CLIMACAP

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Overview of country level data collection in the CLIMACAP project

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1. Introduction

The Integrated Climate Modelling and Capacity Building Project in Latin America, known as the CLIMACAP project, is financed by the European Commission, DG CLIMA. It is a 36 month project, and started in December 2012. The project is led by the Energy research Centre of the Netherlands (ECN), and is implemented in partnership with leading European and Latin-American universities, think-tanks and institutes. The project is collaborating closely with the parallel LAMP initiative, funded by the US EPA and USAID. This brings approximately another 7 modelling groups to the modelling exercise.

The project aims to strengthen modelling capacity to support climate change mitigation strategies of key Latin American countries and regional groupings, as well as to generate cross-model comparison analyses and scenarios up to 2050 that focus on issues such as the economic impacts of policy measures, mitigation costs and potentials, and costs and pathways for reaching specific emission reductions.

The main output from the project will be a special issue of the journal Energy Economics: "Climate Policy in Latin America: implications and impacts for energy and land use". It is anticipated that 11 papers will be co-authored by EU, Latin American and North American researchers, to be ready by November, 2014 in time for the Lima UNFCCC Conference of the Parties (COP 20), covering climate policy, technology diffusion, investment requirements, amongst others.

In this project, one of the first steps was to collect data for the implementation of different energy models for Argentina, Brazil, Colombia, and Mexico. During the initial project meeting, carried out in February 2013 in Amsterdam, the main variables that would be required for the implementation of both the national and the global models were analyzed. After the definition of these variables, a series of exchanges were carried out between the coordinators of the different countries and the following scheme for the collection of basic information was agreed:

- Socio-economic.
- Energy Demand Drivers.
- Energy reserves and resources.
- Energy extraction/production costs.
- Energy supply.
- Agriculture and forestry.
- CO2 storage potential.
- Energy and climate policy.

The data collection process carried out in each country is described in this overview, both for historical data and for the projection of the drivers to be used in the models. The raw data is also shared on the www.climacap.org website and the CLIMACAP portal of the www.commend.org website.

2. Data collection: Argentina

In the case of Argentina, different national official sources and own estimates made by Bariloche Foundation team in the framework of CLIMACAP project (based on its experience in the energy sector), have been the main sources of information used.

In regard to the socio-economic variables related to the population and GDP for the base year and the projections of population, the information source used was the INDEC (National Institute of Statistics and Census). However, in regard to the projection of GDP to year 2050 as well as the added value of the main socio-economic sectors, these figures are the result of own estimations, developed in the framework of this study. Note that in the case of Argentina, there is no official information regarding long term economic variables prospective.

Regarding to energy reserves and resources, the National Energy Secretariat was the main source of information used, for proven oil and natural gas reserves. Meanwhile, potential hydrocarbon resources, as well as unconventional hydrocarbon, were extracted from the USGS, Year 2000 report, Conventional Oil and Gas and World Shale Gas and Shale Oil Resources assessment and from the Energy Information Administration-ARI, June 2013, respectively.

In regard to bioenergy resources, the main information sources were the WISDOM study carried out by INTA (National Institute for Agriculture Technology) and FAO, and Biotop project carried out by WIP-Renewable Energies. Data on these resources represent estimates with significant uncertainty levels associated to their actual availability for energy uses.

Regarding the energy extraction / production costs, it is important to mention that this information was difficult to obtain in the case of Argentina. For oil and natural gas, own estimation were made in the case of extraction costs, based on data obtained through the companies balance sheets or data published in the strategic plan of the YPF national oil company.

Bioenergy feedstock costs are based on biodiesel market price (published by the National Energy Secretariat) and INTA estimates (National Institute for Agriculture Technology). These costs may be subject to large variations depending on specific production conditions and technology changes.

In order to modeling energy demand in the different socio-economic sectors, the national energy balance was the main source of information. With the objective to modeling the impact of some measures, like the introduction of biofuels, improvements in energy efficiency, introduction of hybrid cars, etc., the energy demand was disaggregated in energy uses. To conduct this task own estimations were made in the framework of this study.

In the case of energy supply, this is where more information is available nationally. Statistical yearbooks from CAMMESA (Wholesale Electricity Market) and the National Energy Secretariat,

were the main sources of information regarding the installed power plants in the country and electricity generation. In the case of the oil industry, data of refineries and supply infrastructure was obtained from the National Energy Secretariat.

In relation to the mitigation measures, a bibliographic review was carried out from sources such as the National Energy Secretariat, the National Environment and Sustainable Development Secretariat, and several experts in the energy efficiency area. This allowed collecting information on mitigation measures ranked in terms of their implementation potential, their potential penetration schedule, the associated energy and emissions´ savings, and their costs.

Finally, in the case of Argentina, there were not too many gaps in the information related to the base year, except in regard to energy consumption by end use in different sectors of final energy demand. However, regarding the long-term projection of the main socio-economic variables and in regard to production costs, there is information gap. Also there is no official information regarding expansion plans of the energy supply.

In the following table is presented a description of the main mitigation measures currently under consideration by the government, which were consider in the context of the CLIMACAP project:

Table 1. National Measures considered in CLIMACAP Project for Argentina

Key Themes	National Measures
Residential	• Solar water heaters in the household sector (area of installed solar thermal collectors by 2050: 360,000 m2). • Better thermal efficiency in the residential buildings (percentage of buildings with improvements by 2050: 10%).
Transport	• Eco-driving in freight transport and public transport (100% of drivers in these areas trained by 2050). • Introduction of hybrid cars (share of 5% of the car fleet by 2050). • Freight from truck to train transport (25% of rail transport by 2050).
Energy Demand	• Higher level of biofuel penetration (average penetration of B20 in transport and agriculture, and E45 in transport, volume basis).
Supply side	• Implementation of the Probiomass Program (larger use of biomass in electricity generation, increase in installed capacity by 2,200 MW by 2050). • Promotion of hydroelectric generation (incorporation of 8,800 MW during the period under study). • Promotion of wind generation (incorporation of 1,500 MW during the period under study). • Promotion of nuclear generation (incorporation of 6,200 MW during the period under study). • Promotion of combined-cycle generation (incorporation of 6,300 MW during the period under study).

3. Data collection: Brazil

Socio-economic parameters projections such as GDP, population, etc. were taken from multilateral institutions such as ONU, World Bank and also considering governmental projections of the Brazilian Institute of Geography and Statistics. In some cases, estimations made by the Brazil CLIMACAP team were considered since not all projections were produced until 2050.

In order to model the transport sector, the projections made by Brazil CLIMACAP team were based on pkm/year and tkm/year following from EPE's estimates for current values (The Energy Planning Agency of Brazil- NOTA TÉCNICA SDB-Abast Nº 1/2012.).

The Residential Sector was modeled with the data for equipment ownerships by household of IBGE for the base year. The specific energy consumption by equipment and its evolution until 2019 were taken from EPE (NOTA TÉCNICA DEA 14/10). The Brazil CLIMACAP team made their own assumptions to attend to the 2050 horizon

There was an information gap to model commercial & services sector using an energy services approach. Consequently, the Brazil CLIMACAP team used energy intensities of the National Energy Balances and took our own considerations to model the projections.

The industrial energy sector modeling was based on the study Low Carbon Scenarios for Brazil, which used a bottom-up approach. This approach was based on information contained on the National Energy Balance.

To model the supply infrastructure for oil & gas, data from the National Agency of Petroleum, Gas and Biofuels (ANP) was used. Extraction and Transportation Costs and Future Infrastructure Deployment were taken from public reports of the NOC, Petrobras. Long-term production curves for natural gas & oil were taken from studies developed by PPE-COPPE.

For Power and Transmission, projections of national expansion were taken from the National Energy Plans of EPE. Technologies costs used in MESSAGE-Brazil were taken from the peer-reviewed literature whenever available for Brazilian context otherwise were taken averages for international markets.

In order to estimate Biomass resources in Brazil, data from different sources were used such as IBGE/SIDRA, EPE, Associations of Industries related to Pulp and Paper and Timber activities, amongst other sources. Cost for biomass sources were taken from the EPE (2007)- PNE 2030-Cap. Biomassa and the IPCC-SREEN (2011).

Data of potential resources for non-conventional renewable energy were obtained from ANEEL, EPE and MME sources but also from studies developed by PPE-COPPE.

Finally, a review of national policies for climate change and the development energy sectors were made in the context of the CLIMACAP project, the results are summarized in the following table:

Table 2. National targets attributed to Key themes for Brazil

Key Themes	National Targets
Renewable Energy	To reduce between 79 - 99 millions of tCO2e from emissions projected until 2020 (developing hydropower plants). To reduce between 26 - 33 millions of tCO2e from emissions projected until 2020 (developing non conventional renewable energy sources). In the transport sector the goal is reducing between 48 - 60 millions of tCO2e from emissions projected until 2020 by biofuels development. The target for total renewable energy for electricity is a percentage (%) of Total Installed Capacity (Considering Great Scale Hydro) of 80.4% in 2015 and 83,2% in 2020
Transport	In passenger transport sector, the goal is to reduce 2 million tCO2e/year from the projected emissions in 2015 and to reduce 2.3 million tCO2e/year from the projected emissions in 2020. In freight transport sector, the goal is to reduce 1.8 million tCO2e/year from the projected emissions in 2015 and to reduce 3.7 million tCO2e/year from the projected emissions in 2020.
Energy Efficiency	To reduce between 12- 15 millions of tCO2e from emissions projected until 2020 (developing energy efficiency programs). The target is a percentage (%) of Saved Energy in relation to the Baseline Energy Consumption of 3% in 2015 and 6% in 2020
Land-use policy	To reduce deforestation in the Amazon Region (reduction of 564 millions of tCO2 from emissions projected until 2020). To reduce deforestation in the Cerrado Region (reduction of 104 millions of tCO2 from emissions projected until 2020). To recover pastures (reduction of 83 to 104 millions of tCO2 from emissions projected until 2020). To integrate farming and livestock (reduction of 18 to 22 millions of tCO2 from emissions projected until 2020). Fostering direct planting (reduction of 16 to 20 millions of tCO2 from emissions projected until 2020). According to the Decree N° 7.300 from December 9 of 2010, the emissions for land use sector in the baseline should be 1404 millions of tCO2e in 2020.

4. Data collection: Colombia

In the case of Colombia, different national official sources were used, when lack of information was find, estimations were done by Universidad Nacional modeling team in the framework of CLIMACAP project.

Related to socioeconomic variables such as GDP and population for the base years and projections, DANE (National department of statistics) was used as source, even though several years were projected using the trends that DANE estimated. Also for the economic growth Los Andes research was used as a base to estimate the economic subsectors added value.

Regarding to energy reserves and resources, UPME and other sources like industries aggrupation such as ANDI, Fedebiocombustibles, etc. were used as main source of information mainly in the case of proven oil and natural gas reserves, potentials for biofuels, and oil extrations.

For energy demand the principal source was the energy balance to determine the economic sub sectors. Although some were just resumed due to the principal objective of the modeling was to simulate 2 NAMAs in 2 particular sectors, such as the residential substitution of refrigeration and the introduction of electricity to the off grid areas. In general energy demand was disaggregated by energy resources.

In the case of energy supply, this is where more information is available nationally. Statistical information was found in ISA database (XM), but there is not easily to found the technology used in the energy supply plants. Data for refineries and supply infrastructure were provided by UPME.

In the case of Colombia they were gaps related to the calculation of refrigerators efficiencies, also with the emissions factors, another big gap of information is about the energy supply and demand in the off grid areas. Gaps in the long-term projections in all variables were found. Also there is no official information regarding expansion plans of the energy supply after 2024.

In the following table is presented a description of the main mitigation measures currently under consideration by the government, which were consider in the context of the CLIMACAP project:

Table 3. National Measures (NAMAs) studied to be implemented considered in CLIMACAP Project for Colombia

Key Themes	National Measures
Residential - Urban	• A pilot project in order to substitute 300.000 refrigerators. • PROURE shows a plan to substitute 4´000.000 refrigerators.

Residential – Off grid	• Increase time electricity coverage, so electricity demand rises. • Increase coverage of electricity.
ZNI Supply plants	• by 2030, the proportion of non-conventional energy source is set in 30%, in 2009 it was 8%

5. Data collection: Mexico

The base LEAP Model used for Mexico was developed by SEI as part of a joint collaboration among SEI, UNAM and the National Institute for Climate Change (INECC). This version of LEAP included a base line and a mitigation scenario up to the year 2030. The extrapolation and adjustment up to the year 2050 (LAMP/ CLIMACAP scenarios) was developed by UNAM. The sources of information used by this model include historical and projection data reported in official documents, besides other mitigation studies that have been supported by international cooperation agencies and the World Bank.

The main sources of information for SEI/ UNAM LEAP model are next listed:

Official statistics and documents:

- The System of Energy Information (SIE) administered by Mexico's Secretary of Energy (SENER).
- National Energy Balances published by SENER.
- 2012-2026 Electric power sector outlook published by SENER.
- Annual Operation Reports and the Program of Works and Infrastructure in the Electric Power Sector (POISE) both prepared by the Federal Electricity Commission (CFE).
- The National Commission for the Efficient Use of Energy (CONUEE) and National Survey of Income and Expenditures of Households (ENIGH).
- Mexico's Center for Sustainable Transport.
- Bank of Economic Information (BIE).
- National Institute of Statistics and Geography (INEGI) censuses and the National Population Council (CONAPO).
- Intergovernmental Panel on Climate Change (IPCC) Tier 1 Emission Factors.
- INECC's national GHG inventory (INEGEI).
- Special Program on Climate Change for the 2009 – 2012 and 2014 -2018 period (PECC) published by Mexico's Secretary of the Environment and Natural Resources (SEMARNAT).
- Vision 10 – 20 -40 National Strategy on Climate Change (ENACC) published by SEMARNAT.
- SEI expert team assumptions.
- UNAM assumptions.

Previous mitigation studies carried out for México:

- Cost curve mitigation lever assumptions as reported in INE-McKinsey study.
- Selected additional mitigation measures as reported in World Bank's Low-Carbon Development for Mexico study (MEDEC).

Historical data for energy demand in the residential, services, industrial, transport, oil and gas, and agriculture sectors as reported in SIE and the National Energy Balance in the 1990 – 2009

period. Projections for residential end use correspond to information available from CONUEE and ENIGH.

Historical data and expected new capacity and electricity generation in the electric power sector are based on Annual Operation Reports and the POISE. Projections of road transport fleet, vehicle miles traveled and energy intensity as reported by CTS.

Socio-economic information such as GDP, household data and population as reported in BIE, INEGI censuses and CONAPO, respectively. Emission intensities as indicated in Tier 1 IPCC's emission factors.

Non- energy emissions historical data (1990 – 2009) as reported in INEGEI.

Mitigation measures up to 2030 as consistent as possible with Mexico's aspirational goals for 2020 and 2050 on the basis of information provided in INE-McKinsey and MEDEC. Projections beyond 2030 and up to 2050 as consistent as possible with mitigation potentials officially accepted in ENACC, PECC 2009 - 2012 and CLIMACAP scenarios.

It is important to highlight that there were no important gaps of information for historical data and projections up to 2030. When required, the approach used to overcome this lack of information was to agree rough estimates or assumptions with national institutions such as INECC. On the contrary, there are no disaggregated official data beyond 2030 and up to 2050, therefore, the selected approach to offset these gaps was to extrapolate GHG reduction potentials in the year 2030 up to 2050 in accordance with the maximum potential identified in previous studies for Mexico such as MEDEC, but taking into account as reasonable as possible Mexico's aspirational goals and LAMP/ CLIMACAP scenarios constraints for the corresponding year.

Table 4. National targets attributed to Key themes for Mexico

Key Themes	**National measures**
Electricity	• Coal with CCS, Gas with CCS, Biomass co-firing, Biomass with CCS, On shore wind, Off shore wind, Solar PV, Concentrated solar, geothermal, Small hydro, Oil to gas shift, Coal to gas shift. • Smart grid
Residential	• Lighting - switches to CFLs and LEDs • Efficiency in HVAC • Efficient appliances • Efficient consumer electronics • Efficient new stoves
Services	• Lighting - switches to CFLs and LEDs • Controls in lighting • Efficiency in HVAC

Key Themes	National measures
	• Efficient appliances • Efficient office electronics • Solar hot water heaters
Industry	• Efficiency in iron and steel industry • Alternative fuels in cement industry • Shifting to more natural gas use in the chemicals industry • Cogeneration • Increased charcoal use in iron and steel
Transport	• Sugarcane biofuels • Switchgrass biofuels • HDV Efficiency • LDV Efficiency • Metro and Bus • Urban densification • Bicycles • Increased train freight
Oil and gas	• Natural gas usage planning
Forestry	• Reduced deforestation from slash & burn agriculture Conversion • Reduced deforestation from pastureland conversion • Reduced intensive agriculture conversion • Pastureland afforestation • Cropland afforestation • Reforestation of degraded forests • Degraded Forest Reforestation • New Plantations
Agriculture	• Tillage and residue management practices • Agronomy practices • Cropland nutrient management • Rice management - Shallow flooding • Rice management - nutrient management • Grassland management • Grassland nutrient management • Degraded land restoration • Livestock - Feed Supplements • Livestock - Antimethanogen vaccine
Waste	• Landfill gas flaring • Landfill gas direct use • Recycling new waste • Composting new waste • Wastewater treatment

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