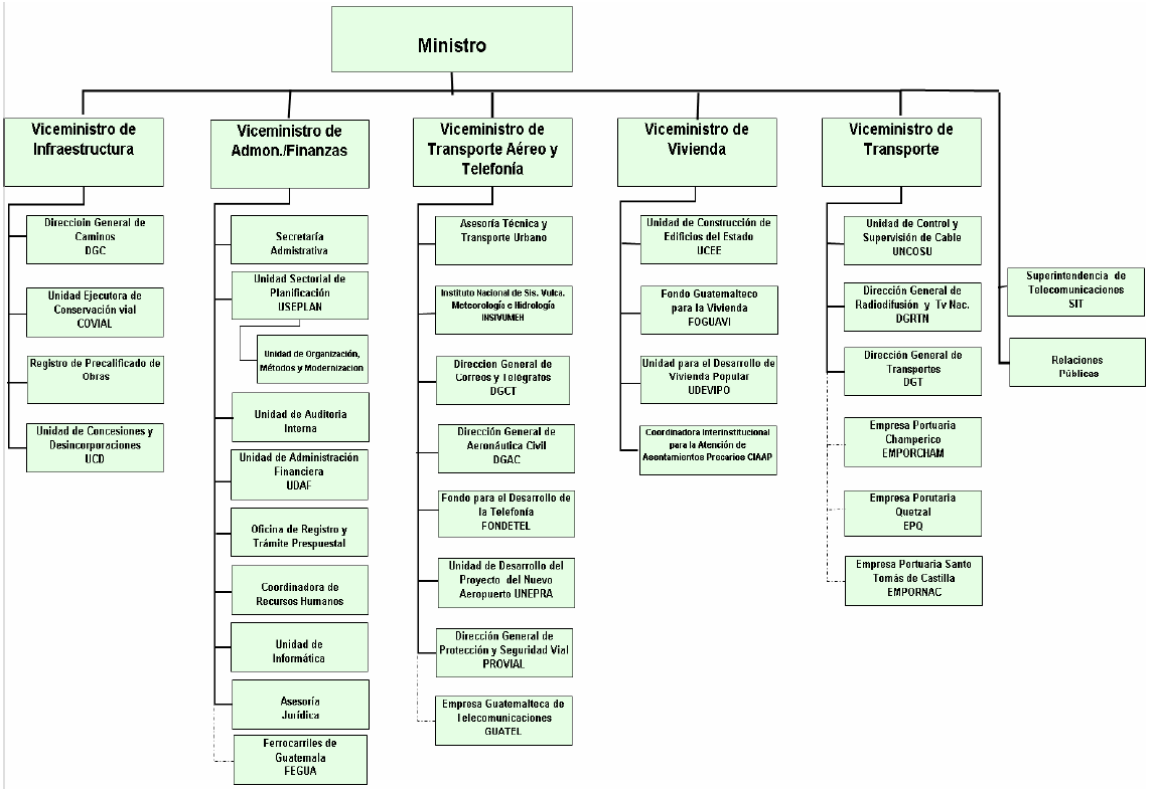


ANNEX 8: EXECUTIVE BODY DECREE 114-97, ARTICLE 14, SEGEPLAN

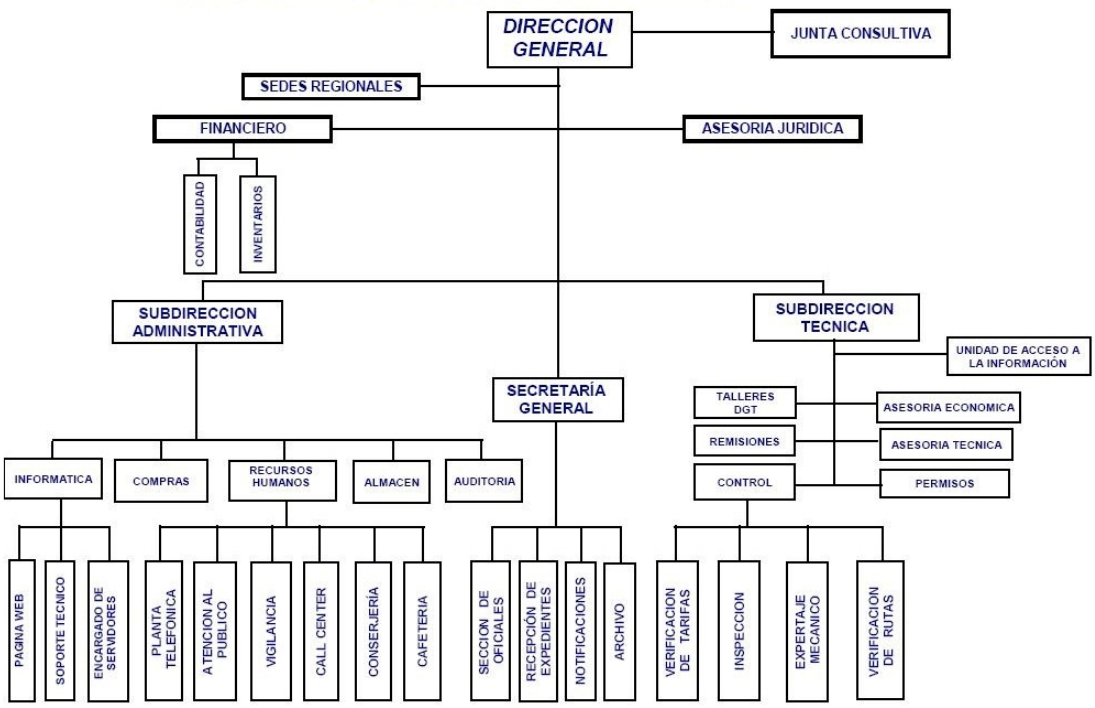
As of the effective date of this law, the General Secretariat of the National Council of Economic Planning is established as a Secretariat reporting to the Presidency of the Republic; Its name is changed to Secretariat of Planning and Programming of the Presidency; it has the following responsibilities:

a) Assist in the formulation of overall government policies and evaluate their execution.
b) Design, coordinate, monitor and evaluate the National Public Investment Projects System and the National Financing System for pre-investment.
c) Integrate and harmonize the preliminary projects and sector plans received from the Ministries and other government bodies with the preliminary projects submitted by the regional and departmental development councils.
d) Develop jointly with the Ministry of Public Finance the most adequate procedures to achieve coordination and harmonization of the annual and multi-annual public sector plans and projects with their respective annual and multi-annual budgets.
e) Prepare jointly with the Ministry of Public Finance, based on the overall policy of the Government and in consultations with the other government Ministries, the preliminary annual and multi-annual investment budget.
f) Follow up on execution of the investment budget and report to the President of the Republic, individually or in the Council of Ministers, the results achieved, proposing any rectifications it believes appropriate.
g) Formulate, for submission to and approval by the President of the Republic, in consultation with government Ministries, the appropriate government entities and other public sector bodies, international cooperation policies and programs, as well as prioritize, negotiate, manage and contract, by delegation of the competent authority, non-reimbursable financial cooperation from international bodies and foreign governments provided to perform projects of mutual interest and coordinate their execution.
h) Coordinate the public investment planning and programming process at the sector and public and territorial levels.
i) Formulate, for submission to and approval by the President, the pre-investment policy, and promote the creation of the financial mechanisms to operate in a decentralized manner to this effect.
j) Create and manage the scholarship funds offered by the international community.
k) Carry out the tasks assigned by the President and Vice-President of the Republic.
l) Prepare and submit to the President of the Republic, for his approval, a proposal on the organizational rules of the Secretariat under his responsibility, establishing the structure, organization and responsibilities of its offices, according to this law.
m) Perform the responsibilities and attributions assigned by the Political Constitution to the Government Planning Body and other assigned to it or to the General Secretariat of the National Economic Planning Council by other laws.

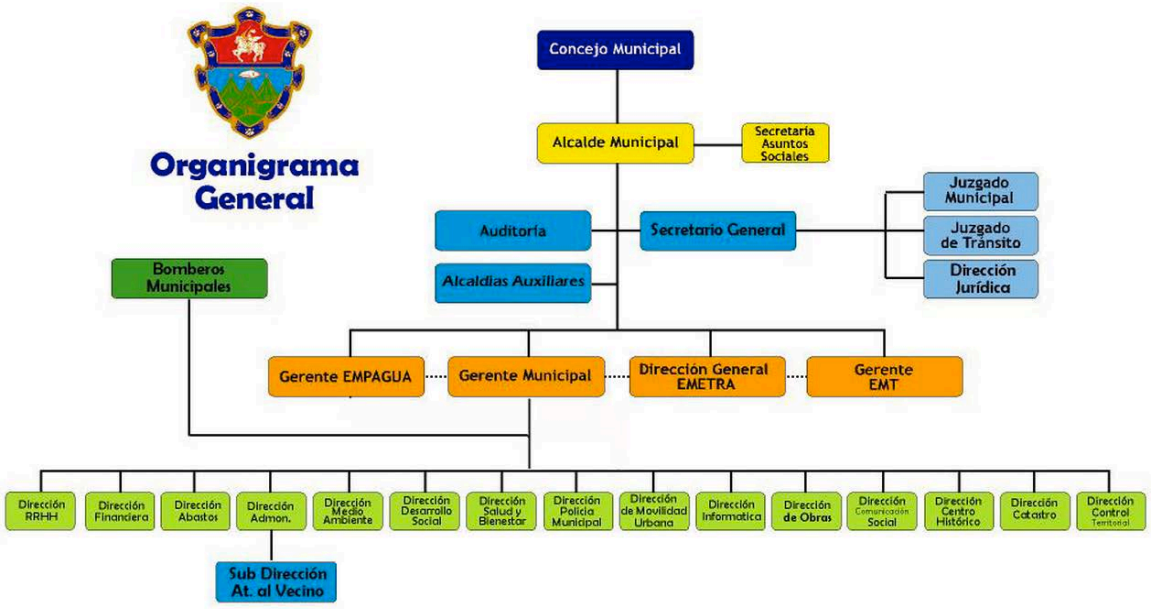
ANNEX 9: MICIVI ORGANIZATIONAL CHART



ANNEX 10: GENERAL TRANSPORTATION DIRECTORATE ORGANIZATIONAL CHART



ANNEX 11: MUNICIPALITY OF GUATEMALA ORGANIZATIONAL CHART



ANNEX 12: MEASUREMENT, REPORTING AND VERIFICATION (MRV)

The main objective of MRV mechanisms is to ensure that emissions reductions are effectively being achieved at the sector level based on adequately agreed-upon baseline scenarios.

As shown below, MRV systems consist of a series of mechanisms for data collection and validation for submitting evidence on the performance of a mitigation measure. Even though there are no strict requirements for the design of MRV mechanisms (precise definition of objectives, limits and incentives for implementation), a key component is its flexibility. The framework for action of the MRV mechanism is broad and they accept different methodologies depending on the mitigation measure, the parameters that need to be measured and the specific case for implementation. This is as long as the reported information is precise, consistent and comparable. Additionally it is important to point out that the MRV system should be cost-effective, i.e. the cost of the system must be a fraction of the savings produced by the reductions, either economic or social. This implies that it is valuable to be able to use existing information, because for the effects of the MRV they are sunk pre-investment costs.

Components of a MRV mechanism

Measurement: The process begins with the objective collection of data related to the mitigation measure. The type of data and measurement procedures are varied and depend on the type of project.

Reporting: The reporting mechanism may make direct use of automated equipment when the project allows it (time of operation per day of a bio-gas flare); otherwise indirect parameters are measured to calculate the reduction in emissions. The latter reporting system requires a large amount of supporting documents to support the precision, consistency and comparability of the data.

Verification: The verification process consists of **assessing the precision, consistency and comparability of the measuring and reporting processes. This process may be conducted by external auditors, internal company staff or by government institutions, depending on existing regulations in the country.**

In the case of Guatemala, even though substantial progress has been made in analyzing the environmental situation, no consensual emissions scenarios have yet been developed on national or sector-level emissions that could be used as the basis for assessing the effects of LEDS mitigation measures. In this sense, it is critical to focus efforts on creating scenarios through consensus with baseline information that is precise, consistent and comparable.

It is necessary to make progress in parallel on the implementation of the improvements in the political and institutional arena mentioned in the two previous sections, aimed at improving governance not only for effective direction and coordination, but also to create and strengthen MRV capabilities.

In this context, any measure aimed at strengthening the methodology of the GHG inventories will have a strong impact on the implementation of MRV processes, which receive inventory information as an input to verify the reduction of emissions associated with the mitigation measures. In the current situation, the uncertainty surrounding the GHG inventories would have an impact on the transparency and credibility of the MRV mechanisms, and it is essential to undertake the improvements indicated in Chapter 2 of this report.

When the time comes to design the implementation of mitigation measures, it would seem reasonable to update the inventories including all the documentation required to replicate the calculations. Unless Guatemala improves the documentation and transparency of GHG inventories, the MRV mechanisms will find an obstacle to guaranteeing the effectiveness of the measures, which will have a negative impact on any investors that participate in the strategy.

ANNEX 13: MECHANISMS FOR THE IMPLEMENTATION OF MITIGATION MEASURES: POAS AND NAMAS

PoAs and NAMAs are two mechanisms developed by UNFCCC to promote the implementation of GHG emissions mitigation measures, and both can become an important part of LEDS development. These mechanisms are designed to support replicable and programmatic projects, unlike specific mitigation actions as was traditionally the case in the clean development mechanism (CDM).

Programs of Activities – PoAs: These are designed for projects that individually have a small mitigation potential in absolute terms, but can be added to establish a larger program. The project/initial proposal, called PoAs, operates through the traditional CDM framework and must be approved by the Executive Directorate of CDM. In this way, additional projects that arise later, called CDM Programs of Activities (CPAs), can be added on at a lower cost and more quickly. The main advantage of a PoA is that an indefinite number of CPAs can be included relatively easily once the PoA has been approved by the Executive Directorate of CDM. Once the PoA is approved, the reduction of emissions can grow quickly. The types of PoAs that have been approved cover a wide variety of sectors, including transportation and energy efficiency. Approximately half of all PoAs are in Asia and 20% in Latin America.

One of the challenges for the implementation of the PoAs is the condition of the carbon credits market and the prices of the Certified Emission Reduction (CER), the values of which make it difficult to make projects of this type viable. Additionally, a barrier that has been identified is the clear definition of a CPA and the responsibility of the Designated Operating Entity (DOE) responsible for verifying the mitigation impact.

National Appropriate Mitigation Actions – NAMAs: These are mechanisms designed at the sector or national level. They are similar to a PoA in that it is possible to add individual projects under a larger program. Preparation of NAMAs is managed by the national or local government, unlike PoAs which are managed by private companies or NGOs. An important feature of a NAMA is the financial and technical support provided by developed to developing countries. Since NAMAs by definition prioritize economic and social development over reduction of emissions, they are expected to have a greater impact compared to the strict framework required by CDM.

Close to 50 countries have proposed or set guidelines for the development of NAMAs, most of which are in the conceptual stage. Also, the framework for submitting, financing and verifying NAMAs is still under development. Even though NAMAs are similar to PoAs in the sense that they cover more than one individual DL project, NAMAs are not ruled by the CDM methodology. This is because NAMAs are not financed through the carbon markets but with domestic funds, international donors, local governments and the private sector. Also, NAMAs do not necessarily have to be based on projects, but may instead focus on laws and regulations or other social development aspects.

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