Assessment of Mexico's policies impacting its greenhouse gas emissions profile

CLIMATE ACTION TRACKER

MEXICO

Conducted by Ecofys and Climate Analytics
03 May 2012

The authors

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The authors from the Climate Action Tracker team prepared this report and take full responsibility for all content.

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EXECUTIVE SUMMARY

What we evaluate

The Climate Action Tracker (CAT) provides information to help answer the question:

"Will current – and pledged – international climate action be enough to limit the negative effects of climate change by holding long term global temperature increase below 2°C"?

The CAT compares and assesses national and global action against a range of different climate targets across all relevant time frames, starting with an ongoing analysis of governments' current emission reduction pledges[1].

This report, which assesses Mexico's currently implemented policies, is the second of a series of country analyses addressing the following questions:

- Does the government implement policies to meet its own targets and approach the targets required for a global 2°C or lower pathway in 2020?
- Does the government implement policies towards a low carbon future (in e.g. 2050)?

While our focus is on domestic action, we acknowledge that international targets and pledges are often contingent on international mechanisms - international trading of carbon units for developed countries and international financial support for developing countries.

As with the broader Climate Action Tracker project, the CAT Country Assessments track progress in elements that contribute to the global efforts to hold warming below 2°C above pre-industrial temperatures. Within this context, the Country Assessments represent a snapshot of implemented climate policy and regulations. If and when plans develop into actual implemented policies, the ongoing CAT project will incorporate these and adjust its findings and ratings for individual countries and country groups.

Mexico is setting the scene for enhanced action

Mexico was the first developing country to adopt an absolute reduction target for 2050. It has made some of the fastest advances of any country in the world in strategic planning on how to incorporate low carbon development into all parts of the economy. Triggered by the strong commitment of President Calderón, the early establishment of the Inter-Ministerial Climate Change Commission in 2005 (CICC), which coordinates the strategic planning, supported this process.

Mexico's progress in policy planning and institution building over the past years has been remarkable in several ways:

- Awareness of climate change issues, on both mitigation and adaptation, has penetrated a wide circle of stakeholders and actors.
- Mexico has achieved a high level of data availability, especially compared to other developing countries. This includes its submission to the UNFCCC of four National Communications with emission inventories, developing the world's first nationally GHG reporting system for industry and several low-carbon development-plan studies (e.g. Johnson et al. 2009). This provides a good basis for policy making.
- A clear institutional setup for climate change policy, with responsibilities, lines of communication and focal points within and between ministries and outside helps to ensure consistency. It also provides the basis for further strategy development.

This progress along the cycle of policy making has laid the basis for the first implemented mitigation policies and regulations that are analysed in this report. The General Law on Climate Change adopted April 2012 consolidates these efforts to provide the appropriate framework. The law includes Mexico's ambitious international "Cancún pledge" to reduce emissions to 30% below business-as-usual (BAU) by 2020, conditional on international financial support, as well as the target to reduce emissions by 50 % below the 2000 level by 2050. It also set a new target to provide 35 % of Mexico's

[1] Results are published and constantly updated under www.climateactiontracker.org.

electricity to come from clean sources by 2024. In a next step the government will need to develop and implement policies to achieve this, e.g. to phase out fossil fuel subsidies, to make renewable power fully competitive with oil, gas and coal.

In international climate diplomacy, Mexico has played a very active and constructive role in comparison to many other governments - in both developed and developing countries. This led to the successful climate talks in Cancún in 2010, under very difficult circumstances after the Copenhagen meeting in 2009. Rebuilding support for a multilateral approach to climate required substantial, top-level governmental resources and financial support. After Cancun, Mexico continued to play an important and constructive role in the lead up to the climate talks in Durban in 2011.

National policies and the international pledge

Mexico's international "Cancún pledge" is a reduction of emissions to 30 % below business-as-usual (BAU) by 2020, conditional on international financial support. This is more ambitious than earlier statements, which include the 20 % reduction target stated in the national climate strategy (PECC) in 2009.

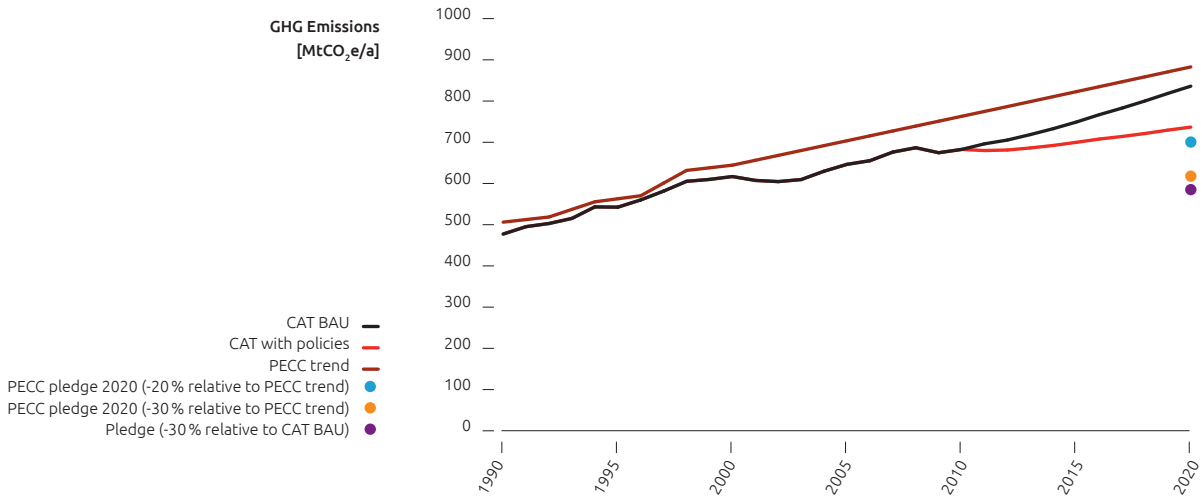
Applied to the BAU projection from the national climate strategy (PECC) that formed the basis for the Mexican pledge the 20 % target implied a pledged emission level of 700 $MtCO_2e/a$. The more ambitious target of 30 % then translates into pledged emission levels of 617 $MtCO_2e/a$ in 2020 (see Figure A). The CAT analysis delivers slightly lower historical emissions and also lower BAU emissions in 2020 than the projections used in the PECC. Applied to the CAT BAU projection the pledge would translate to emission levels of 584 $MtCO_2e$ in 2020.

We evaluated current national action against our own estimated BAU development. Implemented measures will see Mexico achieving just over a third of its pledge in 2020 (see Figure A). We project policies to deliver 12 % reductions below the CAT BAU.

The policies so far have largely been implemented unilaterally, with some programs receiving external support, for example from the World Bank.

The rest of the effort required to achieve the Cancún pledge and the onset of a low-carbon future might be achieved by internationally-funded reduction efforts. It is as yet undetermined to what extent Mexico will need and seek international funding.

Figure A
Emissions and emission reductions for the policy scenario up to 2020 in comparison to Mexico's Copenhagen pledge



Achieving national targets?

Mexico has already implemented policies that will have, according to our analysis, a moderate effect in setting the country on a path toward achieving its short-term goals and toward a long-term low-carbon development for 2050.

Under BAU, we project Mexico's total emissions to rise steadily up to 1,068 $MtCO_2e/a$ by 2030, an increase of over 50 % on current levels. Currently implemented policies have the potential to reduce total emissions (including LULUCF) by around 223 $MtCO_2e/a$, or 21 %, by 2030 below BAU. The reductions come mainly from industry (122 $MtCO_2e/a$), 42 $MtCO_2e/a$ from LULUCF and 40 $MtCO_2e/a$ from energy supply. The impact of measures in other sectors is relatively small (see Figure B).

Looking at the short-term national target set for 2012, our analysis shows that current measures have the potential to achieve a reduction of 24 $MtCO_2e$ in 2012 compared to our BAU. This is less than half of the 51 $MtCO_2e$ envisaged in the national climate plan (PECC), although it must be noted that the climate plan projections of BAU are also higher than the CAT analysis (refer to Annex II for comparison of scenarios).

The long-term national target of cutting emissions in half, i.e. to 340 $MtCO_2e$, in 2050 is not yet supported by implemented policies. While this target is to an undefined degree contingent on international funding, measures need to be established nationally within the coming years to enable Mexico to achieve this ambitious goal. If the recent institutional and strategic groundwork is utilised to fully implement existing potentials, international funding can be put to effective use.

Analysing energy intensity and carbon intensity

Aside from GDP and population development, the two important factors determining overall emissions of a country are the energy intensity of the economy and the carbon intensity of energy use. Most policies aimed at reducing emissions focus on one of the two areas.

In order to move towards a low-carbon development, there needs to be a clear decoupling of emissions from GDP and population developments, by outweighing these developments with strong improvements in energy use and carbon intensity.

Figure B
Emissions and emission reductions for the policy scenario up to 2030 by sector

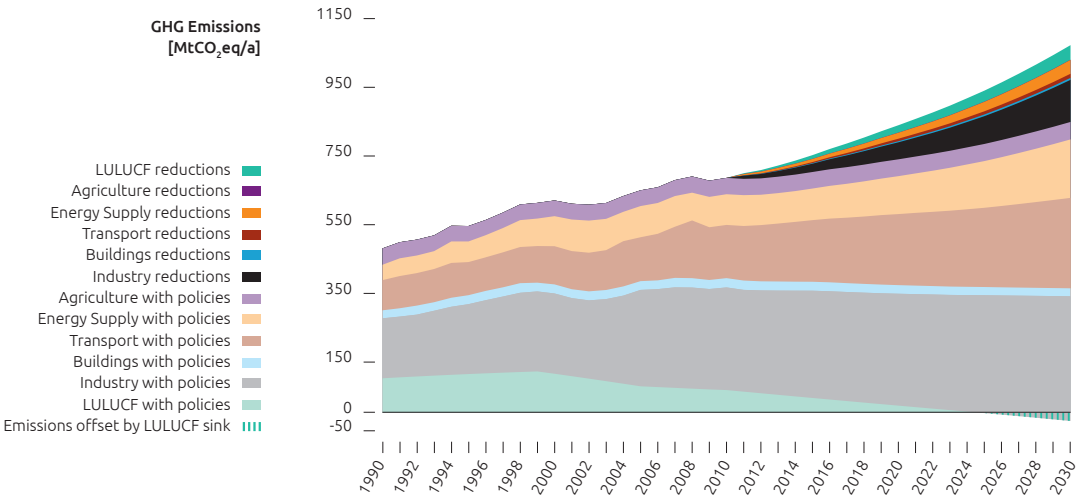
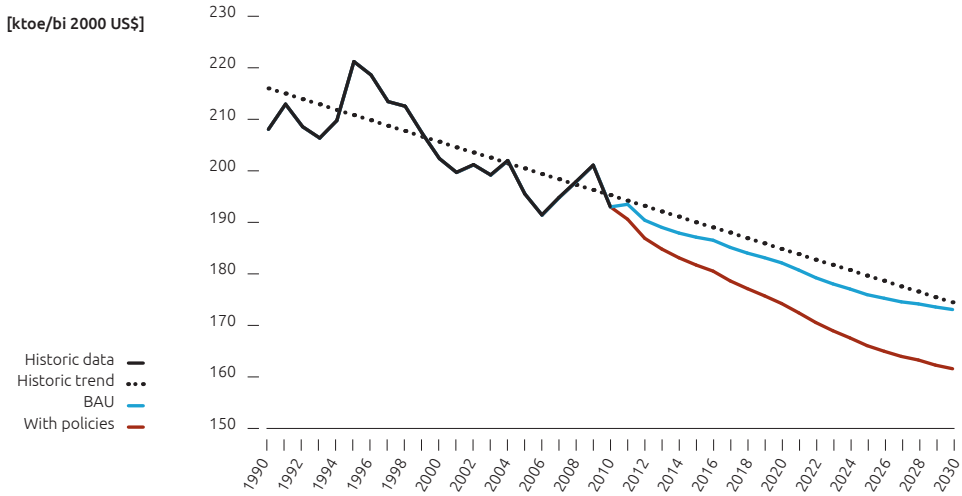


Figure C
Energy intensity history and projections up to 2030
(energy used per unit of GDP)



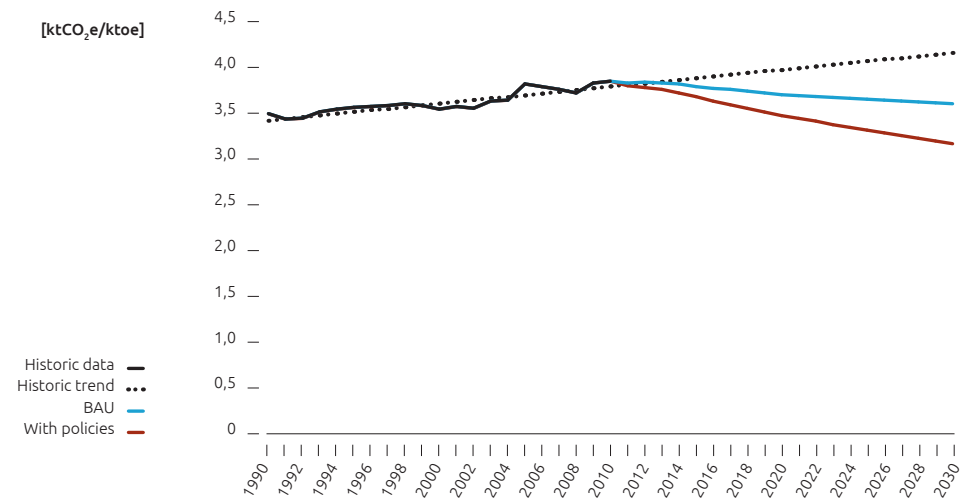
For Mexico we see a clear historic trend in improvement of energy intensity (see Figure C). The recession in 2009 leaves Mexico with a small peak in energy intensity due to the fact that GDP declined more than energy use. Overall BAU development is expected to continue the trend, while implemented policies are expected to further reduce energy intensity by almost 7 % in 2030.

Emissions intensity of the energy used has seen a modest but steady increase over time (see Figure D). Reasons for this include the increasing level of development in Mexico, with increased emissions from landfills and increasing process emissions and non-CO_2 fugitive emissions in the industry sector.

Under business-as-usual we project a reversal of this trend, leading to a modest improvement of carbon intensity up to 2030. This development is largely due to a continuing trend to replace oil with gas in the building and industry sectors.

Implemented measures are expected to improve this further, by almost 0.4 $ktCO_2e$/ktoe in 2030, an improvement of around 10 %.

Figure D
Emissions intensity history and projections up to 2030
(emissions excl. AFOLU per unit of energy used)



How does current policy compare to a long-term low-carbon future?

We have assessed Mexico's policies in the various sectors and policy areas, as seen in the Table A below. We rate policies in each area against a pre-defined low carbon policy package that would be needed to embark on a pathway towards 2°C.

As can be seen from Table A, highlights in Mexico's current policy compared to the low carbon policy package are its general climate strategy (rated D) and its support for energy efficiency in industry (also rated D).

Table A
Rating against the low carbon policy package[2]

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	–	–	–	–	D
Energy supply	–	G	E	G	–
Industry	G	D	G	G	F
Buildings	F	E	G	D	–
Transport	G	G	F	G	–
Agri-culture/ Forestry	E	–	–	–	G

Scoring matrix

Rating	Interpretation
G	No or very limited policies
F	Few policies, ambition level low
E	Some policies with medium ambition level
D	Comprehensive package or good ambition level for a wide range of policies
C	Comprehensive policy package, ambition level good
B	Pathway is set, minor improvements required
A	Consistent with low carbon development

[2] Size of the symbols indicate importance (mitigation potential), letter indicates stringency compared to low carbon policy package (A= emission development consistent with a global path towards 2°C with or without external support, G=no or very limited policies).

While it is clear that existing efforts are not yet sufficient, we have identified important positive elements of the Mexican policy framework:

- Mexico has an ambitious target for 2020 (reducing GHG emissions by 30 % below BAU) and was the first developing country to adopt an absolute reduction target for 2050 (50 % below 2002 levels, first announced by President Calderon at Copenhagen in 2009, confirmed in Cancun in 2010 and now in national law compared to 2000 levels).
- While the first implementation strategy ends in 2012, the government has undertaken several studies that can build the foundation for a long-term strategy.
- Mexico has a long tradition of applying measures to conserve electricity. One example is centralised, demand-side management, which has allowed customers to receive low interest loans for energy efficient appliances, repaid through their electricity bill.
- Mexico is among the countries most advanced in reducing emissions from deforestation and ensuring afforestation through payment for environmental services.

Further highlights are summarised in Table B.

Policy interventions that could potentially make a large difference and strengthen Mexico's efforts to achieve its unilateral and supported targets include (see also Table C):

Climate strategy

- Long-term planning of concrete measures to implement the 30 % reduction target by 2020 and the 50 % reduction target by 2050 would increase predictability and ensure a stable policy environment for investment. A planning process is currently underway that could lead to such a result.

Electricity supply

- The electricity utility CFE's least cost requirement – enshrined in Mexico's constitution – is a barrier to further implementation of electricity generation from renewable energy. This barrier could be removed.
- Mexico could also implement a broad-based support mechanism for renewable electricity generation. A decentralised electricity production system could be promoted to facilitate development of remote areas that currently have no or limited access to the grid and where a connection to the central grid is neither technically nor economically feasible.

Industry

- Mexico could intensify its initiatives on energy efficiency and those that support the production of renewable energy in industry.
- Fugitive emissions from oil and gas production are relevant for Mexico and could be avoided at relatively low cost.
- Waste emissions can be targeted with policies that increase recycling rates to avoid landfilling and methane capturing at landfill sites.
- For some gases, e.g. N_2O, ambitious reduction plans exist until 2012. These could be continued and lined with concrete measures.

Buildings

- Measures could focus more on the efficiency of the building envelope and equipment, not only on appliances. A national, mandatory energy-efficiency code for new buildings would be a good starting point for this. This would need to go hand in hand with a robust enforcement system. The incentives could be supported by loans for new buildings and for retrofitting of existing stock.
- Mexico's substantial electricity subsidies are a barrier to electricity savings. Removal of the subsidies, flanked by measures to compensate higher expenses - for low income households for example - could be a step forward. Air conditioning will be the largest growing future electricity use in Mexico: early steps to avoid this potential increase could include intelligent building design, building codes and efficiency standards. Renewable energy obligations already running in Mexico City could be rolled out across the country.

Transport

- The fuel price subsidy is a barrier to implementation of energy efficient cars. Removal of the subsidies in a socially acceptable manner could encourage use of more efficient cars. This could be further supported by mandatory standards for emissions and an emissions-based vehicle taxation scheme.
- Current measures to embed sustainable transport into an overall sustainable urban planning strategy provide a good basis for further strengthening and expansion of this process, while making the funds more accessible through improved administration and processes.

Agriculture and forestry

- Mexico could further align its mitigation plans in forestry and agriculture. Particularly relevant are deforestation and forest degradation caused by agricultural activities. In addition, large proportions of emissions in agriculture are covered by a strategy but not yet covered by implemented policies, which they could be.
- Existing measures in the forest sector need to be put into a long-term framework with medium and long-term goals and clear implementation strategies. This includes ensuring that measures for afforestation and reforestation are continued and expanded, along with implementing the defined REDD+ strategy with concrete measures.

Given the dynamic nature of policy development and implementation, the analysis in this report must be seen as a snapshot. We have evaluated the impact of policies under the assumption that currently implemented measures and efforts continue at the present level, independent of possible changes in administration. Elections are scheduled for July 1, 2012 and could result in such a change.

Table B
Highlights of Mexican policy

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	▸ Ambitious target for 2020 related to reduction from BAU ▸ Ambitious absolute target for 2050				
Electricity supply	–	▸ The National Program for the Sustainable Use of Energy aims to develop a strategy to promote CHP ▸ Pemex Gas and Petrochemicals Basic (PGPB) conduct a cogeneration project 300 MW, which will start operating in 2011 ▸ Electric Infrastructure Investment Plan includes measures until 2025 to reduce transmission losses ▸ No subsidies for fossil fuels for electricity production	▸ Private producers may produce (renewable) electricity for export or own use. This is indirectly incentivised through relatively high electricity prices for industry ▸ Net accounting approach for renewables (electricity can be fed into the grid and consumed when needed) ▸ Interconnection agreement for small PV ▸ Fiscal credit for research and development		–
Industry		▸ No energy subsidies to industry (contrary to many other countries) ▸ Some energy efficiency standards (only partly affect industry)		▸ CCS practiced in enhanced oil and gas recovery	▸ Voluntary GHG emissions reporting ▸ Mexico is member of the Methane Global Initiative in Mexico ▸ Goals to reduce CH_4 and N_2O
Buildings	▸ *"Desarollos Urbanos Integrales Sustentables (DUIS)"* promotes the integration of urban planning into the context of new housing developments	▸ Sixteen energy efficiency norms for the efficient energy use in buildings ▸ Several programmes provide loans for new dwellings or remodelling/ refurbishment ▸ Unified building code (CEV), including chapters on energy efficiency and sustainability developed by the Comisión Nacional de Vivienda (CONAVI)	▸ Programme for the promotion of solar thermal heating aims at installing 1.7 Mio m² until 2012 ▸ Mandate for all new public-use installations (such as hotels and sport clubs) to heat 30 % of their hot water with solar energy. ▸ Three voluntary standards with a solar energy mandate (NESO -13)	▸ Switching from use of biomass (not sustainable) to LPG. ▸ Increase in use of natural gas, as this is a more cost effective fuel option	–
Transport	▸ Large scale funds for infrastructure investment and system optimization (PROTRAM & PTTU) ▸ Promotion of cycling in Mexico City	▸ Scrapping programmes for vehicles with a federal number plate (public transport, freight)	▸ Goals for 7 % share of bioethanol in the states of Guadalajara, Monterrey and Mexico DF in 2012		–
Agriculture / Forestry	▸ Strategy for selected land uses exists	–	–	–	▸ Detailed sectoral programmes for agriculture and forestry exist and include activities and measures for mitigation and adaptation that are partially implemented ▸ One of the most advanced programmes is ProÁrbol that promotes a range of activities related to forest conservation and restoration

Table C
Gaps in policies compared to the low carbon vision

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	▸ Actions and strategy defined beyond 2012				
Electricity supply	–	▸ No Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO_2 taxes, emissions trading…) ▸ No enhancement of grid development and further efforts to reduce distribution losses	▸ No active support for electricity generation with renewable energy sources other than production for own use ▸ No active support of diversification of renewable energy technologies ▸ No investment and implementation strategy for renewable energy oriented grid structure	▸ No policies, financing mechanisms and strategies that support the increasing use of CCS for coal and biomass	–
Industry	▸ No policies in place to support increasing material efficiency, long product lifetime	▸ No direct incentives for energy efficiency through e.g. voluntary agreements, white certificates, emission trading, energy or CO_2 taxes	▸ No direct support for renewable energy ▸ No framework for sustainable biomass	▸ No incentives for coal, gas, biomass and process emissions CCS	▸ Goals but no incentives to reduce N_2O, CH_4 from oil and gas and waste, F-gas emissions
Buildings	▸ The initiative (DUIS) needs to strongly integrate requirements of energy efficiency and renewable energy use	▸ No national mandatory building energy-efficiency code ▸ Loans provided for new buildings and retrofitting are limited and have little impact on total stock ▸ Building codes are poorly enforced and not consistent throughout municipalities ▸ Energy efficiency standards, particularly for air conditioners need attention ▸ Subsidies on electricity prices for low- and medium income households decrease energy efficiency	▸ No policy for cooking with sustainable, renewable fuels ▸ The exact impact of solar water heaters on the total energy demand for hot water heating in Mexico is not known, but it is estimated to be limited because it has only been adopted in Mexico City	▸ No measures to ensure that fuel wood used is harvested in a sustainable manner	–
Transport	▸ Little efforts to promote cycling in Mexico City and no roll out to all other large cities ▸ Low fuel prices reduce attractiveness of low carbon transport modes	▸ No incentives to improve efficiency of new vehicles ▸ Existing scrapping programmes only target a sub set of the vehicle fleet ▸ Low fuel prices reduce attractiveness of more efficient vehicles	▸ National legislation needs to provide more concrete incentives for the use of renewables ▸ No mandatory scheme to ensure sustainability of biomass (for biofuel) production	▸ There are currently no measures in place to promote electric or other low carbon mobility technology	–
Agriculture / Forestry	▸ No integrated land-use plan to reduce deforestation and forest degradation caused by agricultural activities	–	–	–	▸ Enhancement of implementation of policies that aim at reducing emissions from the agricultural sector ▸ Extend existing afforestation and reforestation programs within a long-term framework that ensures medium and long-term implementation ▸ Implement REDD+ strategy

Content

1 | INTRODUCTION

Introduction

The Climate Action Tracker (CAT) provides information to help answer the question:

"Will current – and pledged – international climate action be enough to limit the negative effects of climate change by holding long term global temperature increase below 2°C"?

The CAT compares and assesses national and global action against a range of different climate targets across all relevant time frames, beginning with an ongoing analysis of countries' current emission reduction pledges[3].

This report is the second of a series of country analyses where the Climate Action Tracker addresses the following questions:

- **Are governments implementing policies to meet their own targets and to approach the targets required for a global 2°C or lower pathway in 2020?** This will include quantitative analysis of the effectiveness of policies. It will be driven by "deviation from reference" with all its complications: what is BAU before policies? What is the effect of action against this BAU? How are previous efforts factored in?
- **Are governments implementing policies for a low carbon future (in e.g. 2050)?** This turns the focus towards a "common endpoint" away from a "deviation from reference". We focus on whether countries have policies in place to meet a common endpoint: a low carbon economy. The core approach is to analyse "facilitating policies": policies that provide a coherent and consistent strategy to achieve a long-term low-carbon future, eliminate barriers to implementation and enhance incentives for stakeholders and sectors to ultimately make an economy-wide transition. Such method is less dependent on a BAU, or even immediate emission reductions, and can focus on the positive messages that some countries are progressing well in this direction (because of current *and/or* past actions).

We assess a country's domestic action and aim to provide a profound basis for national and international policy discussion. Our analysis provides policy makers and stakeholders with an independent assessment of the country's current policy environment and what this means towards an ambitious, long term goal - and more immediate targets.

While our focus is on domestic action, we acknowledge that this does not always directly relate to international targets and pledges. These are often contingent on international mechanisms - international trading of carbon units for developed countries and international financial support for developing countries.

Our analysis can help clarify the gap between current domestic action and the pledges, thus stimulating discussion on how best to close the gap, taking into consideration the international regime.

In this report we present the results on Mexico. The following chapters include a brief description of our methodology (chapter 2), a short introduction of the economic, environmental and political context of Mexico (chapter 3), results of the evaluation of existing policies in Mexico (chapter 4) and a summary of our findings as well as a description of the way forward (chapter 5).

[3] Results are published and constantly updated under www.climateactiontracker.org.

2 | METHODOLOGY

This chapter provides a brief overview of the methods used for this assessment. A detailed description of the method is provided in a separate technical paper.

2.1 General approach

The basis of the analysis is the collection of data and information on policy and its effectiveness. Information and data gathering is organised along the segments shown in Figure 1 below. The evaluation produces a qualitative assessment for the long and medium term, but also supports the quantification of policy impact, which then results in emissions pathways for implemented and planned policies.

For the calculation of emission pathways we use a simple and transparent Excel based bookkeeping tool. On the basis of a business as usual scenario we calculate the impact of already implemented policies as well as of planned policies to 2030. These scenarios provide the basis for assessing progress towards 2020 pledges and the overall trend towards 2030.

Figure 2 illustrates the different elements of the analysis and the different outcomes related to the time frames analysed.

Figure 1
Dimension of the analysis - definition of segments

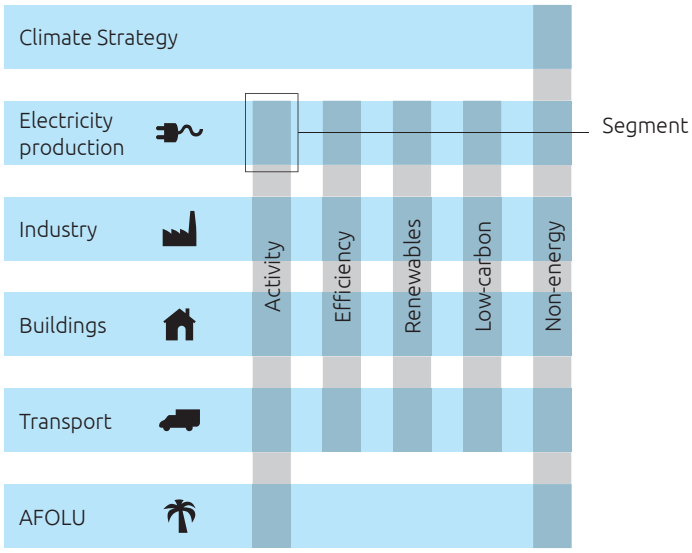
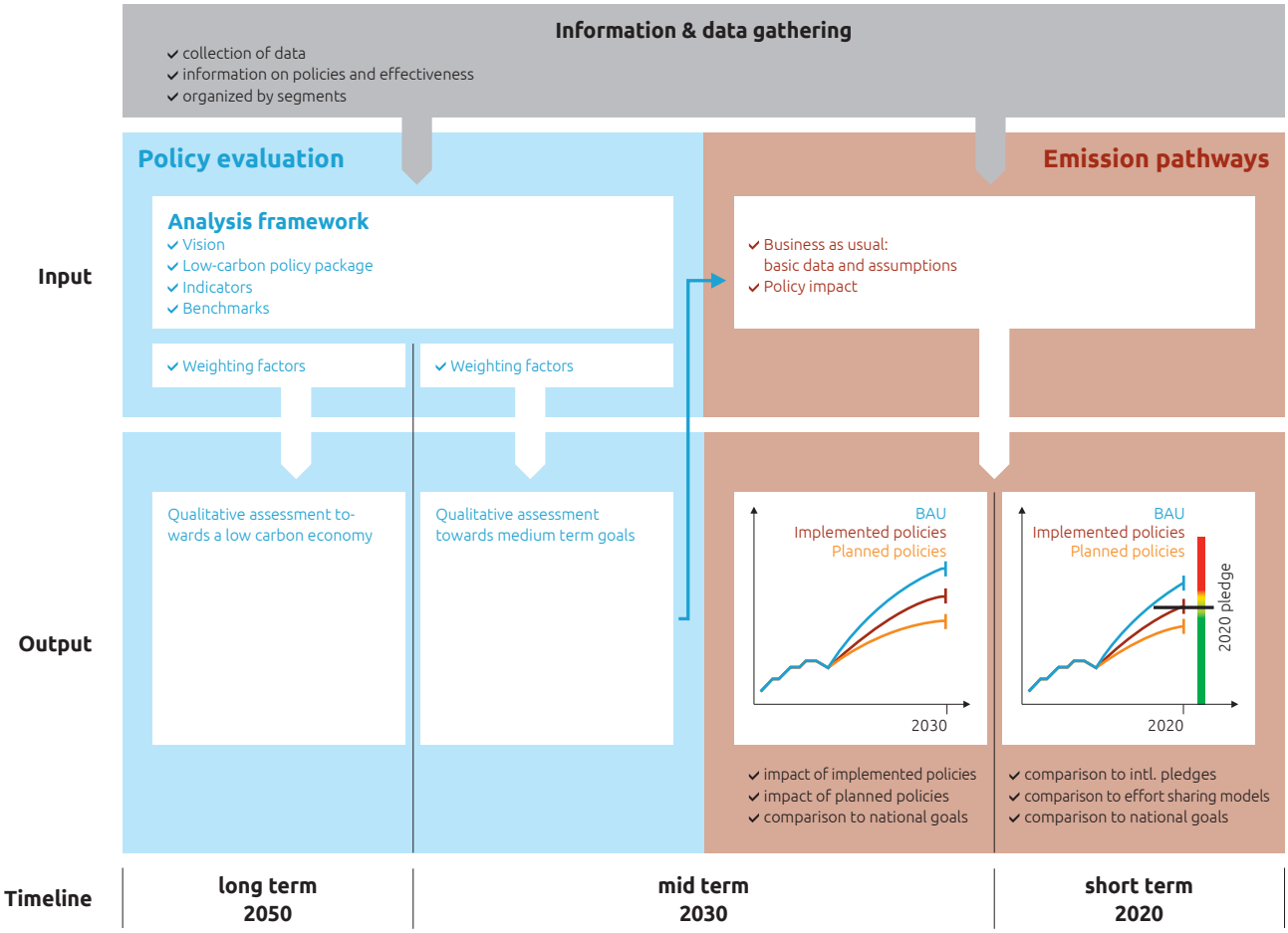


Figure 2
General approach for country analysis



2.2 The low carbon vision

Based on the review of various low-carbon scenarios[4], we developed a framework vision of a low carbon future. This constitutes the benchmark for the Climate Action Tracker. The common major features of the scenarios are as follows:

- **Ambitious energy efficiency improvements:** A fully sustainable low-carbon future is only possible if all energy efficiency potentials are fully implemented in a very ambitious way.
- **100 % carbon free energy supply by 2050:** The scenarios show that 100 % carbon free energy supply is technically possible and economically feasible. We use two alternatives to reach this. The first is that a 100 % renewable energy supply is technically possible and economically feasible: significant adjustments to the electricity grid are necessary. The alternative is that carbon capture and storage as well as nuclear energy can be used. Sensitivity to these assumptions is provided in the report.

[4] e.g. "The Energy report: 100 % renewable Energy in 2050" WWF 2011; "World Energy Outlook 2010" and "Energy technology perspectives 2010" IEA 2010; The Economics of Low Stabilization: Model Comparison of Mitigation Strategies and Costs" Edenhofer et al (2010)

- **Wide application of zero emission buildings:** Buildings need to be retrofitted to very high energy efficiency standards at least twice as fast as current practice. These renovated buildings and all new buildings need to be zero-emission buildings.
- **Paradigm shift in industrial production:** Not only is energy efficiency necessary, but material efficiency must be significantly improved. Industrial production must be redefined to move away from material-intensive products to long lasting, almost 100 % recyclable products.
- **Almost fully decarbonised mobility:** Provided there is a massive shift away from individual energy-based mobility, the remaining passenger car fleet must meet ambitious requirements both regarding efficiency and fuels used. Sustainably-produced biomass will be used in areas where there are no technological alternatives, e.g. trucks, aviation and shipping. Hence, passenger cars have to use alternative technologies, e.g. run on electricity with suitable batteries or other storage options.
- **New options to reduce emissions in agriculture:** Major reductions in non-energy emissions in agriculture are necessary. Where there are currently no mitigation options, research must be intensified.
- **Comprehensive land use strategies:** Comprehensive land use strategies need to be developed to solve the potential conflict in use of land. Land use can be optimised to reduce transport emissions. Agricultural products, forests and wood production compete for food production, as a source of biofuels and for carbon storage, biodiversity and other ecosystem services. We do not determine whether carbon sequestration in biomass or bio-energy should be favoured. Additionally, a framework for sustainable biomass production must be in place to ensure biomass used for energy purposes is produced in a sustainable way that actually decreases emissions. Where biomass imports occur, a framework to ensure the sustainability of these imports is required to ensure that leakage is minimised.
- **Halting deforestation:** global deforestation needs to be halted in the early half of this century.
- **Prompt action:** While global emissions need to peak no later than around 2020 to set the world on a pathway consistent with 2 and 1.5°C warming limits (United Nations Environment Programme 2009), power plants, industrial investments, infrastructure and transport fleets have life cycles of multiple decades. Hence, action has to start immediately to initiate a fast transformation. Participation and the phase-in of all major emitting countries is required within the coming decade.

To make this happen, fundamental changes in all sectors are needed. Policies need to be evaluated against how far they are able to trigger these fundamental changes. No single instrument can achieve this. It is essential to combine single policy measures into a coherent package both within each policy area, as well as between the different areas.

Our approach does not require an explicit representation of these elements of the low-carbon vision in policies and measures. The method is to assess if, ideally, Mexico is implementing a comprehensive and economy-wide integrated set of instruments that facilitate this development.

In other words, the policy packages need to form a coherent and consistent strategy to achieve a long-term low-carbon future, eliminate barriers to implementation and enhance incentives for stakeholders and sectors to ultimately make an economy-wide transition.

2.3 From vision to policies

At the heart of the analysis is the definition of a **'low carbon policy package'** that contains the policies necessary to reach a low carbon economy.

We look at both positive and negative aspects of policy, i.e. those that support the low carbon goal and those that are barriers and need to be removed.

Table 1
Low carbon policy package

	Changing activity	Energy efficiency	Low carbon			Other
			Renewables	With nuclear/CCS (low carbon vision)	Without nuclear/ CCS (100 % renewable vision)	
Climate Strategy	▸ Ambitious binding greenhouse gas reduction target, consistent with major effort sharing approaches ▸ Comprehensive and consistent long term strategy beyond 2020					
Electricity (heat) supply	(Electricity production is driven by the demand of the other sectors)	**Efficiency of fossil fuel power plants:** leading to average efficiency of 45 % (coal) and 60 % (natural gas) in 2030 or inventive is > 100 US$/tCO$_2$) **Combined heat and power production (CHP):** leading to 10 % additional share of electricity production in 10 years **Reduction of distribution losses:** leading to 4 % distribution losses in 2030	**General incentives for the production of electricity from renewable energy sources:** supporting at least 10 %points increase in share in 10 years **Support different technologies:** including sufficient support for 1-2 high price technologies (PV, geothermal power, biogas …) **Support for adapted electricity grids** **Sustainability standards for biomass use** **Removal of administrative and grid barriers**	**Policies that influence fuel choice:** taxes, emissions trading, emission performance standards in the order of 100US$/tCO$_2$e **Support for biomass CCS:** demonstration scale plants are supported **Support for coal CCS:** support for substantial increase in capacity **Support for substantial increase of nuclear capacity**	**Policies that influence fuel choice:** taxes, emissions trading, emission performance standards in the order of 100US$/tCO$_2$e **Support for biomass CCS:** demonstration scale plants are supported **Support for coal CCS is a *barrier* to renewable energy** **Support for substantial increase of nuclear capacity is a *barrier* to renewable energy**	Not applicable
Industry	**Restructuring industry towards high material efficiency:** leading to 0.5 % additional material efficiency improvement per year	**General incentives such as taxes, subsidies, ETS:** tax >100 % of energy price or leading to 0.5 % additional annual increase in energy efficiency	**General incentives:** energy taxes (> 100 % of energy price) and subsidies, ETS, overall leading to additional 5 % in 10 years **Sustainability standards for biomass use**	**Support for coal and gas CCS:** 10 % in 2030 **Support for CCS on biomass and process emissions:** 10 % in 2030	**Support for CCS on biomass and process emissions:** 10 % in 2030 **Support for coal and gas CCS is a *barrier* to renewable energy**	**Reduce N_2O process emissions:** to 10 % of historical maximum by 2030 **Reduce fugitive CH_4 from oil and gas production:** to 10 % of historical maximum by 2030 **Reduce CH_4 from waste:** by 20 % below BAU by 2030 **Reduce emissions of F-gases**
Buildings	**Urbanisation policy that leads to energy efficient development**	**Efficiency standards for new buildings:** zero energy by 2020 **Support to increase energy efficient retrofit rate:** 3 % per year **Incentives for efficient electrical appliances:** leading to 1-2 % less electricity use per year **General incentives:** taxes in the order of 100 % of the energy price **Removal of barriers, e.g. subsidies**	**Support for renewables in new and existing buildings:** increase in share of 10 % in 10 years **General incentives:** taxes in the order of 100 % of the energy price **Sustainability standards for biomass use:** national and imported	**Support for fossil fuel switching (to gas)**		Not applicable
Transport	**Strategies to avoid transport or to move to non-motorised transport:** 4 % avoided by 2020 **Strategies for modal shift:** 8 % increase of capacity by 2020 **General incentives:** e.g. tax of the order of 100 % of energy price	**Incentives for efficiency in light vehicles:** trajectory to reach 95g/km in 2020 for new cars **Incentives for efficiency in freight transport:** reduce specific emissions by 20 % by 2020 **General incentives:** e.g. tax of the order of 100 % of energy price	**Incentives for renewables in transport:** additional share of 10 % by 2020 **Sustainability standards for biomass use:** national and imported	**Support for fossil fuel switching (to gas) an other low carbon technologies** **Support for electro mobility (cars and infrastructure):** 5 % electric cars by 2020		Not applicable

s. next page ▶

	Changing activity	Energy efficiency	Low carbon			Other
			Renewables	With nuclear/CCS (low carbon vision)	Without nuclear/ CCS (100 % renewable vision)	
Agriculture, Forests and other land use	**Incentives for sustainable consumption practices** **Consistent land use strategy exists and is implemented** **Land use register exists**	Not applicable				**Decrease livestock CH_4 and N_2O emissions:** by 3 % below BAU in 2030 **Decrease cropland and organic/ peaty soils, all non-CO_2 emissions (including rice production):** 5 % below BAU in 2030 **Implement measures CO_2 on cropland:** on 100 % of the area available for this purpose by 2030 **Reduce grassland all non-CO_2 emissions:** 7 % below BAU in 2030 **Implement deforestation measures:** on 100 % of the forest area by 2030 **Promote the conversion of non-forest land to forests through afforestation and reforestation (A/R):** leading to A/R on 100 % of the area available for this purpose by 2030

We measure how effective a policy package is by looking at whether we can prove the direct relationship between the political influence on the actors (e.g. taxes, regulations, incentives) and the policy's intended effect (reaching of target e.g. through sectoral change).

We only evaluate **policy packages**, i.e. all policies relevant within a segment, and not individual policies or measures. Often only the combination of a range of measures creates the desired impact.

The scoring system

If a policy does not deliver the expected results, it is not always easy to assess whether this is because the policy has not been driven properly, or because of existing barriers. We have developed an indicator for both incentives and barriers to allow for this.

For each indicator we defined a benchmark - on the basis of the defined vision. The benchmark is descriptive, but aims to include quantified expected results where possible.

Incentive scores: 0 to 4

0 **1** 2 3 4

Scale for scoring incentives

We evaluate incentives on a scale against the defined benchmarks, from 0-4, where 4 is excellent.

Barrier scores: -4 to 0

-4 -3 -2 **-1** 0

Scale for scoring barriers

We evaluate barriers on a similar scale, from -4 to 0, where 0 means that barriers have been addressed. This negative score counts against its related incentive.

We evaluate the impact of policies that have been adopted, i.e. the proven and future expected effects of measures that are **fully implemented**.

Where policies have already been in place for some time we evaluate both the past effectiveness and the expected effects of the policy.

Policies that have just recently been implemented are evaluated on the basis of their design and potential effectiveness.

We aggregate the individual scores per segment to an overall rating between 0 and 4. This segment rating is translated into a scale from A to G according to the matrix in table 2.

Table 2
Scoring matrix

Assessment value >=	Rating	Interpretation
0	G	No or very limited policies
0.57	F	Few policies, ambition level low
1.14	E	Some policies with medium ambition level
1.71	D	Comprehensive package or good ambition level for a wide range of policies
2.29	C	Comprehensive policy package, ambition level good
2.86	B	Pathway is set, minor improvements required
3.43	A	Consistent with low carbon development

2.4 From policies to emissions

The development of emission pathways is based on a highly simplified, excel-based model: the "book-keeping model". This is to provide transparency, allowing discussions about the model, its assumptions and results to be accessible to people with limited modeling or technical background.

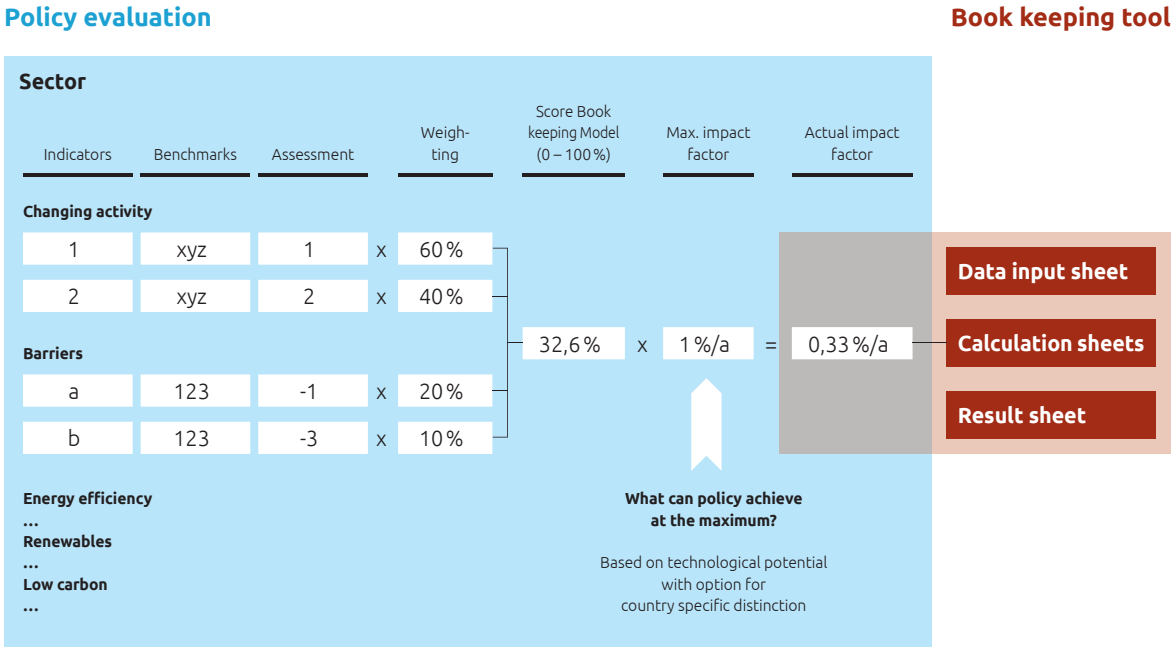
The "book-keeping model" works at the level of energy and emission data and does not include activity data (e.g. kilometers driven per car and year). The output from the policy analysis directly affects either energy consumption or greenhouse gas emissions.

The basis for the calculation of the policy scenario is the business as usual (BAU) scenario. It consists of two parts:
1. Historic energy use and emissions
2. Projected energy use and emissions

Before being able to quantify the emission pathways that result from the policy analysis, we translated the results from the policy evaluation into a format that can be used as an input in the 'book-keeping model'.

We had to aggregate the indicator scores, including both incentives and barriers. For example, all scores that drive the share of renewables in a sector have to be aggregated.

Figure 3
From policy evaluation to emissions pathways



For each of the aggregated scores we defined a 'maximum impact factor' and multiplied it with its associated **'book-keeping model score'** to derive the **'actual impact factors'**. We then used the actual impact factor in the calculations for that segment.

2.5 Data sources

We use a variety of data sources for the determination of historic emissions and projections of future emissions. An important factor for the choice of data sources is to ensure consistency within the dataset for historic and projected data and to enable comparability with other countries. We furthermore try to use in-country data sources whenever available.

Table 3 shows the different data sources used for all sectors except AFOLU, which follows a different approach as outlined further below.

For Mexico's historical final energy use of the demand sectors and the fuel mix of the energy sector, we used data from the "Sistema de Información Energética" of SENER (2011b). This is combined with data from the IEA, where we calculate the efficiency of power plants on the bases of primary energy demand and electricity output.

For historical data on non-energy related emissions we used the UNFCCC data interface which presents Mexico's national greenhouse gas inventories as submitted in the national communications to the UNFCCC (UNFCCC 2012a).

For the projections of energy use and non-energy emissions we generally use pre-defined energy and/or emissions scenarios from trusted sources, preferable an in-country institution.

For energy projections in this report we used the growth rates in energy consumption per carrier from the Energy Ministry (SENER) (2010b, 2010c,2010d, 2010e, 2010f) until 2025 and for the remaining years the average of the projected growth between 2011 and 2025. For non-energy related emissions projections we used estimates from the Instituto Mexicano del Petróleo (2006) and USEPA (2006).

Table 3
Sources for emissions data for the electricity supply, industry, buildings and transport sectors

	Historic data	Projections
Energy CO_2	▸ SENER energy statistics 2011, final energy demand and fuel mix of electricity supply sector ▸ IEA energy statistics (2011), primary energy consumption and electricity output and losses and own consumption of electricity supply sector ▸ IPCC 2006 emission factors	▸ SENER energy projections (to 2025) ▸ IEA Energy projections (2025 -2030) ▸ IPCC 2006 emission factors
Non-energy emissions	▸ Data as communicated to the UNFCCC and in the 4th National Communication Mexico	▸ Instituto Mexicano del Petróleo 2006 ▸ USEPA Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990-2020

Table 4
Sources for emissions data for the AFOLU sector

	Historic data	Projections
CH_4 and N_2O (Agriculture)	▸ UNFCCC data interface for national GHG inventories (UNFCCC 2012a)	▸ Usepa 2006
CO_2 (LULUCF)	Own calculations based on land area changes and carbon content: ▸ **Area:** – FAO's Global Forest Resource Assessment – INEGI statistics ▸ **Carbon content:** – IPCC 2006 carbon content (deforestation, grassland, cropland) – 4th National Communication (afforestation)	Own calculations based on trend development of areas.

A combination of two approaches determine the emissions for AFOLU: for CH_4 and N_2O emissions we use UNFCCC inventory data; CO_2 emissions from land use change and forestry are calculated using the historic data for de- and afforested area, grassland and cropland from the Instituto Nacional de Estadísticas y Geografía (2007) and the Global Forest Resource Assessment (FAO 2010). The appropriate values for the carbon content for the areas are taken from the IPCC 2006 Guidelines (IPCC 2006) and the 4th National communication of Mexico (Comisión Intersecretarial de Cambio Climático 2009a).

For all details on the methodology please consult the separate technical paper available on the Climate Action Tracker website (www.climateactiontracker.org).

3 | MEXICO IN BRIEF

This chapter gives a brief introduction on Mexico's economic, administrative and environmental context as well as on the major pillars of its climate policy.

3.1 Context

Climate and administration

Mexico covers an area of about 1.97 million km² in the southern part of the North American continent. In the north, it shares a border of more than 3,000 km length with the United States of America. Neighbouring states in the southeast are Guatemala and Belize.

Mexico has both temperate and tropical climate zones. The northern area experiences thermal fluctuations with cooler temperatures during winter, while temperatures are fairly constant during the year in the southern area (Parsons and Schaffer 2004).

The United Mexican States are a federation of thirty-one free and sovereign states that together form a union that exercises a degree of jurisdiction over the Federal District and other territories. Each state has its own constitution, congress and a judiciary (Estados Unidos Mexicanos 2010).

In 2010, Mexico celebrated 200 years of independence. The constitution, still valid today, was first introduced in 1917 (Estados Unidos Mexicanos 2009). The power is distributed to the president and its secretaries, the national court, the congress and the state governments (Estados Unidos Mexicanos 2011).

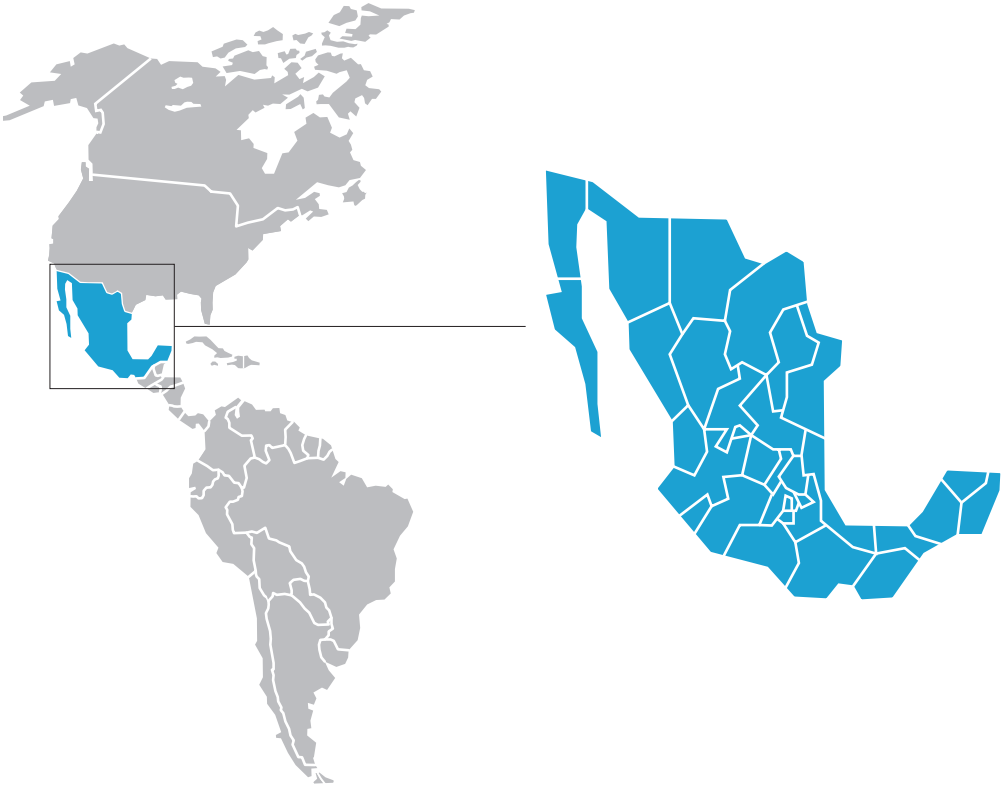
Felipe Calderón Hinojosa from the National Action Party (Partido Acción Nacional) has been President of Mexico since 2006.

Highlights

Area:	1.97 million km²
Population (2010):	112 million
Population density:	57 cap/km²
GDP per capita:	~ $ 8,000
Human Development Index:	0.75

Sources: World Bank 2009; Instituto Nacional de Estadística y Geografía (INEGI) 2010b; International Monetary Fund 2010; CIA 2011; UNdata 2011; Myhre et al.

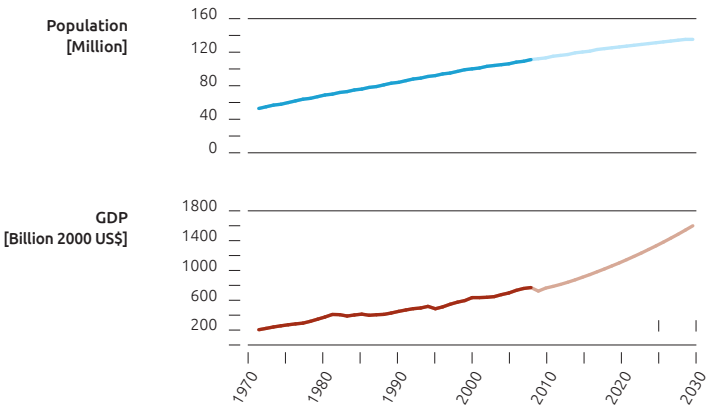
Figure 4
Map of Mexico



Social and economic situation

Mexico's population was around 112 million in 2010, with an increasing share (78 % in 2010) living in urban areas (United Nations Department of Economic and Social Affairs (UN DESA) 2011). Between 1990 and 2010, the population grew by 1.5 % annually, on average. This growth rate is slowing and is likely to keep decreasing with further development of the country but is expected to remain in a positive range in the coming decades (UNdata 2011).

Figure 5
Time series of historical (dark line) and projected data (light line) for population[5] (blue) and GDP[6] (brown)



The per capita gross domestic product (GDP) was slightly below US$ 8.000 in 2009. Between 2008 and 2009 the GDP per capita dropped by about 20 % due to the financial crisis. The average growth rate from 1990 to 2009 was 5.4 % (UNdata 2011). Real GDP (2000 US$) has followed a steady growth, with a significant drop due to the financial crisis in 2009, but recovering from 2011 with a further accelerating trend (see Figure 5).

The GDP is mainly generated in the service sector (59 %), followed by industry (37 %). At 4 %, the agricultural sector contributes a small amount (UNdata 2011). Internationally, the Mexican economy is highly integrated via various organizations such as the OECD and the NAFTA. Mexico has particularly strong links to the United States, which was the destination of about 80 % of Mexican exports and the origin of about 50 % of Mexican imports (Estados Unidos Mexicanos 2009).

In 2010, the World Bank gave Mexico a Human Development Index (HDI) of 0.75, which indicates high development. It ranked the country at 56 out of 169 countries (UNdata 2011). However, in 2004, 47 % of the population lived below the national poverty line, with the share being higher in rural areas (57 %) than in urban areas (41 %) (UNdata 2011).

Environmental issues

Mexico consists of many different climatic regions with a high diversity of plants and animals. According to Mexico's fourth National Communication, issued in 2009, anthropogenic activities such as deforestation, contamination of soils and water and heavy exploitation of natural resources are threatening these ecosystems (Estados Unidos Mexicanos 2009).

Air quality, mainly due to transport, is a major issue in urban areas such as Mexico City. Increasing traffic, combined with limited urban planning concepts, has led to an increase in air pollution. Co-firing of waste is another important source of negative environmental effects. It reduces the demand for fossil fuels - but may also lead to increased air pollution (Ecofys 2011).

[5] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat 2010
[6] Source for historical data was the IEA 2011. Real GDP (2000 US$) between 2008-2030 was estimated using annual growth rates delivered by World Bank World Development Indicators, International Financial Statistics of the IMF, HIS Global Insight, and Oxford Economic Forecasting

Energy and CO_2 emission trends and projections to 2030

Energy consumption constantly increased between 1990 and 2008 to about 150 000 ktoe (see Figure 6). Since 1990, energy supply has been dominated by fossil fuels, especially by oil and gas, which are extracted domestically. Still, Mexico's resources are not very abundant, with the reserves to production ratio being only 10.6 years for oil and 8.9 years for gas (BP 2011). In 2010, the renewable energy share of the primary energy demand was 11 % with biomass and waste as the biggest contributor (5.6 %). Mexico is one of the leading countries in geothermal electricity production. About 3 % of the electricity is produced by this renewable energy source.

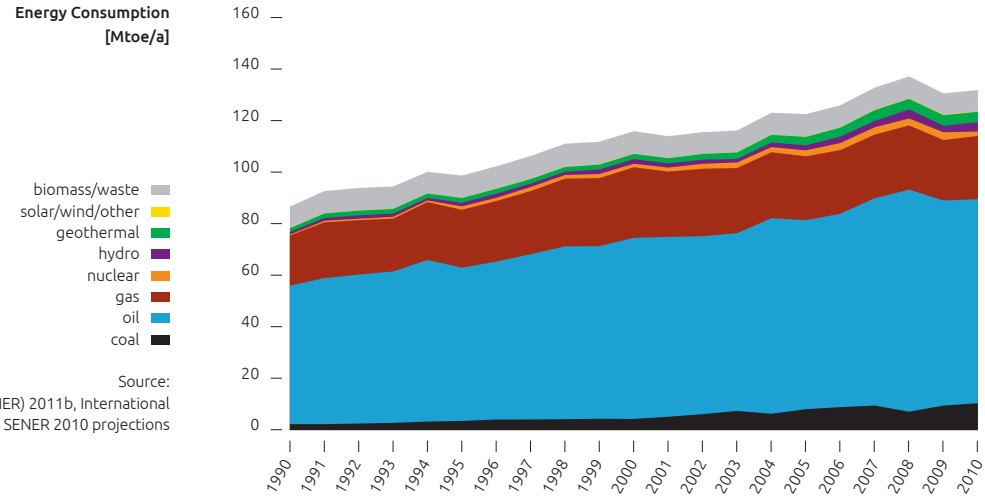
In 2008, the largest energy demand sector was the transport sector, which took up 36 % of the primary energy demand, followed by the energy supply sector, which consumed 31 %. The industrial sector consumed 19 % and the residential and commercial sector 14 %.

Analysis of trends in the fundamental driving parameters for future national carbon dioxide emissions, i.e. a decomposition analysis, supports the assessment as to whether policies are at a sufficient scale to reduce emissions fast enough to get within emission pathways consistent with warming targets such as 2°C or 1.5° goal.

Energy intensity (energy use per GDP) peaked in the '90s, and has been on a continuous downward trend since then. Carbon intensity (CO_2 per energy unit) has fluctuated moderately, with an overall slightly decreasing trend that is projected to continue.

Together both elements have actually worked towards a decarbonisation of the Mexican economy. However, this has been over-compensated through increases in GDP per capita and population growth (see Figure 7 and Figure 8).

Figure 6
Primary energy consumption in Mexico 1990 - 2010



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

Figure 7

Time series of main drivers

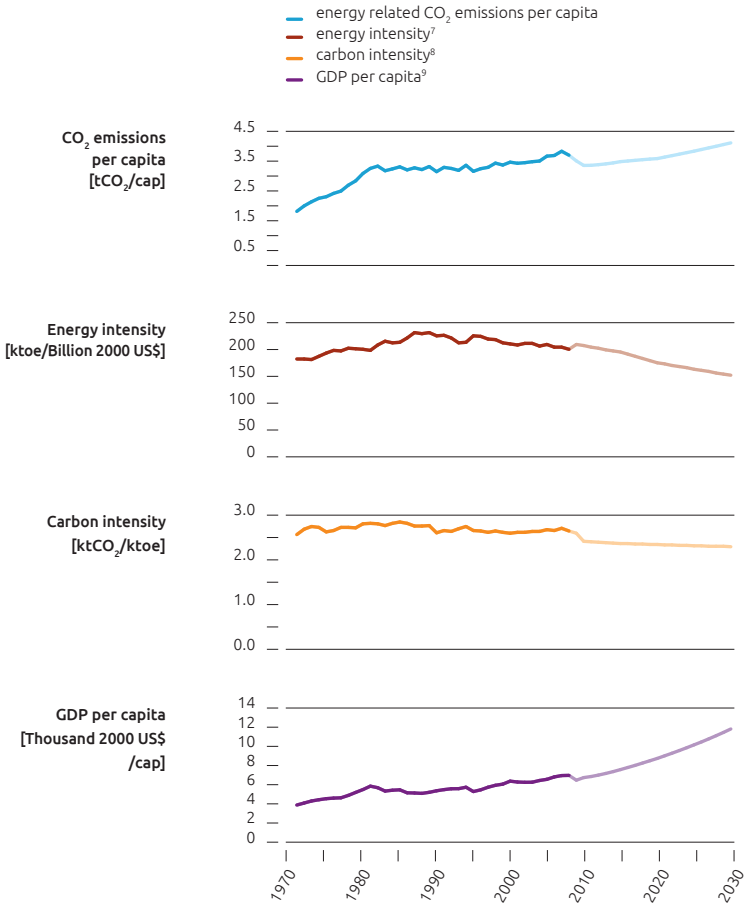
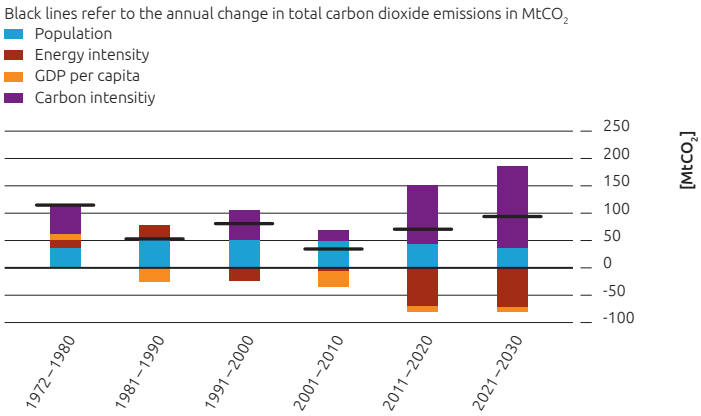


Figure 8

LMDI decomposition analysis[10] per decade.



[7] Historical data (1971-2007) from IEA 2010 edition (total primary energy supply). Values between 2008 and 2030 were estimated using annual projected growth rates for TPES/GDP from the International Energy Outlook (EIA)

[8] Historical data from IEA 2010 edition. Values between 2008 and 2030 were estimated using annual projected growth rates from International Energy Outlook 2010 (EIA)

[9] We break up changes in energy related CO_2 emissions along the factors of the Kaya identity (Kaya 1990) and express CO_2 emissions as a product of the driving forces population density (P), energy intensity (E/GDP), GDP per capita (GDP/P) and carbon intensity (CO_2/E) on total carbon emissions. Non-energy emissions and other gases are not included. Sources for GDP and population see Figure 5;

[10] We employed the LMDI (Logarithmic mean Divisia index) method (Ang 2005) to determine the individual effect of the driving forces on changes in CO_2 emissions.

Sources of greenhouse gas emissions

Mexico's greenhouse gas emissions excluding land use change (LULUCF) have constantly increased to about 616 Mt CO_2e in 2010, with an average growth rate of 1.8% since 1990. In 2010, the biggest emitters were the industry sector (48%) followed by transport (25%), energy supply (14%) and far off agriculture (8%) and the building sector (4%). Emissions have increased particularly in the industry, transport and energy supply sectors, while emissions from agriculture and buildings have remained fairly constant.

3.2 Climate policy in Mexico

Institutional framework

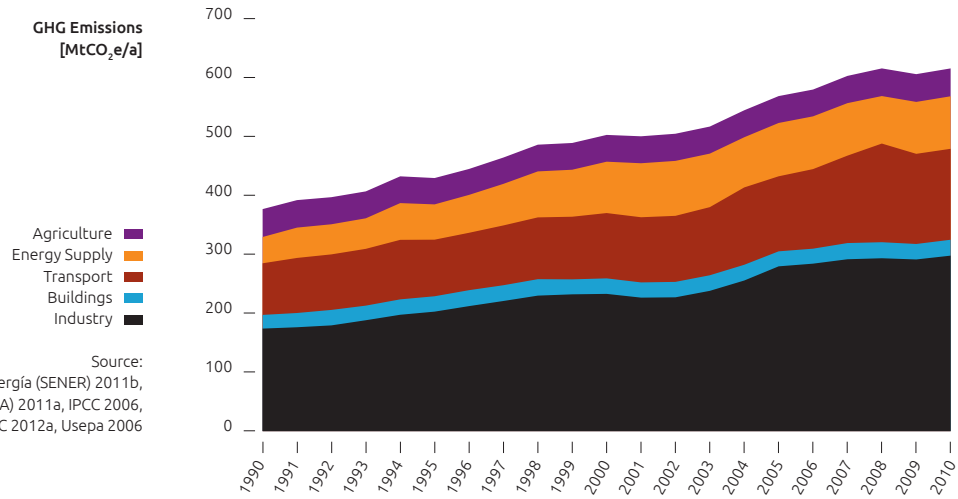
The United Mexican States form a federal constitutional republic. State governors are elected directly for a six-year mandate. The states are sovereign to a high extent, each having their own unicameral congress and constitution. The basic units of Mexican government are the municipalities. Municipal presidents are elected for a three-year mandate, without an option of re-election for the subsequent period.

The fiscal system in Mexico is one of the most centralised in Latin America. Both states and municipalities are subordinated to federal transfers and largely rely on the financial resources of the national government (Cabrero Mendoza 2010).

Policy at the municipality level mostly constitutes a response to demands for public services or specific demands and strictly follows the criteria of the federal government (Cabrero Mendoza 2003). However, over the past three decades a process of decentralization has evolved (Cabrero Mendoza 2010).

At the national level the Department of Energy ("Secretaría de Energía", SENER) and the Environment Ministry ("Secretaría de Medio Ambiente y Recursos Naturales", SEMARNAT) are responsible for energy and environment related issues. The federal government's monopoly on electric utilities is enshrined in the federal Constitution. The major, state-owned electricity service provider is the Federal Electricity Commission (Comisión Federal de Electricidad - CFE). Gasoline and diesel prices are determined by the federal government and implemented through the publicly owned oil company (Petróleos Mexicanos – PEMEX).

Figure 9
GHG emissions in Mexico 1990 - 2010



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, Instituto Mexicano del Petroleo 2006, UNFCCC 2012a, Usepa 2006

The degree of centralisation (or lack of it) can have both positive and negative effects on climate policy. A centralised approach can allow the adoption of policies with a national coverage and coherent strategy. A more decentralized approach can allow more ambitious or innovative states, municipalities, or other actors to move ahead and take more action.

The Inter-secretarial Commission on Climate Change ("Comisión Intersecretarial de Cambio Climático", CICC) was established in 2005. It brings all relevant Ministries and Agencies together and meets twice a year under the presidency of the Ministry of the Environment. The different working groups of the Commission address the different topics - mitigation, adaptation and REDD - as well as specific issues related to CDM and the coordination for the international negotiations. It published the National Climate Change Strategy in 2007, which led to the Federal Government's Special Climate Change Program (PECC), published 2009.

Main instruments to date

The "Special Program for the Use of Renewable Energy" includes six major strategies to increase the share of renewable energy in Mexico (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b). The strategies are not based on market mechanisms but on governmental action, which is in line with the monopolistic structure in the energy sector.

The "National Program for the Sustainable Use of Energy" supports energy efficiency in different sectors (Secretaría de Energía (SENER) 2010a). It is a package of financial incentives (e.g. green mortgages, support for efficient lighting), regulations and standards (e.g. standards for insulation of public buildings) and information (e.g. certification of efficient appliances).

The Federal Mass Transit Program (PROTRAM) provides financial and technical support for Sustainable Urban Mobility and to strengthen local capacity for planning, regulation and management of transport systems (OECD International Transport Forum 2011). This is complemented and strengthened by the Urban Transport Transformation Project (PTTU) that directly targets GHG emissions (Mier-y-Teran 2009).

Providing the basis for further action

In 2009, the Mexican government launched the Special Climate Change Programme (Programa Especial de Cambio Climático – PECC). This Programme includes strategies for all sectors.

Through this program, the different entities of the Federal Administration commit to adopting, as part of their work plans, objectives, strategies, lines of action and goals to mitigate greenhouse gas emissions and carry out adaptation measures during the period 2009-2012. However, in most areas, the PECC lacks clear policy instruments to achieve the stated goals.

It gave special attention to cleaner urban transportation, energy efficiency and renewable energy (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b). The Clean Technology Fund has provided $500 million to support these efforts.

Departments need to report on the progress of their activities on the bimonthly basis. The Government has also commissioned an independent evaluation of progress towards the stated goals, which is scheduled for publication at the same time as this analysis.

Mexico was the first developing country to adopt an absolute reduction target for 2050. Generally it is one of the countries with the fastest advances in strategic planning on how to incorporate low carbon development into all parts of the economy.

Triggered by the high commitment of President Calderón, the early establishment of the Inter-Ministerial Climate Change Commission in 2005 (CICC), which coordinates the strategic planning, supported this process.

Mexico's progress in policy planning and institution building over the past years has been remarkable. Given the phases that shape the general cycle of policymaking, the process in Mexico has moved well ahead in several ways:

- Awareness of climate change issues, both mitigation and adaptation, has penetrated a wide circle of stakeholders and actors.
- Mexico has achieved a high level of data availability, especially compared to other developing countries. This includes the submission of four National Communications with emission inventories to the UNFCCC, the first compulsory GHG reporting system for industry and several low-carbon development-plan studies (e.g. Johnson et al. 2009). This provides a good basis for policy making.
- A clear institutional setup for climate change policy, with responsibilities, lines of communication and focal points within and between ministries and outside helps to ensure consistency. It also provides the basis for further strategy development.

Mexico's planning exercise to define future long-term climate strategies are not part of this evaluation, but could substantially influence the results once they are implemented.

Box 1

The Climate Change Law (Ley General de Cambio Climático)

On 19 April 2012 the General Law on Climate Change became legislation in Mexico. This was a first successful step in the political process, after earlier attempts had failed.

The new legislation does not include concrete measures and activities, but rather consolidates the existing institutional structure and anchors a number of useful planning tools within the law. Below we summarize some of the main points:

- Formulation of different targets:
  - Reemphasis of the "Cancún pledge" to reduce emissions to 30 % below business-as-usual (BAU) by 2020, conditional on international financial support
  - Long-term emission reduction target of 50 % below 2000 levels by 2050.
  - Electricity target to provide 35 % of Mexico's electricity to come from clean sources by 2024
- Creation of a climate fund to collect and channel resources for climate change activities to reduce greenhouse gas emissions (mitigation) and adapt to the changing climate (adaptation).
- Creation of a National Environment and Climate Change Institute (INECC) providing research and policy recommendations, but also supporting capacity building and the evaluation of progress of the climate change legislation.
- Establishment of an overall institutional structure responsible for planning and implementing activities, including inter alia the Interministerial Commission for Climate Change (CICC), a Climate Change Council, a cooperation platform ('Sistema Nacional') and the INECC.
- Requirement for mandatory emissions reporting and the creation of a public emissions registry.
- Implementation of a national strategy for climate change, covering mitigation and adaptation with a 40 year horizon and regular revisions (every 10 years the latest).
- Mandates the development of programs to define goals and activities in the different sectors in line with the defined strategy.
- Authorizes the CICC to establish an emissions market, including the establishment of a regulating entity.
- Opens the possibility for interested entities to conduct international transactions between Mexico and any countries with which it makes emissions trading agreements.

Overall the legislation does not implement direct measures. It sets targets and consolidates the efforts to provide the appropriate institutional and informational framework for future action. It has the potential to embed a permanent system for planning and revision within the country.

Source: Legislation as adopted by the Senate on 19 April 2012 (Estados Unidos Mexicanos 2012)

International arena

In its submission to the Copenhagen Accord, the Mexican Government said: "Mexico aims at reducing its GHG emissions up to 30% with respect to the business as usual scenario by 2020 provided the provision of adequate financial and technological support from developed countries as part of a global agreement." President Felipe Calderón announced this target during the Copenhagen conference in 2009 (UNFCCC 2009).

Mexico has a very detailed national plan up to 2012, which includes emission reduction measures and their estimated effects on emissions. The resulting emission reductions to 2012 are a first, unconditional step. The plan is in line with an overall strategy to reduce emissions by 50% below the 2002 level by 2050. It assumes moderate reductions in the early years and more ambitious reductions later. National funding is secured for the measures up to 2012, while the achievement of the reduction target beyond this date will be conditional to international funding.

Mexico has not only come forward with comparatively ambitious goals as part of the Copenhagen Agreement (see www.climateactiontracker.org), it has also played a vital role in the negotiations leading to the Cancun Agreements in 2010. As a host to COP 16 it was - and still is - extremely active in preparing the ground through informal meetings dedicated to individual critical topics.

Mexico is also participating in different regional organisations like the "Bilateral Framework on Clean Energy and Climate Change" between the USA and Mexico, and the "Energy and Climate Partnership of the Americas". Furthermore, it signed the "North American Leaders' Declaration on Climate Change and Clean Energy", an agreement between the North American states to combat climate change and promote renewable energy.

Box 2

Mexico and the Carbon Market

Mexico has been active in the discussion around carbon markets and crediting mechanisms for the last years. It was actively involved in CDM discussions how to move beyond a project-by-project approach and the first Program of Activities for the replacement of incandescent light bulbs was registered in Mexico in July 2009 (UNFCCC 2012b).

Mexico also explored options for sectoral crediting mechanisms and NAMA crediting for various sectors over the last years. To support this interest and allow Mexico to further explore ideas and set up necessary structures the World Bank provided a US$ 350,000 grant within their 'Partnership for Market Readiness (PMR)' (World Bank 2011). According the Expression of Interest (EoI) the support is to be used for:

- Capacity building in the Mexican governmental agencies and in the main business organizations
- Identification of potential mitigation, assessment of GHG reduction measures, and setting targets for medium term in the private and public sectors.
- Identification of the main financial mechanisms to implement the GHG reduction activities

The General Law on Climate Change (see box 1) would provide the first step of the required legislative basis for the establishment of any type of carbon market within Mexico and provide the basis for trading of credits within offset schemes where bilateral agreements exist.

4 | POLICY EVALUATION

This chapter provides an overview of the policies in place in Mexico in the different sectors and evaluates their effectiveness towards a low carbon development.

4.1 General climate strategy

Under the Copenhagen Accord and the Cancun Agreements, Mexico pledged to reduce its GHG emissions by 30 % below business-as-usual by 2020, conditional on external financing. Mexico aims to reduce absolute emissions by 50 % below 2000 in 2050.

Key indicators

Emission reduction target 2020:	30 % below BAU
Emission reduction target 2050:	50 % below 2000

Sources: (Estados Unidos Mexicanos 2012)

The 2020 target is among the most stringent for developing countries. Mexico is also the only developing country that has set itself a target of absolute reductions by 2050.

A strategy to implement the targets is the Special Programme on Climate Change (PECC). It includes details on actions up to 2012 to reduce emissions by 50 $MtCO_2$ below BAU, financed mainly from domestic resources. It does not include actions after 2012. These actions are conditional to external funding. Several low carbon development strategies have been developed for Mexico, but none has developed into an official government long-term plan.

The PECC includes elements of an innovation strategy but a full comprehensive strategy is missing.

Potential options for future actions

Mexico could adopt a climate strategy beyond 2012. Such strategy process is underway but not yet finalised.

Table 5
Qualitative summary of the climate strategy

	General climate strategy
Highlights	▸ Ambitious target for 2020 related to reduction from BAU ▸ Ambitious absolute target for 2050, unique for developing countries
Requirements of the low carbon policy package	▸ Ambitious binding greenhouse gas reduction target, consistent with major effort sharing approaches ▸ Comprehensive and consistent long term strategy beyond 2020
Gap of national policies to low carbon policy package	▸ Actions and strategy only defined until 2012
Rating	D
Relevance for emissions in 2020	Low relevance for immediate emission reductions, very high relevance for long-term development towards a low-carbon economy

Note on rating: Rating represents the aggregated score per segment between G (poor) to A (excellent). Size of the letters resembles the mitigation potential of the segment

4.2 Electricity and heat

General situation

The Mexican government holds a monopoly on electric utilities, based on its Constitution. The government is responsible for the control and development of the national electric industry. The major, state-owned electricity service provider is the Federal Electricity Commission (Comisión Federal de Electricidad - CFE). The CFE is responsible for the generation, transmission and distribution of electricity in Mexico and has an installed power generating capacity of approximately 58 GW (roughly 70 % of installed generation capacity). It also provides the complete electricity transmission and distribution infrastructure.

To support economic growth and make energy available to low-income households, Mexico subsidises energy. For 2008, the subsidies paid through electricity tariffs to CFE and LFC consumers by the Federal Government amounted to an estimated US$10 billion (close to 1 % of GDP). Two-thirds of all electricity subsidies in Mexico are directed at residential electricity customers. This share has increased over time. The subsidies provided to residential customers have increased by 46 % since the last tariff reform in 2002. Often efforts to reduce subsidies have been followed by the creation of new and more highly subsidised tariff categories to offset the burden on those residential customers adversely affected by the last tariff change (Irastorza 2006; Comisión Federal de Electricidad (CFE) 2008a,2008b; Kornives 2010).

Key Indicators 2008

Installed capacity:	58 GW
Total electricity production:	22,716 GWh
Share of renewables:	19 %
Share of non-hydro REN:	4 %

Sources: International Energy Agency (IEA) 2010b; Secretaría de Energìa (SENER) 2011a; own estimate

Heat production does not play an important role, as the concepts of combined heat and power and district heating are not very common. Climatic conditions result in low demand for residential heating. Process heat demand is included in the industry sector.

The energy supply relies heavily on gas-fired power plants produced 51 % of the electricity in 2008, followed by oil with 19 %. Hydro power is the third biggest electricity producer with about 15 % of the total electricity production, followed by coal with 8 %. Mexico also has a nuclear power plant with two 800 MW reactors, producing about 4 % of the total electricity in 2008. The remaining 3 % is covered by geothermal energy. Other renewables are still in their fledgling stages, e.g. 20 wind park projects are operational with a capacity of 2.6 GW (Secretaría de Energía (SENER) 2011). Overall, 19 % of the electricity production was based on renewable sources.

Mexico's per capita consumption of electricity is low compared to industrialised countries (IEA 2010a). However, with increasing income, electricity consumption will increase. The national electricity consumption in Mexico is expected to grow by 3.8 % per year between 2008 and 2017 (Estados Unidos Mexicanos 2009). By 2030, electricity demand is projected to more than double (Johnson et al. 2009).

In 1992, amendments to the Public Service Electricity Law (Ley de Servicio Público de la Energía Eléctrica) allowed the private sector to participate in specific electricity generation activities:

- **Self-supply:** Produced electricity can be directly used by the producer or sold to the CFE, but not to third parties. However, due to the regulation that CFE has to provide electricity at least cost, the CFE pays low electricity tariffs.
- **Cogeneration:** For private cogeneration, the same rules apply as for self-supply. Often, consortia are built to jointly produce and use electricity and heat from cogeneration. This is more difficult without an existing market.
- **Independent power production:** The CFE concludes contracts with the private producers for a fixed price under long-term power purchase agreements, which normally last 20 to 25 years. This is a successful model for natural gas-fired power plants. Due to the low tariffs and potential transmission fees, it is more difficult for renewable energy projects. Independent power production accounts for approximately 23 % of Mexico's total installed capacity and 31 % of total electricity generated (Johnson et al. 2009; Rothkopf 2009).

- **Small energy producers:** Small energy producers are allowed to operate plants smaller than 30 MW. The Secretariat of Energy (SENER) identifies special areas where these plants have to be located. Small Energy Producers may sell their power to rural communities for their own use and to the CFE (Garrison 2010).
- **Import and export:** Private producers can sell their electricity to other countries - mainly the USA, Belize and Guatemala.

As of the end of 2009, private production capacity was around 23 GW. The majority was based on combined-cycle and gas-fired turbines. Several private wind energy projects are currently under construction. Some private wind projects are located near the USA for electricity exports (Garrison 2010).

Electricity prices for industry have been comparatively high in Mexico while low income households receive subsidized electricity.

Overview of policies and their effectiveness

The most significant policies in México are those taken by the Energy Regulatory Commission, related to interconnection for renewables, transmission costs of electricity, and amendment to the Electricity Public Service Act (Ley del Servicio Público de Energía Eléctrica).

Distribution losses are considerable in Mexico. Electric power transmissions and distribution losses are between 16 % and 19 % (world average 9 %). Mexico is aware of this and has plans to reduce transmission losses.

The Special Program for Climate Change 2009-2012 (PECC) aims to increase the electricity generation from renewable energy from today's 4 % to between 4.5 % and 6.6 % (excluding large hydro) with wind power accounting for 1.7-2.9 %, mini hydro 0.4-0.6 %, geothermal 2.2-2.7 % and biomass and biogas 0.2-0.3 % (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b). The PECC includes targets and objectives, as well as plans of the CFE to construct hydro and wind plants. It does not specify actual policy instruments to achieve the target related to the private sector.

The main visible policy instruments to achieve this target are:

- The opportunity for the private sector to produce electricity and heat under special conditions. Production for own use in industry is indirectly incentivized by relatively high electricity prices for industry, which makes it an attractive option. In addition, electricity not consumed on site can be fed into the grid and will be deducted from overall consumption from the grid.
- Some financial incentives: fiscal credit of 30 % for research and development and 100 % depreciation for all renewable energy capital investment in the first year.

However, several barriers that prevent new renewable installation still need to be removed:

- Renewables may be produced by the private sector only for self-consumption or to sell to other countries (e.g. USA). It can be sold also to the CFE but due to the least cost requirement, the tariffs are low.
- Fees and charges for transmission are not regulated.

In recent years, more and more oil capacity has been replaced by gas (combined cycle gas turbines), leading to stable absolute emissions from the electricity sector with increase in absolute production. This is due to the price difference and not due to specific policies. Plans for new nuclear power plants (currently accounting for 5 % of the electricity supply) have also been changed in favour of gas (Rodriguez 2011; World Nuclear Association 2011).

National funds to support renewable energy supply (Fund for the Energy Transition and the Sustainable Use of Energy) and grid development (Fund to Support Social Infrastructure, FAIS) are in place and need to be maintained in the future. A next step to significantly increase renewable energy production could be feed-in tariffs along with a subsidies reform.

Table 6
Qualitative summary of policies for the electricity and heat sector

	Energy efficiency	Low carbon		
		Renewables	With Nuclear/CCS (low carbon vision)	Without Nuclear/CCS (100 % renewable vision)
Highlights	▸ The National Program for the Sustainable Use of Energy aims to develop a strategy to promote CHP ▸ Pemex Gas and Petrochemicals Basic (PGPB) conduct a cogeneration project 300 MW, which will start operating in 2011 ▸ Electric Infrastructure Investment Plan includes measures until 2025 to reduce transmission losses- ▸ No subsidies for fossil fuels for electricity production	▸ Private producers may produce (RE) electricity for export or own use. This is indirectly incentivised through relatively high electricity prices for industry ▸ Net accounting approach for renewables (electricity can be fed into the grid and consumed when needed) ▸ Interconnection agreement for small PV ▸ Fiscal credit for research and development		
Requirements of the low carbon policy package	▸ Efficiency of fossil fuel power plants (leading to average efficiency of 45 % (coal) and 60 % (natural gas) in 2030 or inventive is > 100 US$/tCO$_2$) ▸ CHP (leading to 10 % additional share of electricity production in 10 years) ▸ Reduction of distribution losses (leading to 4 % distribution losses in 2030)	▸ General incentives that support at least 10 %points increase in 10 years of the share of production of electricity from renewable energy sources ▸ Support different technologies (including sufficient support for 1-2 high price technologies (PV, geothermal power, biogas…) ▸ Support for adapted electricity grids ▸ Sustainability standards for biomass use ▸ Removal of administrative and grid barriers	▸ Policies that influence fuel choice (taxes, emissions trading, emission performance standards in the order of 100US$/tCO$_2$e) ▸ Support for biomass CCS (demonstration scale plants are supported) ▸ Support for coal CCS (support for substantial increase in capacity) ▸ Support for substantial increase of nuclear capacity	▸ Policies that influence fuel choice (taxes, emissions trading, emission performance standards in the order of 100US$/tCO$_2$e) ▸ Support for biomass CCS (demonstration scale plants are supported) ▸ Support for coal CCS is a *barrier* to renewable energy ▸ Support for substantial increase of nuclear capacity is a *barrier* to renewable energy
Gap of national policies to low carbon policy package	▸ No Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO$_2$ taxes, emissions trading…) ▸ No enhancement of grid development and further efforts to reduce distribution losses	▸ No active support for electricity generation with renewable energy sources other than production for own use ▸ No active support of diversification of renewable energy technologies ▸ No investment and implementation strategy for RE oriented grid structure	▸ No policies, financing mechanisms and strategies that support the increasing use of CCS for coal and biomass	▸ No policies, financing mechanisms and strategies that support the increasing use of CCS for coal and biomass
Rating	**G**	**E**	**G**	**G**
Relevance for emissions in 2020	High relevance: The increase of efficiency has direct short and long-term effects on emissions	High relevance: Renewable electricity has a high impact on emissions in 2020. Several technologies already exist and can, with appropriate support, directly add to Mexico's energy supply and support emission reduction	Low relevance: the increasing use of nuclear energy and CCS would have mid- to long-term effects. Especially the CCS can be assumed to become relevant only after 2020.	

Note on rating: Rating represents the aggregated score per segment between 0 (poor) and 4 (excellent) and is translated into G (poor) to A (excellent). Size of the letters resembles the mitigation potential of the segment

Potential options for future actions

Options for future action in the electricity and heat sector lie in the increase of energy efficiency and in the increasing use of low-carbon fuels and technologies.

Energy efficiency can be stimulated with incentives to increase efficiency in fossil power plants, such as performance standards, energy and CO_2 taxes or emissions trading. Furthermore, effort to reduce distribution losses could add to increase the overall efficiency.

A second important option is the promotion of renewable electricity. This can be achieved in a variety of ways, for example through providing more incentives to private and industrial production. This would require adjustments to regulation allowing private production, financial incentives above the current feed in prices, regulation on transmission charges, rules on preferential grid access and congestion management for renewable electricity and investment - and an implementation strategy for a renewable energy-oriented grid structure.

Impact on emissions in 2020 and 2030

Emissions from the electricity and heat sector have increased substantially in the 1990s, basically doubling up to 2010. They have been stable in the last five years due to the switch to natural gas while production increased as shown in Figure 10.

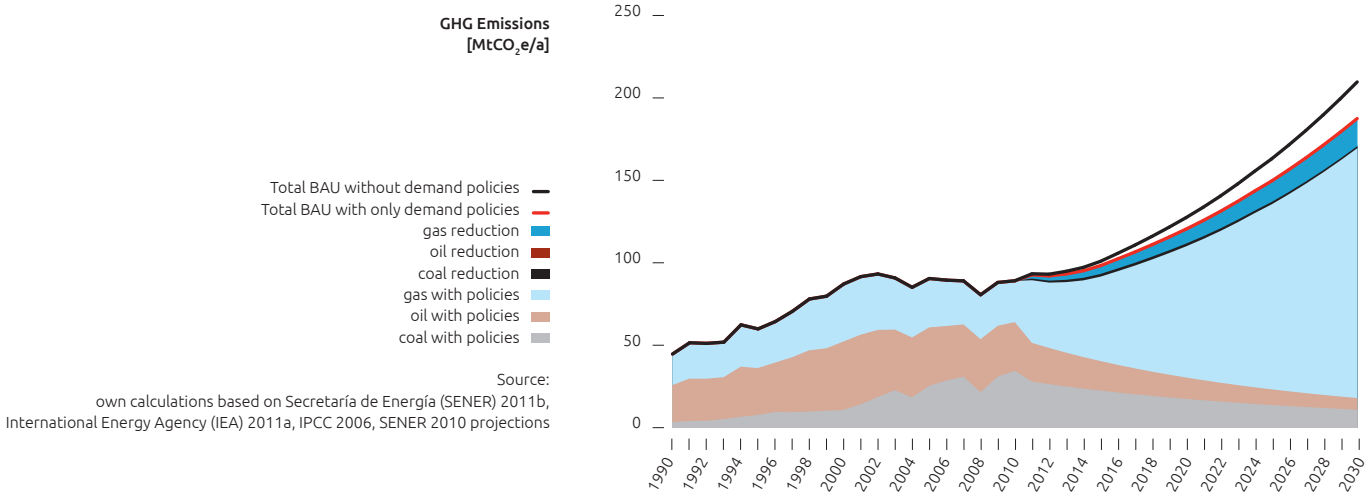
Under the business as usual scenario (BAU) with no policies in the demand sectors, emissions would increase by another 136 % to 2030 compared to 2010 to 210 $MtCO_2e/a$ by 2030 (see Figure 10 and Figure 11).

If we consider policies in the demand sectors under the BAU, we assume emissions would increase by 111 % between 2010 and 2030, leading to total emissions of 188 $MtCO_2e/a$ by 2030. We assume that the switch to gas continues, but saturates and cannot compensate for the increase in production.

Policies implemented to save electricity in the demand sectors reduce emissions by about 22 $MtCO_2e/a$ by 2030, a reduction of 11 %. These policies are described in the demand side sector analysis sections below.

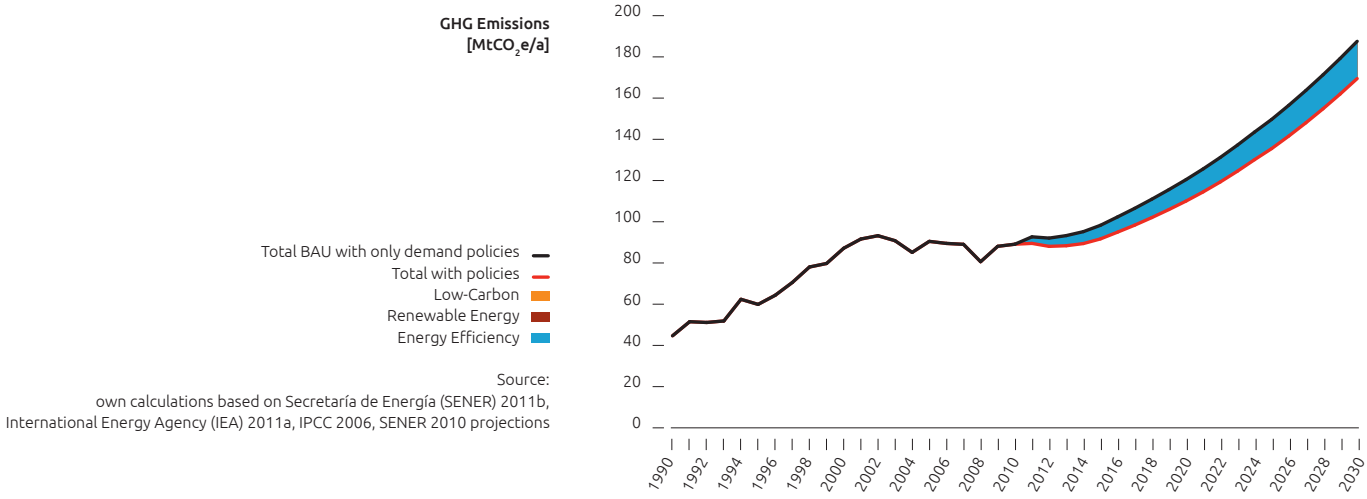
Policies directly targeting the electricity sector can reduce emissions by another 18 $MtCO_2e/a$. This is mainly due to efficiency gains and only marginally through low carbon technologies and the support of renewable energy, all of which will mainly be replacing gas.

Figure 10
Electricity emissions projections to 2030



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

Figure 11
Electricity emissions projections to 2030 by policy area



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

4.3 Industry

General Situation

Mexican industry, including the manufacturing, mining, construction and energy supply sectors, contribute 37 % to the country's GDP (UNdata 2011)[11]. The food and beverage, metal working (incl. the automobile), textile and leather product fabrication and non-metal minerals industries (especially cement production) are economically the most important industrial sectors [Aguayo 2003; Instituto Nacional de Estadística y Geografía (INEGI) 2010a].

Mexican industry consumed about 30,000 ktoe in 2008, of which 36 % were from electricity, 29 % gas, 23 % oil 7 % coal and 5 % biomass or waste. Main energy-consuming sub-sectors were the iron and steel industry (19 %), the non-metallic minerals industry (15 %), the chemical and petrochemical industry (10 %) and the food and tobacco industry (8 %). The CO_2 emissions, including emissions as a result of energy consumption as well as process emissions, are mainly from the iron and steel industry (25 %), non-metallic minerals (23 %), and the chemical and petrochemical industry (11 %) (IEA 2010a).

Mexico's industry sector has a broad spectrum of sub-sectors that differ substantially in their technologies, necessary inputs and resulting outputs. Therefore, energy intensity varies within the industrial sector. The Mexican cement industry, for instance, is one of the most efficient worldwide, whereas other industries (e.g. mining, construction) are still in transition from human labour to machines and therefore exhibit increasing energy intensity. Still, an overall downward trend in energy intensity since 1990 can be observed, mainly due to two factors: increased energy efficiency due to technological changes, and shifts within the composition of the sector (Aguayo 2003).

In recent decades, many so-called "maquiladoras" have been established in the north of Mexico as economic integration has increased with North America. Maquiladoras are factories producing or assembling labour-intensive goods, mainly clothing, plastic products, electronics or automobile components for export to the USA. They are often owned by foreign investors attracted by low wages in Mexico and the short distance to the USA - and trade agreements like the NAFTA allowing easy transition of goods and money to and from the northern markets. There are concerns with Maquiladoras around the disposal of hazardous waste and other environmental problems (Carrillo and Schatan 2005).

PEMEX (Petroleos Mexicano) is the Mexican state owned oil company. It is the biggest enterprise in Mexico and the biggest fiscal contributor to the country. PEMEX is comprised of four subsidiary entities that are engaged in exploration, production, transformation and marketing activities related to crude oil, natural gas, refined products, liquefied petroleum gas and petrochemicals in the domestic and international markets.

Industry does not receive subsidies for fossil fuels (in contrast to many other countries). In addition, electricity prices are relatively high (Center for Energy Economics 2006, Johnson et al. 2009).

[11] We discuss the energy supply separately in this analysis, but in national statistics, it is normally part of the industry sector

Overview of policies and their effectiveness

Mexico has some energy efficiency standards for electrical appliances used in industry, e.g. water pumps, but efforts to support energy efficiency are relatively low. Efficiency is indirectly supported by the relative high electricity price for industry.

The only policy to support renewable energy in industry is the option to generate electricity from renewable sources for self-use. Several wind parks have been established on the basis of this rule.

Non-energy emissions from industry are substantial and there have been some initial efforts to reduce emissions. Fugitive emissions from the oil and gas sector are a key source (about 10 % of total emissions). There are projects to reduce CH_4 from gas through the state-owned oil company PEMEX, but no coordinated strategy is visible.

Mexico developed a voluntary GHG reporting from companies. In 2004 Mexico launched the Mexico GHG Programme[12] a public-private partnership established between the Secretariat of Environment and Natural Resources (Secretaía de Medio Ambiente y Recursos Naturales or SEMARNAT), the World Resources Institute (WRI), and the World Business Council for Sustainable Development (WBCSD).

The programme developed a voluntary reporting platform on GHG emissions for Mexican businesses. Based on the GHG Protocol Corporate Accounting and Reporting Standard, the program provides a platform for accounting and reporting GHG emissions. In 2007, the programme was adopted in the National Strategy on Climate Change. It is recognised as a capacity-building instrument and source of information to promote climate change mitigation in the industrial sector, and was adopted as part of the country's portfolio of efforts to address climate change. In 2009, it was adopted in the Special Program of Climate Change launched by the Federal Government.

In early 2009, Mexican President Calderón and President Obama announced plans to strengthen and deepen bilateral cooperation by establishing the US-Mexico Bilateral Framework on Clean Energy and Climate Change. One of the priorities under this framework is the implementation of mandatory GHG emissions reporting.

[12] http://www.geimexico.org

Table 7
Qualitative summary of policies for the industry sector

	Changing activity	Energy efficiency	Low carbon			Other
			Renewables	With nuclear/CCS (low carbon vision)	Without nuclear/ CCS (100 % renewable vision)	
Highlights		▸ No energy subsidies to industry (contrary to many other countries) ▸ Some energy efficiency standards (only partly affect industry)		▸ CCS practiced in enhanced oil and gas recovery		▸ Voluntary GHG emissions reporting ▸ Mexico is member of the Methane Global Initiative in Mexico ▸ Goals to reduce CH_2 and N_2O
Requirements of the low carbon policy package	▸ Restructuring industry towards high material efficiency leading to 0.5 % additional material efficiency improvement per year	▸ General incentives such as taxes, subsidies, ETS (tax >100 % of energy price or leading to 0.5 % additional annual increase in energy efficiency)	▸ General incentives (energy taxes (> 100 % of energy price) and subsidies, ETS, overall leading to additional 5 % in 10 years) ▸ Sustainability standards for biomass use	▸ Support for coal and gas CCS (10 % in 2030) ▸ Support for CCS on biomass and process emissions (10 % in 2030)	▸ Support for CCS on biomass and process emissions (10 % in 2030) ▸ Support for coal and gas CCS is a *barrier* to renewable energy	▸ Reduce N_2O process emissions to 10 % of historical maximum by 2030 ▸ Reduce fugitive CH_4 from oil and gas production to 10 % of historical maximum by 2030 ▸ Reduce CH_4 from waste by 20 % below BAU by 2030 ▸ Reduce emissions of F-gases
Gap of national policies to low carbon policy package	▸ No policies in place to support increasing material efficiency, long product lifetime	▸ No direct incentives for energy efficiency through e.g. voluntary agreements, white certificates, emission trading, energy or CO_2 taxes	▸ No direct support for renewable energy ▸ No framework for sustainable biomass import	▸ No incentives for coal, gas, biomass and process emissions CCS	▸ No incentives for biomass and process emissions CCS	▸ Goals but no incentives to reduce N_2O, CH_4 from oil and gas and waste, F-gas emissions
Rating for 2050	**G**	**D**	**G**	**G**	**G**	**F**
Relevance for emissions in 2020	Low relevance: the impact is important only for the long term	Low relevance: Efficiency measures already have short term effects, but share is low	Low relevance: Increasing the share of renewable fuels used will have direct impact, but share is low	Low relevance: Fuel switch and CCS measures have a low impact. Possibilities of fuel switch are limited. CCS options will not be medium term options but rather play a role after 2020		High relevance: The share of these emissions for Mexico is large and a large amount can be avoided effectively and within a comparatively short time frame.

Note on rating: Rating represents the aggregated score per segment between G (poor) to A (excellent). Size of the letters resembles the mitigation potential of the segment

Potential options for future actions

Energy related emissions can be targeted via policies that increase energy efficiency (e.g. taxes, standards, emission trading, voluntary agreements, support for breakthrough technologies) and those that support the production of renewable energy.

Non-energy related emissions mainly derive from production processes and landfills. In particular fugitive emissions from oil and gas production are relevant for Mexico, which could be avoided at relatively low cost. Waste emissions can be targeted with policies that increase recycling rates to avoid landfilling and methane capturing at landfill sites. For some gases, e.g. N_2O, ambitious reduction plans exist until 2012. These could be continued and lined with concrete measures.

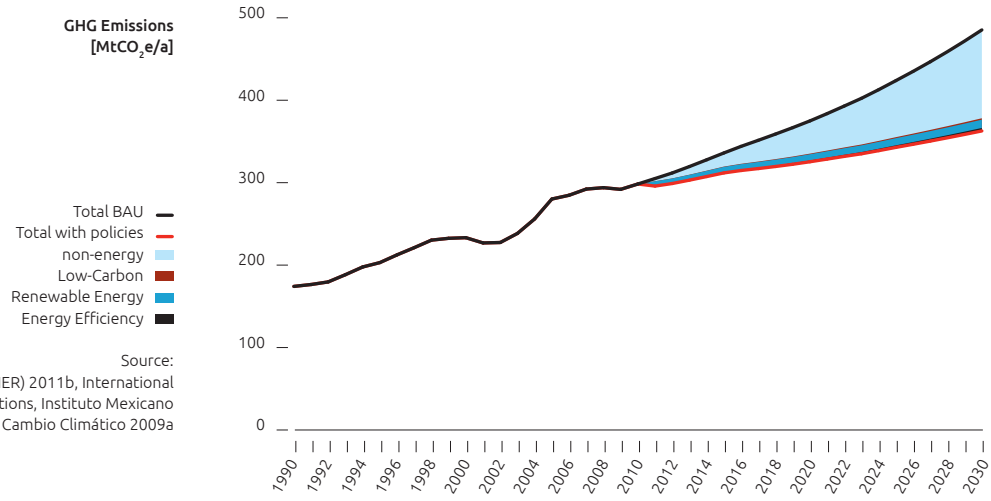
A third area is the products themselves. The longer the product lifetime, the higher the recycling rate and the higher the material efficiency, the lower the resulting energy demand and resulting emissions in the medium term. This could be supported through efficiency standards and measures for higher recycling rates and material efficiency.

Impact on emissions in 2020 and 2030

In the past two decades emissions in the industry sector grew by 77 %, mainly driven by increased non-CO_2 emissions from landfills and growing electricity use. Under the business as usual (BAU) scenario, emissions from the industry sector in 2030 increase by 63 % compared to 2010 and by 137 % compared to 1990.

Policies being implemented now have the potential to decrease emissions by 126 $MtCO_2e/a$ (22 %) by 2030 compared to BAU, but would not halt emissions growth. Existing policies show the biggest impact in the area of non-energy emissions (CH_4 in the oil and gas sector and from landfills) (see Figure 12).

Figure 12
Industry sector emissions projections to 2030 by policy area



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections, Instituto Mexicano del Petroleo 2006, Comisión Intersecretarial de Cambio Climático 2009a

4.4 Buildings

General situation

The building sector, including the residential and the commercial sector, consumed about 21,000 ktoe of energy in 2008, constituting 14 % of total energy consumption in Mexico. Oil products consumed 39 % of this, 28 % each for electricity and biomass 28 % each and natural gas 5 %. The consumption of oil products is largely in liquefied petroleum gas, which, like biomass and natural gas, is mainly used for cooking and hot water generation in households. Electricity is used by electric appliances in lighting, entertainment, refrigeration, etc and space cooling. Because of the climatic conditions, almost no room heating is necessary (United Nations Environment Programme 2009).

Urban sprawl is a major issue in many metropolitan areas. One reason for this is the preference of developers to locate new housing with low and medium density in the suburbs of the city. This is mainly due to the cost of land. It is profitable to buy land classified as "land for future growth" or outside the city limits at low cost and develop it. This triggers high demand for roads, transportation and services. Current practices make it difficult to consolidate the city and develop urban services such as recreation, education, sports or health.

This urban model, supported by the influence of the "American way of life" in Mexico, leads to unsustainable systems, as the dispersion generates environmental, social and economic impacts. Examples of this include increased energy and land consumption, the decrease in leisure-time that results in a lower quality of life, and a high demand for urban services and infrastructure (Arellano and Roca 2010).

Residential housing

According to the latest census data, The number of residential households in Mexico increased from 22.3 to 28.6 million between 2000 and 2010, representing an increase of 28.3 % (Instituto Nacional de Estadística y Geografía (INEGI) 2009). The average number of occupants per household has decreased substantially in recent decades. Whereas in 1970 the average number of people living in a household was around five members, in 2000 it was reduced to 4.3 people and declined further to 3.9 in 2010 (Instituto Nacional de Estadística y Geografía (INEGI) 2010a).

Key Indicators 2010

No of households (million):	28.6
Av. household growth rate:	2.3 %
No of occupants (million):	112
Av. occupants per household:	3.9
Share in national emissions:	4 %

Sources: Instituto Nacional de Estadística y Geografía (INEGI) 2010a, own estimate

The residential sector accounts for about 18 % of total energy end-use. The total electricity consumption from domestic use increased its share from 16 % in 1995 to 22 % in 2006 (Johnson et al. 2009).

The per capita residential electricity consumption (320 kWh/year) in Mexico is still relatively low compared to e.g. the United States (3,150 kWh/year). US states that have a similar climate to that of large parts of Mexico (i.e. Arizona, New Mexico, and Texas) have a high air-conditioning demand and electricity accounts for up to 80 % of residential energy consumption.

With a growing income in Mexico, the implied growth potential for residential electricity demand is staggering. A recent study projects that air-conditioner electricity use in Mexico could increase tenfold by 2030 and electricity use for air conditioning in 2030 could be three times higher than total residential electricity use in 2005 (McNeal 2008). Increased demand for home appliances and electronics add to the expected growth. For refrigeration, the market penetration was already at 82 % in 2006, but there is still room for growth, both in number and storage capacity.

In urban areas of Mexico, cooking and water heating rely primarily on liquefied petroleum gas (LPG), accounting for more than 53 % of residential fuel consumption (Johnson et al. 2009). Rural households primarily use biomass for cooking in traditional open fires.

There are two reasons why the residential use of biomass is relevant for greenhouse gas emissions. First, a portion of the fuel wood used is not harvested in a sustainable manner, so the biomass consumption produces net CO_2 emissions. Second, incomplete biomass combustion causes non-CO_2 gas emissions. Additionally, the traditional use of biomass is linked to severe respiratory and other health problems, especially among women and children in rural households because of exposure to smoke from inefficient fuel wood combustion.

In Mexico, the experience shows that the transition to LPG among rural households faces severe important economic and cultural barriers. In the short term, improving biomass stoves is a more feasible way to address both health impacts and greenhouse gas emissions (Troncoso 2007; Johnson et al. 2009).

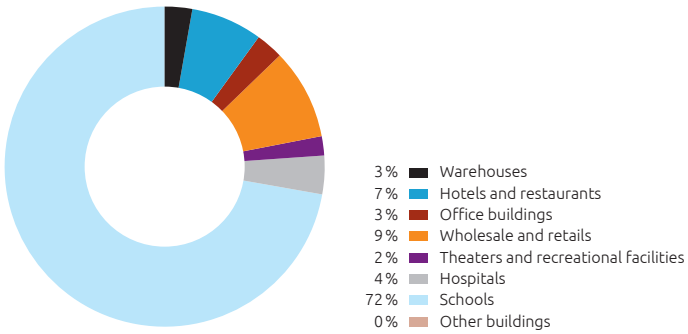
Incandescent lamps still account for about 85 % of the in-use residential light bulbs in Mexico, notwithstanding recent efforts to promote compact fluorescent lamps, indicating that there is still a large potential for scaling up use of compact fluorescent lamps (Johnson et al. 2009).

Heating demand for domestic hot water accounts for about 52 % of residential LPG and natural gas consumption. It is the main end-use driving up residential fuel consumption (Procalsol 2007). There is some potential to improve the energy efficiency of hot water boilers. However, the much larger potential for fossil fuel savings can be addressed by scaling up the application of solar water heaters, especially in low-density dwellings, such as single-family homes and townhouses.

Commercial and public buildings

The commercial and public services sector in Mexico is estimated to account for less than 4 % of total energy end-use. However, the sector accounts for more than 21 % of total electricity use and is therefore an important electricity consumer. The commercial and public services sector will assume a much larger role in Mexico's energy use as cities expand and modernise (Johnson et al. 2009).

Figure 13
Floor area of the non-residential building stock



The sector is dominated by warehouses with large floor areas that require lighting as the most important electricity consumer (more than 50 %), followed by air conditioning and refrigeration (about 18 % each). Substantial economies of scale are available through fairly simple procurement and retrofit programs, since a large portion of the commercial and public services sector (public buildings and municipal water companies) is owned by federal, state, or municipal governments (Johnson et al. 2009).

Overview of policies and their effectiveness

There are few policies and measures targeting energy use in buildings in place. Energy standards for buildings are scarce and poorly enforced. While some measures go in the right direction, the impact is limited either due to lack of enforcement or restricted coverage, either regionally or for parts of the building stock.

The focus of legislation is on energy efficiency, with minimum energy performance standards (MEPS) for 18 types of electricity-consuming equipment, including air conditioners, refrigerators, and clothes washers. These standards are, in general, on par and consistent with the MEPS in the United States and Canada because of harmonisation efforts that started in the early 1990s. In general, these harmonisation effects lead to the update and improvement of MEPS in Mexico (De Buen 2007). In northern Mexico, where air-conditioning demand is highest, the availability of cheap and inefficient second-hand air conditioners from the United States is problematic (De Buen 2009). However, the highly subsidised residential electricity tariffs are a high barrier for the acquisition of better technologies (Kornives 2010).

Mexico has had a mandatory standard for commercial buildings since 2001 but this standard has been effective because local government has not enforced it. Another national mandatory standard relates to energy efficiency standards for non-residential building lighting systems. The lighting system standard is enforced through the service contracting process of the national utilities but this is done poorly (De Buen 2009, Lui et al. 2010).

More recently, the Comisión Nacional de Vivienda (CONAVI) developed a voluntary national regulation for residential construction (CEV) to be used as a model by local authorities. It was updated in 2010, with enhanced chapters on energy efficiency and sustainability. This code is not mandatory, but housing developers want to participate in CONAVI's subsidised low-income housing development program have to comply with the standard (Lui et al. 2010). The government of Mexico City has issued a regulation that requires non-residential buildings in Mexico City to use solar water heating systems for a minimum of 30 % of their hot water demand (Secretaría del Medio Ambiente (SMA) 2006).

Apart from regulation, Mexico has housing finance programmes in place to promote energy-related measures, both in refurbishment and for new buildings. The Instituto del Fondo Nacional de la Vivienda para los Trabajadores (INFONAVIT "Green mortgages" programme is a public fund that provides low interest loans (INFONAVIT 2008; De Buen 2009). CONAVI is a federal government institution that provides subsidies for low income housing to implement measures for sustainable housing, solar water heating and for power generation through photovoltaic energy (De Buen 2009; Wehner 2010). The programmes reached about 100,000 dwellings in 2009. The overall impact is supposed to be low in comparison to the total building stock, which is smaller than 0.4 %.

Table 8
Qualitative summary of policies for the building sector

	Changing activity	Energy efficiency	Low carbon	
			Renewables	Fuel switch
Highlights	▸ "Desarollos Urbanos Integrales Sustentables (DUIS)" promotes the integration of urban planning into the context of new housing developments.	▸ Sixteen energy efficiency norms for the efficient energy use in buildings (e.g. building shell, appliances) ▸ Several programmes provide loans for new dwellings or remodelling/ refurbishment (e.g. Green mortgages program, Esta tu casa program) ▸ Unified building code (CEV), including chapters on energy efficiency and sustainability developed by the Comisión Nacional de Vivienda (CONAVI)	▸ Programme for the promotion of solar thermal heating aims at installing 1.7 Mio m² until 2012 (CONUEE/ GIZ/ ANES). ▸ Since 2006 the Government of Mexico City has mandated, through an environmental standard that all new public-use installations (such as hotels and sport clubs) have to heat 30 % of their hot water with solar energy. ▸ Three voluntary standards have been issued through a private sector standardization initiative with a solar energy mandate (NESO -13)	▸ Switching from use of biomass (not sustainable) to LPG. ▸ Increase in use of natural gas, as this is a more cost effective fuel option.
Requirements of the low carbon policy package	▸ Urbanisation policy that leads to energy efficient development	▸ Efficiency standards for new buildings (zero energy by 2020) ▸ Support to increase energy efficient retrofit rate (3 % per year) ▸ Incentives for efficient electrical appliances leading to 1-2 % less electricity use per year ▸ General incentives (taxes in the order of 100 % of the energy price) ▸ Removal of barriers, e.g. subsidies	▸ Support for renewables in new and existing buildings (increase in share of 10 % in 10 years) ▸ General incentives (taxes in the order of 100 % of the energy price) ▸ Sustainability standards for biomass use (national and imported)	▸ Support for fossil fuel switching (to gas)
Gap of national policies to low carbon policy package	▸ The initiative (DUIS) needs to strongly integrate requirements of energy efficiency and renewable energy use.	▸ No national mandatory building energy-efficiency code ▸ Loans provided for new buildings and retrofitting are limited and have little impact on total stock ▸ Building codes are poorly enforced and not consistent throughout municipalities ▸ Energy efficiency standards, particularly for air conditioners need attention ▸ Subsidies on electricity prices for low- and medium income households decrease energy efficiency	▸ No policy for cooking with sustainable, renewable fuels. ▸ The exact impact of solar water heaters on the total energy demand for hot water heating in Mexico is not known, but it is estimated to be limited because it has only been adopted in Mexico City.	▸ No measures to ensure that fuel wood used is harvested in a sustainable manner
Rating for 2050	F	E	G	D
Relevance for emissions in 2020	Low impact: Measures on sustainable urbanisation measures have important long-term effects and medium effect on emissions in 2020	High impact for measures on appliance efficiency: Life times for most appliances are short to medium term and due to population and GDP growth there is a large demand for new appliances Medium impact for measures on building efficiency: due to the long life time of buildings and the low renovation rates	High impact: Direct replacement of emissions through the uptake of renewables. Technologies are readily available. Life time of equipment is medium term (e.g. water heating systems) and replacement of a large share could happen until 2020	Medium impact: Direct replacement of emissions possible. In the case of Mexico likely increasing emissions through the change to LPG and LNG.

Note on rating: Rating represents the aggregated score per segment between 0 (poor) and 4 (excellent) and is translated into G (poor) to A (excellent). Size of the letters resembles the mitigation potential of the segment

Potential options for future actions

The attention in the building sector could focus more on the efficiency of the building envelope and equipment, not only on appliances. A national mandatory energy-efficiency code for new buildings would be a good starting point for this. This would need to go hand in hand with a robust enforcement system. The incentives could be complemented by loans provided for new buildings and for retrofitting of existing stock.

Air conditioning is another area that requires special attention. Here strict standards could be applied, potentially also supported with low interest loans.

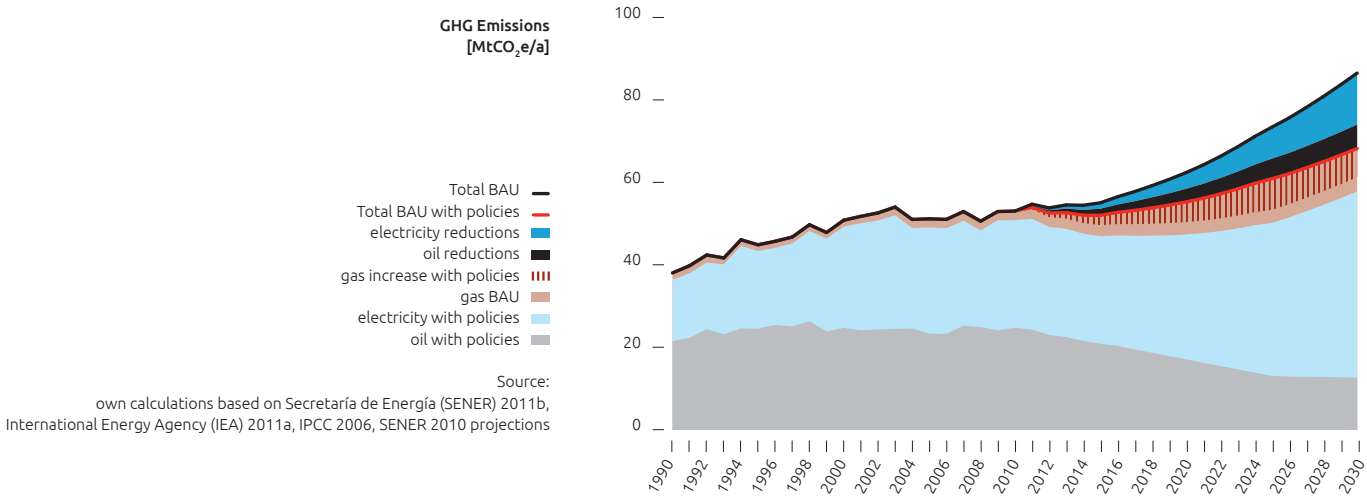
The potential for solar water heaters is large and the mandate initiated in Mexico City could be extended to a national coverage.

Impact on emissions in 2020 and 2030

Emissions from the building sector increase in the business as usual (BAU) scenario by 63 % compared to 2010 and more than double compared to 1990 (see Figure 10). The largest increase in demand is expected for electricity, increasing the share from 30 % in 1990 to 67 % in 2030. Oil demand is expected to decrease while absolute gas consumption is slowly growing with an almost stable share of around 4 %.

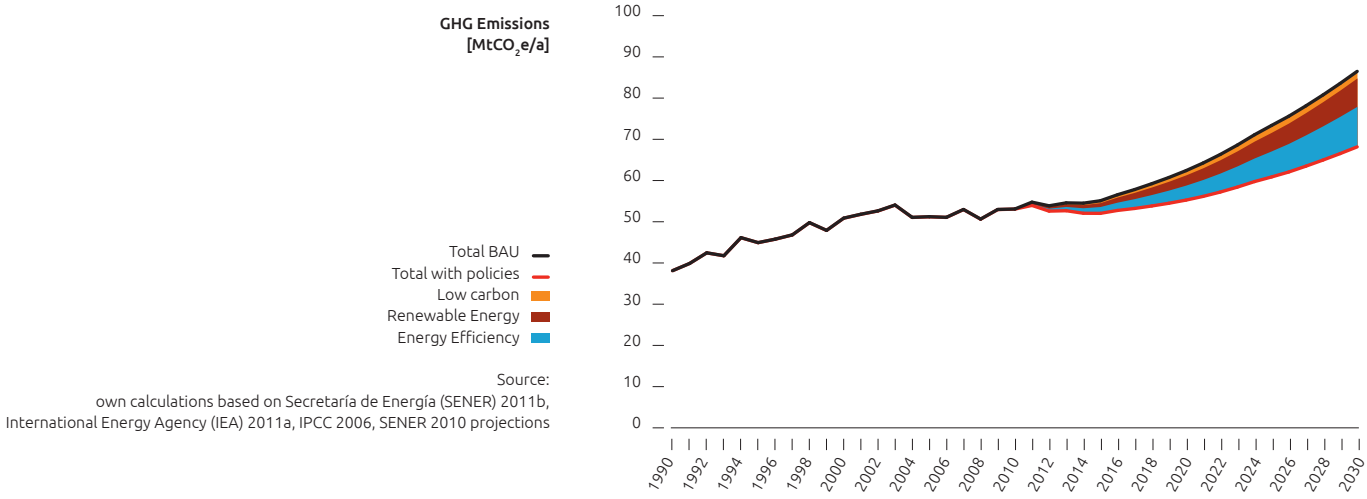
Policies implemented at the moment have the potential to decrease emissions by 18 $MtCO_2e$ or 21 % compared to BAU in 2030. Reductions by existing policies can mainly be identified in the area of energy efficiency with a share of 53 % of total reductions (see Figure 15).

Figure 14
Building sector emissions projections to 2030



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

Figure 15
Building sector emissions projections to 2030 by policy area



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

4.5 Transport

General situation

The energy consumption and greenhouse gas emissions of the transport sector show the highest growth rate of all sectors, mainly because of an increasing number of vehicles.

Mexico depends mainly on road transport, which has increased considerably in the last decades. This is triggered by overall economic growth as well as by the added activity as a consequence of the North American Free Trade Agreement (NAFTA).

Important factors explaining the increase in motorisation in the country include the increase in per capita income, the availability of (used) inexpensive vehicles and the relatively low cost of transportation fuels.

Increased urbanisation and the expansion of urban sprawl are important elements of the explanation for the development of transport patterns in the last years. The strong fragmentation of cities leads to increased distances travelled and higher motorisation rates (Centro de Transporte Sustenable 2011; OECD International Transport Forum 2011).

Other factors that have contributed to increasing energy use and GHG emissions from the transport sector are the deteriorating quality of public transportation, the inadequate enforcement of vehicle emission standards, the neglect of transportation needs in urban development plans, and the lack of regulation of freight transport (Johnson et al. 2009). The transport sector demands almost exclusively fossil oil products.

The transport sector also plays an important role in the economy with a contribution of 6.9 % of GDP in 2009. In 2008 almost 60 % of freight and 97 % of passengers were transported by road, even though most Mexicans do not own a vehicle. Although the absolute number of passengers transported by railway has increased by factor 4 between 2003 and 2008, the share is still below 1 % of total transport. Investment in rail infrastructure in 2009 is estimated to be almost three times higher than in 2008 and almost 36 times higher than in 2003 (Subsecretaría de Transportes (SCT) 2011).

Key Indicators

Size:	1,958,201 m^2
Road density (2007):	0.18 km / km^2
Vehicle ownership (2007):	244 cars / 1000 pop
Emissions (2006):	144.6 $MtCO_2e$
Share in national emissions (2006):	20 %

Sources: T-Mapper 2011; Secretría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009a

A main characteristic of the Mexican road transport is the high average age of the vehicle fleet. For example, in 2010, the estimated average age of a vehicle with a federal plate (buses, trucks) is 14.67 years. This is a small decrease from 15 years in 2000 and a large backdrop after the average age had improved to just below 13 years in 2008 (Subsecretaría de Transportes (SCT) 2011). Improvements in the past were, to a limited extent, due to scrapping programs, but still a large portion of the fleet remains composed of highly inefficient old vehicles.

Gasoline and diesel prices are determined by the government and implemented through the publicly-owned oil company PEMEX. In recent years, this system has led to substantial subsidies. High dependence on road transport, for the delivery of consumer products and food to the population, makes economic instruments on fuels a highly political and complex issue. However, low fuel prices together with insufficient public transport infrastructure substantially contribute to the heavy dependence on road transport.

The transport sector is projected to grow substantially, with an increase in the number of vehicles from around 24 million in 2008 to roughly 70 million in 2030 (Johnson et al. 2009). This includes a large increase of privately-owned cars and a subsequent increase in emissions per person from the sector.

Overview of policies and their effectiveness

At the federal level, the focus of activities is on investment in public transportation infrastructure and urban planning and in the renovation of the vehicle fleet.

A fund responsible for infrastructure development in communications, transportation, water, natural resources and tourism - FONADIN - was established in February 2008 and is hosted by the National Development Bank (BANOBRAS). Under this fund a Federal Mass Transit Program ("Programa Federal de Apoyo al Transporte Masivo", PROTRAM) was created.

The objective is to provide financial and technical support for Sustainable Urban Mobility and to strengthen local capacity for planning, regulation and management of transport systems (OECD International Transport Forum 2011).

This is complemented and strengthened by the Urban Transport Transformation Project ("Programa para la Transformación del Transporte Urbano", PTTU) (Mier-y-Teran 2009). This project is directly targeting GHG emissions through capacity building, the development of integrated transport systems and support for monitoring activities.

In principle, existing measures are going in the right direction, but are often unable to use the full potential. The largest measure in this area, PROTRAM, has been quite bureaucratic in its starting phase, leading to delays in implementation, with only six out of 33 project proposals being accepted to date. However, measures to improve this are underway and the number of projects in the pipeline is increasing. Other promising projects are only regionally implemented, especially in Mexico City.

The main focus to increase vehicle efficiency has been on scrapping programmes, aiming at the replacement of old, inefficient vehicles. Programmes are in place to replace some vehicles (public transport and freight) with a federal number plate, with a special programme to renew the taxi fleet in Mexico City.

While there are mandatory emissions standards addressing air pollutants for both new cars (NOM 042 & NOM 044) and for use vehicles (NOM 041 and NOM 044), there are no mandatory vehicle energy or GHG emission standards, which could have a large effect on the efficiency of the vehicle fleet.

Measures to reduce illegal imports of old vehicles from the US could also significantly improve overall fleet efficiency. Energy subsidies are the main driver preventing efficiency improvements and increasing gasoline and diesel consumption - and emissions growth - in México. They represent an important policy option to reduce emissions, which has not been tackled so far.

There are no concrete measures to promote biofuels in Mexico, although there is a huge potential for biomass production. There are only limited efforts to limit risks of biofuels in terms of carbon debt incurred from land use change, N_2O, biodiversity loss, water use, etc.

Table 9
Qualitative summary of policies for the transport sector

	Changing activity	Energy efficiency	Low carbon	
			Renewables	Nuclear / CCS / fuel switch
Highlights	▸ Large scale funds for infrastructure investment and system optimization in place (PROTRAM & PTTU) ▸ Promotion of cycling in Mexico City through a variety of programmes, including infrastructure, information and bike sharing	▸ Scrapping programmes for vehicles with a federal number plate (public transport, freight)	▸ Goals for 7 % share of bioethanol in the states of Guadalajara, Monterrey and Mexico DF in 2012	
Requirements of the low carbon policy package	▸ Strategies to avoid transport or to move to non-motorised transport (4 % avoided y 2020) ▸ Strategies for modal shift (8 % increase of capacity by 2020) ▸ General incentives (e.g. tax of the order of 100 % of energy price)	▸ Incentives for efficiency in light vehicles (trajectory to reach 95g/km in 2020 for new cars) ▸ Incentives for efficiency in freight transport (reduce specific emissions by 20 % by 2020) ▸ General incentives (e.g. tax of the order of 100 % of energy price)	▸ Incentives for renewables in transport (additional share of 10 % by 2020) ▸ Sustainability standards for biomass use (national and imported)	▸ Support for fossil fuel switching (to gas) an other low carbon technologies ▸ Support for electro mobility (cars and infrastructure), 5 % electric cars by 2020
Gap of national policies to low carbon policy package	▸ Little efforts to promote cycling in Mexico City and no roll out to all other large cities ▸ Low fuel prices reduce attractiveness of low carbon transport modes	▸ No incentives to improve efficiency of new vehicles ▸ Existing scrapping programmes only target a sub set of the vehicle fleet ▸ Low fuel prices reduce attractiveness of more efficient vehicles	▸ National legislation needs to provide more concrete incentives for the use of renewables ▸ No mandatory scheme to ensure sustainability of biomass (for biofuel) production	▸ There are currently no measures in place to promote electric or other low carbon mobility technology
Rating for 2050	**G**	**G**	**F**	**G**
Relevance for emissions in 2020	High relevance: Measures in this segment often require longer time frames to take full effect and are extremely important for the long term decarbonisation of the sector. Due to the large growth and share in emission of the sector even small changes achievable until 2020 will have large absolute effects in the short term.	High relevance: Efficiency measures already have short term effects. They have the potential to contribute substantially to reductions in 2020	Medium relevance: Increasing the share of renewable fuels used will have direct impact. Larger scale deployment will require additional infrastructure and technical changes to vehicles, but moderate levels can be achieved in a short time frame	Medium relevance: Some low carbon technologies are well advanced and widely available, like LPG, LNG, CNG and hybrid technologies. Others are still in an early development state and need further support to have long term effects

Note on rating: Rating represents the aggregated score per segment translated into G (poor) to A (excellent). Size of the letters resembles the mitigation potential of the segment

Potential options for future actions

A recent study, supported by the World Bank (Johnson et al. 2009), identified the estimated baseline for the transport sector as well as mitigation potentials in the sector. The identified potentials are largely included in the Mexican Climate Plan (PECC). Some of the goals set in the PECC build on already existing measures and propose to scale them up / expand coverage. However, it is unclear to which extent these measures will be implemented, since for some financing is a major obstacle for implementation.

Energy or GHG emission efficiency standards for new light and heavy duty vehicles would directly reduce GHG emissions of the sector. The government is currently working on adjusting the existing regulation to include GHG emissions, but it is not yet clear when this will be implemented, nor how strict the standards will be (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2011). These efforts could be supported by measures addressing the existing vehicle fleet, for example through a GHG emissions based tax system.

Sustainable urban planning, including optimised urban transport planning, could be improved through a scaling up of existing efforts (PROTRAM & PTTU). While effects of these programmes on GHG emissions are rather long term and indirect they have a large overall potential and create substantial co-benefits to society.

Infrastructure needs to be upgraded to make rail transport attractive mainly for freight, additionally to the optimisation of legislation to avoid operational conflicts for intermodal transport as laid out in the PECC.

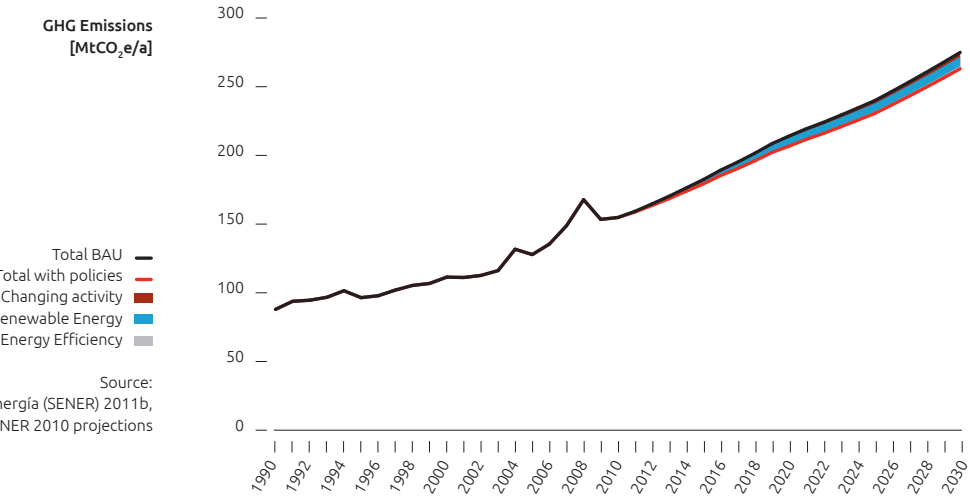
The optimisation of conventional bus systems in large and mid-size cities would achieve direct emission reductions through the decrease in the overall number of buses, distances travelled and increased attractiveness of the system.

Impact on emissions in 2020 and 2030

Emissions from the transport sector have increased steadily since 1990 and are projected to continue this growth up to 276 $MtCO_2e/a$. This represents an increase of 78 % by 2030 compared to 2010 in the business as usual scenario (BAU).

Policies implemented at the moment are projected to have a small impact, decreasing emissions by 12 $MtCO_2e/a$ or 4.3 % compared to BAU in 2030. Most of this reduction (57 %) is expected to come from increased use of biofuels. Investment in public transport infrastructure and measures to change modal shift is expected to contribute 27 %. Efficiency measures are estimated to contribute only 2 $MtCO_2e/a$.

Figure 16
Transport sector emissions projections to 2030 by policy area



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, SENER 2010 projections

4.6 Agriculture and Land Use, Land Use Change and Forestry (LULUCF)

General situation

According to Mexico's fourth National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), the agriculture and land use sectors contributed about 16.3 % of the total national anthropogenic greenhouse gas (GHG) emissions in 2006. Land use change from forests to agriculture and pasture accounted for the largest share of agriculture and land use emissions (Secretaría de Medio Ambiente y Recursos Naturales - Instituto Nacional de Ecología (SEMARNAT – INE) 2009). However, recent assessments also show a significant mitigation potential for the sectors. By becoming a net sink the sectors could contribute about 33,9 % to the total national mitigation potential by 2030 (Johnson et al. 2009).

Key Indicators

Forest area:	64,238,000 ha
Deforestation (`02-`07 annual):	160,667 ha (0.2 %)
Share of agriculture emissions (2006):	6.4 %
Share of LULUCF emissions (2006):	9.9 %
Share of GDP from agriculture (2010):	4.2 %
Agriculture/labor force (2005)	13.7 %
Protected area/surface:	12.9 %
States with climate mitigation program **and** institutional arrangements in place (2010):	3 out of 31 (9 %)

Sources: Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b, CONANP Comisión Nacional de Áreas Naturales Protegidas (CONANP) 2011, CIFOR 2010 Center for International Forestry Research (CIFOR) 2010; CIA 2011 CIA 2011

Agriculture

In Mexico, approximately 55 % of the land is used for agriculture. About 13 % of the area is under cultivation and 42 % are used for pasture.

During the last 15 years, agricultural production has decreased in Mexico. Moreover, the focus has shifted to the production of export crops, resulting in an increasing need to import staple crops to meet the national demand (Escalante and Catalán, 2008).

One of the most important problems affecting the productivity of the agricultural sector is increasing land degradation. Important causes of degradation are water erosion, salinization, biological degradation and wind erosion (World Bank, 2009). The agricultural sector accounts for about 75 % of the water usage of the country in which 85 % of the land area is classified as arid and semi-arid (World Bank, 2009).

Land Use, Land Use Change and Forestry (LULUCF)

The reasons for deforestation and forest degradation are complex and differ from region to region. Land use change from forests to agriculture and pastures accounts for 82 % (approx. 130,000 hectares annually) of deforestation at the national level (Comisión Nacional Forestal (CONAFOR) 2010a).

Sub-national causes of deforestation include the conversion of forests to high-input avocado plantations in Michoacán State, the establishment of grazing land and the development of tourist infrastructure along the Gulf of Mexico and in northern States, and slash-and-burn agriculture in southern States (Comisión Nacional Forestal (CONAFOR) 2010a).

Forest degradation is mainly driven by extraction of timber, firewood, slash and burn practices and illegal logging (Center for International Forestry Research (CIFOR) 2010). A lack of land use planning, unclear property rights and poverty in rural areas are also important underlying causes of deforestation in some regions (Comisión Nacional Forestal (CONAFOR) 2010a).

Mexico's forests covered an area of 64,238,000 hectares in 2005 according to the Forest Resources Assessment published by the United Nations Food and Agriculture Organisation. Most of this area consists of coniferous and broadleaf forests. About 12 to 13 million people, of whom five million are indigenous, live in these areas that are mainly owned by communities (55 %) and private actors (35 %). Only small areas are national forests (Center for International Forestry Research (CIFOR) 2010). The annual deforestation rate dropped from 0.52 % to 0.30 % during the periods from 1990 to 2000 and from 2000 to 2010, respectively (FAO 2010).

Overview of policies and their effectiveness

The agriculture and land use sector is expected to contribute approximately 30 % of the reduction (15.3 $MtCO_2e$) of the 51 $MtCO_2e$ reduction of the PECC by 2012. Apart from emissions impacts of already implemented initiatives such as the ProArbol programmes and existing REDD+ pilot projects, State level Climate Change Programmes (PEACC) are also expected to contribute to emission reductions (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b).

An important framework for forest conservation and restoration is the ProÁrbol program that was established in 2007 by the Federal Government and consists of several programs that promote the establishment of forest plantations, reforestation and restoration activities, forest development, payments for environmental services and activities related to the prevention of forest fires, among others (Comision Nacional Forestal (CONAFOR) 2010).

A National REDD+ strategy is currently in initial stages of development. Goals for REDD+ by 2020 include zero net emissions from forest land-use change and a significant reduction of the forest degradation rate (Comision Nacional Forestal (CONAFOR) 2010). Plans for agricultural activities are outlined the Agricultural Sector Program for the period from 2007 to 2012 and focus on mitigation and adaptation measures (Secretaría de Medio Ambiente y Recursos Naturales - Instituto Nacional de Ecología (SEMARNAT – INE) 2009).

Activities to achieve agriculture and land use emission reduction targets for the 2009-2012 period set out in the PECC (2009) are reflected in the following nine objectives:

- Conservation and sustainable management of forest ecosystems and mitigation of emissions from deforestation and forest degradation
- Increasing forest carbon stocks through forest management and reforestation
- Designing and implementing an incentive system to address deforestation and forest degradation (REDD)
- Reducing forest fires originating from agricultural activities
- Restoration of low productive and degraded agricultural land
- Green harvesting of sugar cane
- Reducing N_2O emissions from fertiliser use
- Increasing the use of sustainable agricultural practices
- Regeneration or improvement of cover of vegetation in pasture lands.

The effectiveness of existing and planned agriculture and land use sector policies is restricted by barriers, which can slow down or even prevent the achievement of Mexican AFOLU emission reduction targets. Barriers identified are:

- Poor law enforcement in the forest sector, due to a lack of human and financial resources (Center for International Forestry Research (CIFOR) 2010).
- Limited government access to targeted resources due to the presence of organized groups of illegal loggers and drug traffickers in certain areas (USAID 2009)
- Lack of ownership and participation resulting in general doubts about programmes' suitability (Veledíaz et al. 2009; Carabaias 2009)

Most of the mitigation potential of afforestation and reforestation by 2030 will be achieved through already existing programs and activities. While these measures have proven to be very effective, no long-term goals are available, and existing programs have short time horizons.

While there is strong indication that these efforts will continue, which is reflected in the very positive BAU development, information on the expansion of reforestation and afforestation activities beyond existing programs and activities is not available.

Table 10
Qualitative summary of policies for the AFOLU sector

	Changing activity	Other
Highlights	▸ Strategy for selected land uses exists	▸ Detailed sectoral programmes for agriculture and forestry exist and include activities and measures for mitigation and adaptation that are partially implemented ▸ One of the most advanced programmes is ProÁrbol that promotes a range of activities related to forest conservation and restoration
Requirements of the low carbon policy package	▸ Incentives for sustainable consumption practices ▸ Consistent land use strategy exists and is implemented ▸ Land use register exists	▸ Decrease livestock CH_4 and N_2O emissions by 3 % below BAU in 2030 ▸ Decrease cropland and organic/peaty soils, all non-CO_2 emissions (including rice production) 5 % below BAU in 2030 ▸ Implement measures CO_2 on cropland on 100 % of the area available for this purpose by 2030 ▸ Reduce grassland all non-CO_2 emissions 7 % below BAU in 2030 ▸ Implement deforestation measures on 100 % of the forest area by 2030 ▸ Promote the conversion of non-forest land to forests through afforestation and reforestation (A/R) leading to A/R on 100 % of the area available for this purpose by 2030
Gap of national policies to low carbon policy package	▸ No integrated land-use plan to reduce deforestation and forest degradation caused by agricultural activities	▸ Enhancement of implementation of policies that aim at reducing emissions from the agricultural sector ▸ Extend existing afforestation and reforestation programs within a long-term framework that ensures medium and long-term implementation ▸ Implement REDD+ strategy
Rating	E	G
Relevance for emissions in 2020	Low relevance: Measures in this segment mainly have a long term effect.	High relevance: Emissions from AFOLU have a significant proportion in Mexico and measures can directly contribute to emissions reductions both in the short and long term, in particular forestry.

Note on rating: Rating represents the aggregated score per segment translated into G (poor) to A (excellent). Size of the letters resembles the importance of the segment towards developing a low carbon economy

Potential options for future actions

Mexico could further align its mitigation plans of forestry and agriculture. In particular relevant are deforestation and forest degradation caused by agricultural activities. In addition, large proportions of emissions in agriculture are covered by a strategy but not yet covered by implemented policies.

Existing measures need to be put in a long-term framework with medium and long-term goals and clear implementation strategies. This includes ensuring that measures for afforestation and reforestation are continued and expanded and implementing the defined REDD+ strategy with concrete measures.

Impact on emissions in 2020 and 2030

Agriculture

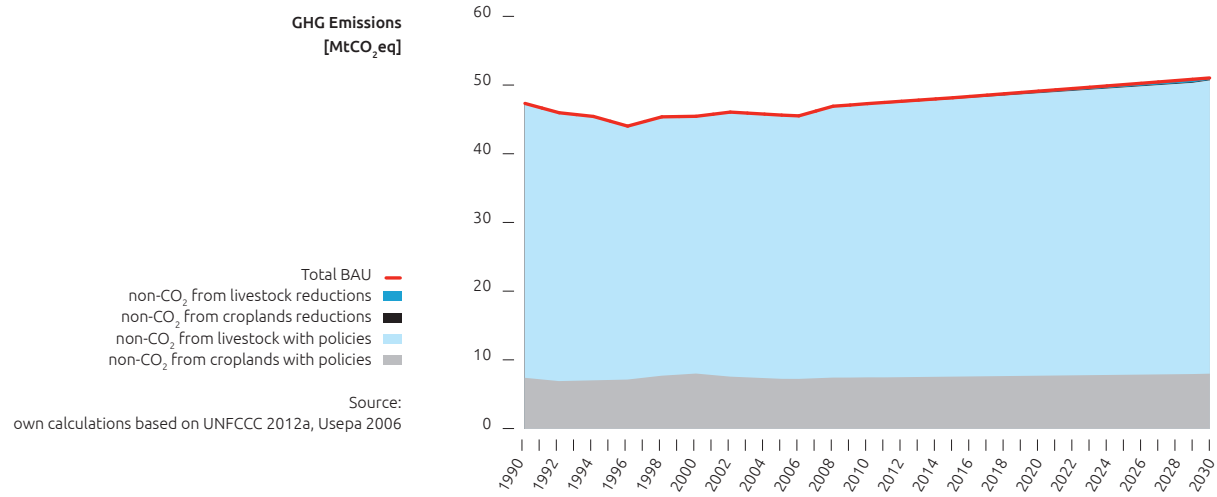
Emissions from the agricultural sector have remained fairly stable between 1990 and 2006. They represented 6.4 % of total emissions in the last reported inventory 2006. Projections expect to see a slight increase in business-as-usual emissions to 51 $MtCO_2e/a$ in 2030, a 12 % increase to 2006 (Figure 17). Nevertheless the contribution of the sector to overall emissions under BAU is expected to decrease to 4.9 %.

Currently implemented policies in the sector are only expected to result in a reduction of 0.4 $MtCO_2e$, a 1 % decrease to BAU. This reduction is expected to be the result of a fairly good overall land use strategy process, which will support individual activities.

Land Use, Land Use Change and Forestry (LULUCF)

Emissions from LULUCF are mainly determined by two activities: afforestation/reforestation and deforestation. There are large uncertainties connected to the determination of these emissions, starting with the availability of data as well as the calculation methods used.

Figure 17
Agriculture sector emissions projections to 2030 by policy area



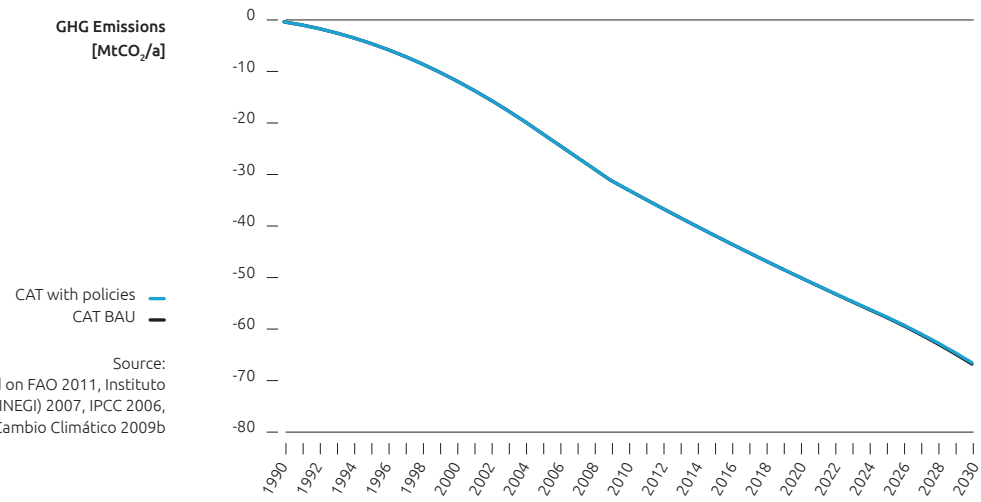
Source:
own calculations based on UNFCCC 2012a, Usepa 2006

Mexico so far provided data for 2002 and 2006 for this category under the UNFCCC. Other data is scarce and no comprehensive accounting system is yet in place in Mexico. Figure 18 and Figure 19 show the historic and projected developments for these two key activities.

The sink from afforestation has increased significantly over the past 20 years and this trend is projected to continue. We do not project any additional reductions from policies in place above this already very positive trend.

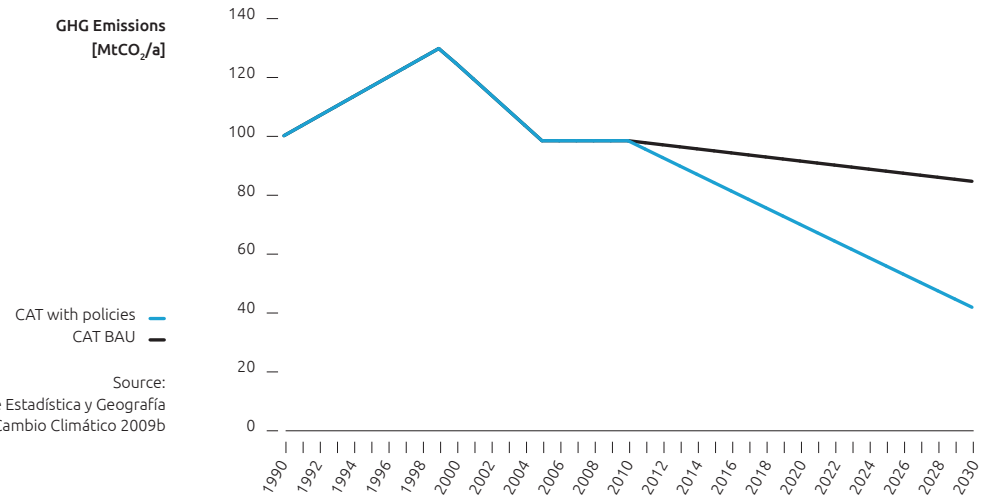
Emissions from deforestation show a relatively stable development with a slight downward trend that is expected to continue under BAU. The policies in place are estimated to reduce the deforested area by 50 % in 2030 resulting in emissions of 42 $MtCO_2e/a$. This is about half of the maximum LULUCF (REDD) mitigation potential identified by Johnson et al. (2009).

Figure 18
Afforestation emissions history and projections up to 2030



Source:
own calculations based on FAO 2011, Instituto Nacional de Estadística y Geografía (INEGI) 2007, IPCC 2006, Comisión Intersecretarial de Cambio Climático 2009b

Figure 19
Deforestation emissions history and projections up to 2030

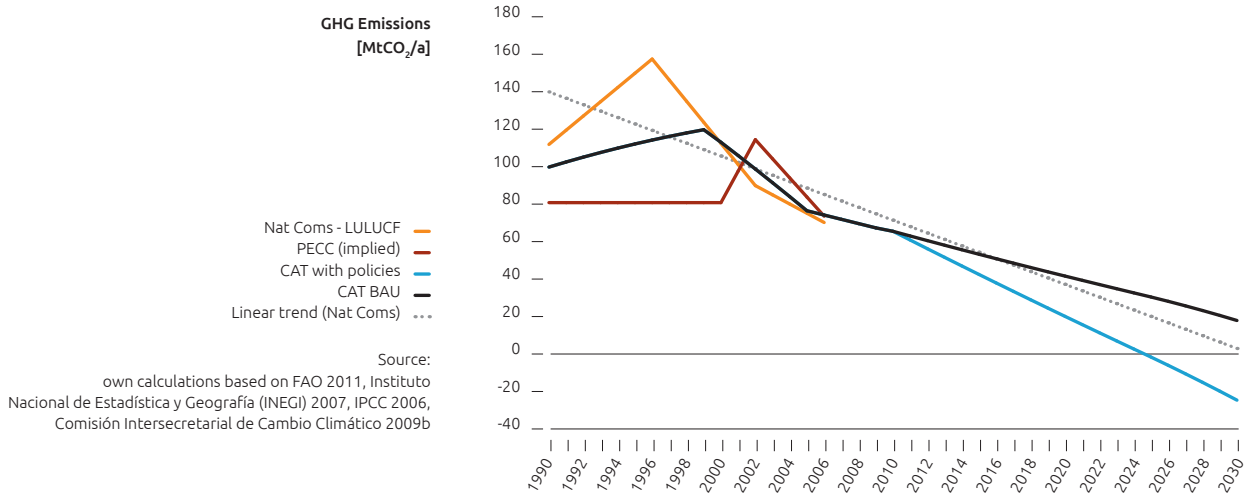


Source:
own calculations based on FAO 2011, Instituto Nacional de Estadística y Geografía (INEGI) 2007, IPCC 2006, Comisión Intersecretarial de Cambio Climático 2009b

Overall the assumptions lead to a business-as-usual development that leads to a further significant decrease of LULUCF emissions up to 2030, although above the trend from the very few and varying data points available from the National Communications.

The additional reduction that could turn the sector to a net sink by around 2025 comes exclusively from additional measures in combating deforestation.

Figure 20
LULUCF sector emissions projections to 2030



Source:
own calculations based on FAO 2011, Instituto Nacional de Estadística y Geografía (INEGI) 2007, IPCC 2006, Comisión Intersecretarial de Cambio Climático 2009b

5 | SUMMARY AND WAY FORWARD

This chapter summarises the policies in place and their impact on emissions and provides options for further action.

5.1 Setting the scene for enhanced action

Mexico was the first developing country to adopt an absolute greenhouse gas reduction target for 2050. It is one of the countries with the fastest advances in strategic planning on how to incorporate low carbon development into all parts of the economy.

Highlights

- ✓ Mexico has an ambitious target for 2020 and was the first developing country to adopt an absolute reduction target for 2050.
- ✓ First implementation strategy exists only until 2012, but several studies were undertaken that can build the foundation for a long-term strategy

Triggered by the high commitment of President Calderón, the early establishment of the Inter-Ministerial Climate Change Commission in 2005 (CICC), which coordinates the strategic planning, supported this process.

Mexico's progress in policy planning and institution building over the past years has been remarkable. Given the phases that shape the general cycle of policymaking, the process in Mexico has moved well ahead in several ways:

- Awareness of climate change issues, both mitigation and adaptation, has penetrated a wide circle of stakeholders and actors.
- Mexico has achieved a high level of data availability, especially compared to other developing countries. This includes the submission of four National Communications with emission inventories to the UNFCCC, the first full GHG reporting system for industry and several low-carbon development-plan studies (e.g. Johnson et al. 2009). This provides a good basis for policy making.
- A clear institutional setup for climate change policy, with responsibilities, lines of communication and focal points within and between ministries and outside helps to ensure consistency. It also provides the basis for further strategy development.

Mexico's efforts in international climate diplomacy are in tune with its national efforts. Mexico has played a very active and constructive role in comparison to many other governments, both developed and developing countries.

Given the dynamic nature of policy development and implementation, the analysis in this report must be seen as a snapshot. Effects are evaluated under the assumption that currently implemented measures and efforts are continued at the present level, independent of possible changes in administration. Elections are scheduled for July 1, 2012 and could result in such a change.

An illustration of the dynamic nature of policy making is the announcement of Mexico's energy minister on November 1, 2011, that the government will publish an update to its energy strategy during the first quarter of 2012. This strategy is expected to include abolishing current plans for 10 new nuclear power plants in exchange for expanded exploitation and use of gas from the Gulf of Mexico and shale gas reserves. Assuming this strategy under consideration is implemented, a phase-out of nuclear power plants was included in our assessment just before finalizing our analysis. Other strategies and policies under development can be included in the update of this analysis envisioned for end of 2012.

5.2 How do sectors compare to the 'low carbon policy package'?

Mexico has made initial steps towards a low carbon society. This started with the target to reduce GHG emissions by 50% by 2050 and the implementation strategy to 2012. Several planning exercises were undertaken or are currently underway to determine a long-term low carbon strategy. This is a promising approach.

Highlights

- ✓ Mexico has a long tradition with measures to conserve electricity. One example is demand side management administered by the CFE. The scheme promotes energy efficient appliances through low interest loans that are repaid through the electricity bill for customers.
- ✓ Mexico was the first developing country to introduce mandatory GHG reporting for companies.
- ✓ Mexico has one of the most elaborate programmes on forestry activities.

Implemented policies to date are, however, only the first step on the way towards a low carbon economy and do not yet present a comprehensive picture. They differ significantly in stringency and, in particular, the high-growth sectors of transport and industry are not given the attention required to move developments in these areas towards a low carbon future. Table 11, Table 12 and Table 13 provide summaries of highlights, gaps and overall rating of the policy areas.

Electricity

To date the most influential policy influencing the electricity sector is the requirement enshrined in the Constitution to provide electricity at least cost. There are some promising support initiatives for renewable electricity generation, but they are restricted in impact by the overall constraints through the least-cost-requirement. Generally high electricity prices have indirectly incentivised industry to produce electricity from renewable sources for own use.

Industry

Efforts to support energy efficiency are relatively low with only a few energy efficiency standards for electrical appliances. Efficiency is indirectly incentivised through relatively high electricity prices for industry and the absence of energy subsidies for industry. There is no support for renewable fuel use. Non-energy emissions from industry are substantial. Fugitive emissions from the oil and gas sector are a key source. There are projects to reduce CH_4 from gas through the state owned oil company PEMEX but efforts could be strengthened significantly.

Buildings

The focus of legislation is on energy efficiency, with minimum energy performance standards (MEPS) for 18 types of electricity-consuming equipment. There are few measures targeting energy use in buildings. Energy standards for building standards are scarce and poorly enforced. While some measures go in the right direction, the impact is limited either due to lack of enforcement or restricted coverage, either regionally or for parts of the building stock only.

Transport

There are substantial plans to avoid traffic and to foster modal shift through improved public transport infrastructure. The Federal Mass Transport Programme (PROTRAM) and the Urban Transport Transformation Project (PTTU) were initiated with a progressive concept, targeting various important areas, including urban planning and the optimisation of public transport services. So far implementation is slow due to high administrative barriers. Other areas of action, especially on vehicle efficiency are not yet well covered by measures. The focus here is on scrapping programmes for a part of the vehicle fleet.

Land use

Mexico has one of the most elaborate programmes on establishment of forest plantations, reforestation and restoration activities, forest development, payments for environmental services and activities related to the prevention of forest fires, among others. A National REDD+ strategy is currently in initial stages of development. Goals for REDD+ by 2020 include zero net emissions from forest land-use change and a significant reduction of the forest degradation rate. Plans for agricultural activities could be more integrated with forestry activities and strategies need to be translated to policies and measures that are implemented widely and involve stakeholders to enhance the prospects for full implementation.

Table 11
Highlights of Mexican policy

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	▸ Ambitious target for 2020 related to reduction from BAU ▸ Ambitious absolute target for 2050				
Electricity supply	–	▸ The National Program for the Sustainable Use of Energy aims to develop a strategy to promote CHP ▸ Pemex Gas and Petrochemicals Basic (PGPB) conduct a cogeneration project 300 MW, which will start operating in 2011 ▸ Electric Infrastructure Investment Plan includes measures until 2025 to reduce transmission losses ▸ No subsidies for fossil fuels for electricity production	▸ Private producers may produce (RE) electricity for export or own use. This is indirectly incentivised through relatively high electricity prices for industry ▸ Net accounting approach for renewables (electricity can be fed into the grid and consumed when needed) ▸ Interconnection agreement for small PV ▸ Fiscal credit for research and development		–
Industry		▸ No energy subsidies to industry (contrary to many other countries) ▸ Some energy efficiency standards (only partly affect industry)		▸ CCS practiced in enhanced oil and gas recovery	▸ Voluntary GHG emissions reporting ▸ Mexico is member of the Methane Global Initiative in Mexico ▸ Goals to reduce CH_4 and N_2O
Buildings	▸ *"Desarollos Urbanos Integrales Sustentables (DUIS)"* promotes the integration of urban planning into the context of new housing developments	▸ Sixteen energy efficiency norms for the efficient energy use in buildings ▸ Several programmes provide loans for new dwellings or remodelling/ refurbishment ▸ Unified building code (CEV), including chapters on energy efficiency and sustainability developed by the Comisión Nacional de Vivienda (CONAVI)	▸ Programme for the promotion of solar thermal heating aims at installing 1.7 Mio m² until 2012 ▸ Mandate for all new public-use installations (such as hotels and sport clubs) to heat 30 % of their hot water with solar energy. ▸ Three voluntary standards with a solar energy mandate (NESO -13)	▸ Switching from use of biomass (not sustainable) to LPG. ▸ Increase in use of natural gas, as this is a more cost effective fuel option	–
Transport	▸ Large scale funds for infrastructure investment and system optimization (PROTRAM & PTTU) ▸ Promotion of cycling in Mexico City	▸ Scrapping programmes for vehicles with a federal number plate (public transport, freight)	▸ Goals for 7 % share of bioethanol in the states of Guadalajara, Monterrey and Mexico DF in 2012		–
Agriculture / Forestry	▸ Strategy for selected land uses exists	–	–	–	▸ Detailed sectoral programmes for agriculture and forestry exist and include activities and measures for mitigation and adaptation that are partially implemented ▸ One of the most advanced programmes is ProÁrbol that promotes a range of activities related to forest conservation and restoration

Table 12
Gaps in policies compared to the low carbon vision

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	▸ Actions and strategy defined beyond 2012				
Electricity supply	–	▸ No Incentive to increase efficiency of fossil fuel power plants (e.g. performance standards, energy and CO_2 taxes, emissions trading…) ▸ No enhancement of grid development and further efforts to reduce distribution losses	▸ No active support for electricity generation with renewable energy sources other than production for own use ▸ No active support of diversification of renewable energy technologies ▸ No investment and implementation strategy for RE oriented grid structure	▸ No policies, financing mechanisms and strategies that support the increasing use of CCS for coal and biomass	–
Industry	▸ No policies in place to support increasing material efficiency, long product lifetime	▸ No direct incentives for energy efficiency through e.g. voluntary agreements, white certificates, emission trading, energy or CO_2 taxes	▸ No direct support for renewable energy ▸ No framework for sustainable biomass	▸ No incentives for coal, gas, biomass and process emissions CCS	▸ Goals but no incentives to reduce N_2O, CH_4 from oil and gas and waste, F-gas emissions
Buildings	▸ The initiative (DUIS) needs to strongly integrate requirements of energy efficiency and renewable energy use	▸ No national mandatory building energy-efficiency code ▸ Loans provided for new buildings and retrofitting are limited and have little impact on total stock ▸ Building codes are poorly enforced and not consistent throughout municipalities ▸ Energy efficiency standards, particularly for air conditioners need attention ▸ Subsidies on electricity prices for low- and medium income households decrease energy efficiency	▸ No policy for cooking with sustainable, renewable fuels ▸ The exact impact of solar water heaters on the total energy demand for hot water heating in Mexico is not known, but it is estimated to be limited because it has only been adopted in Mexico City	▸ No measures to ensure that fuel wood used is harvested in a sustainable manner	–
Transport	▸ Little efforts to promote cycling in Mexico City and no roll out to all other large cities ▸ Low fuel prices reduce attractiveness of low carbon transport modes	▸ No incentives to improve efficiency of new vehicles ▸ Existing scrapping programmes only target a sub set of the vehicle fleet ▸ Low fuel prices reduce attractiveness of more efficient vehicles	▸ National legislation needs to provide more concrete incentives for the use of renewables ▸ No mandatory scheme to ensure sustainability of biomass (for biofuel) production	▸ There are currently no measures in place to promote electric or other low carbon mobility technology	–
Agriculture / Forestry	▸ No integrated land-use plan to reduce deforestation and forest degradation caused by agricultural activities	–	–	–	▸ Enhancement of implementation of policies that aim at reducing emissions from the agricultural sector ▸ Extend existing afforestation and reforestation programs within a long-term framework that ensures medium and long-term implementation ▸ Implement REDD+ strategy

Table 13
Rating against the low carbon policy package[13]

	Changing activity	Energy efficiency	Renewables	Low carbon	Other
General	–	–	–	–	D
Energy supply	–	G	E	G	–
Industry	G	D	G	G	F
Buildings	F	E	G	D	–
Transport	G	G	F	G	–
Agri-culture/ Forestry	E	–	–	–	G

Scoring matrix

Rating	Interpretation
G	No or very limited policies
F	Few policies, ambition level low
E	Some policies with medium ambition level
D	Comprehensive package or good ambition level for a wide range of policies
C	Comprehensive policy package, ambition level good
B	Pathway is set, minor improvements required
A	Consistent with low carbon development

[13] Size of the symbols indicate importance (mitigation potential), letter indicates stringency compared to low carbon policy package (A= emission development consistent with a global path towards 2°C with or without external support, G=no or very limited policies).

5.3 Impact of policies on GHG emissions in 2020 and 2030

Domestic action

Under BAU, Mexico's emissions are projected to rise steadily up to 1,068 $MtCO_2e/a$ by 2030, an increase of just over 50 % to current levels. The largest absolute growth is expected in the industry sector, followed by transport and energy supply.

Currently implemented policies have the potential to reduce total emissions (including LULUCF) by around 223 $MtCO_2e/a$, or 21 %, by 2030 compared to BAU.

We project emissions excluding LULUCF to increase up to 1,050 $MtCO_2e/a$ by 2030. Reductions from policies are estimated to be around 180 $MtCO_2e/a$ by 2030, a decrease of 17 % compared to BAU, but still 63 % above current levels. The reductions come mainly from industry (122 $MtCO_2e/a$, 68 %), and 40 $MtCO_2e/a$ (22 %) from energy supply. The impact of measures in other sectors is relatively small.

Looking at the short-term national target set for 2012, our analysis shows that current measures have the potential to achieve a reduction of 24 $MtCO_2e$ in 2012 compared to BAU. This is less than half of the 51 $MtCO_2e$ envisaged in the national climate plan (PECC), although it must be noted that the climate plan projections of BAU are significantly higher than the CAT analysis (Refer to Annex II for comparison of scenarios).

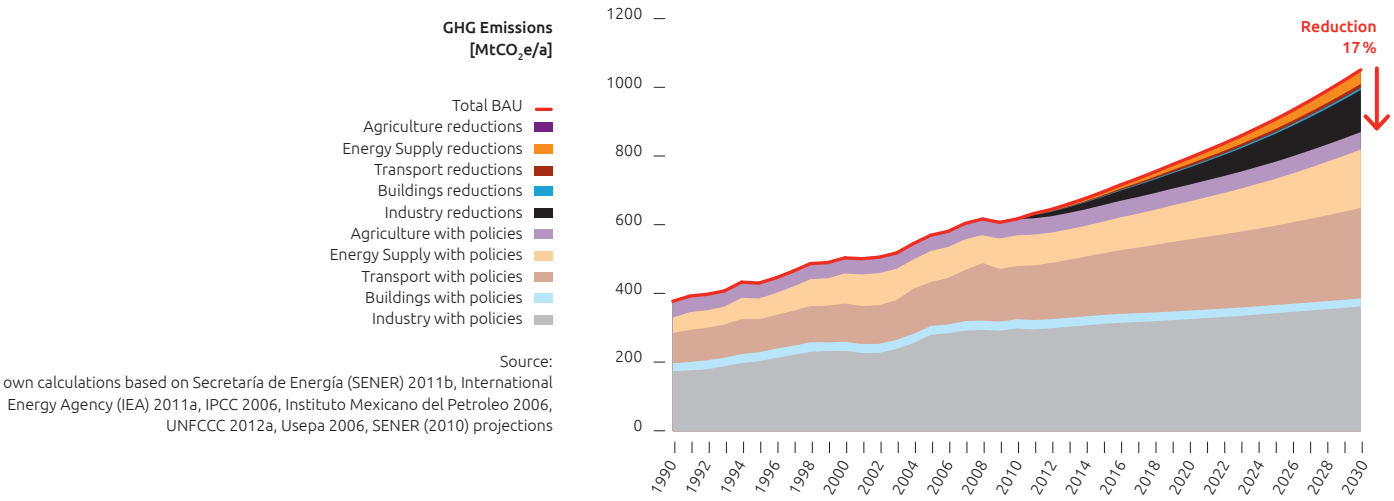
The long-term national target of cutting emissions in half, i.e. to 340 $MtCO_2e$, in 2050 is not yet supported by implemented policies. While this target is contingent on international funding, measures need to be established nationally within the coming years to enable Mexico to achieve this ambitious goal. If the recent institutional and strategic groundwork is utilised to fully implement existing potentials, international funding can be put to effective use.

Analysing energy intensity and carbon intensity

Aside from GDP and population development, the two important factors determining overall emissions of a country are the energy intensity of the economy and the carbon intensity of energy use. Most policies aimed at reducing emissions target one of the two areas.

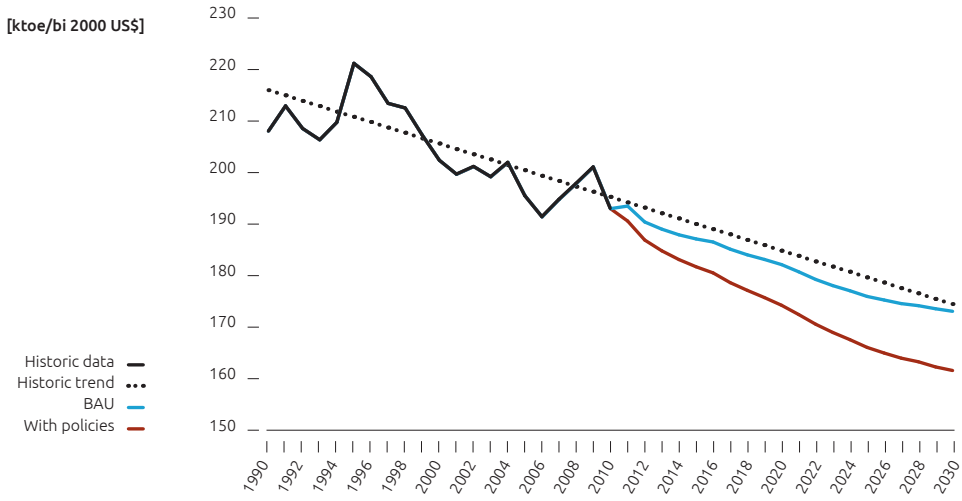
In order to move towards a low carbon development energy use and carbon intensity, there needs to be a clear decoupling from GDP and population developments.

Figure 21
Emissions and emission reductions (excl. LULUCF) for the policy scenario up to 2030



Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, Instituto Mexicano del Petroleo 2006, UNFCCC 2012a, Usepa 2006, SENER (2010) projections

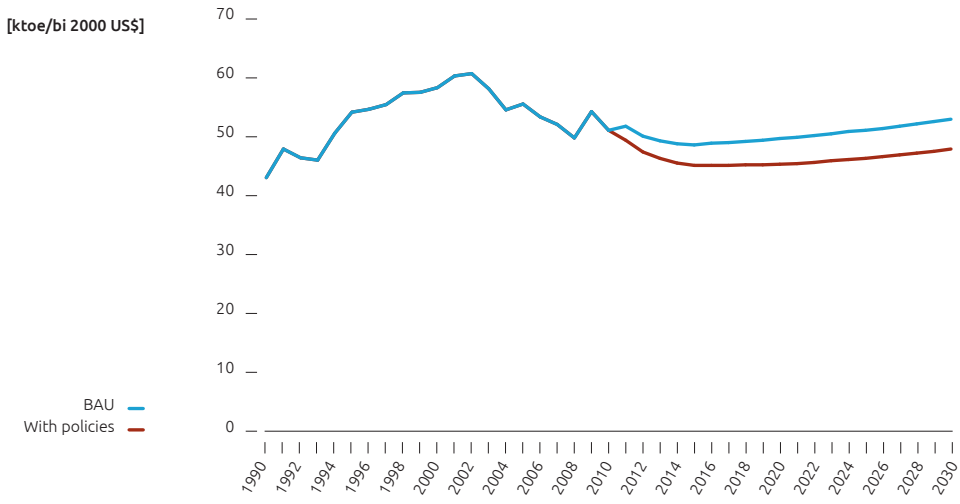
Figure 22
Energy intensity projections to 2030
(energy used per GDP)



For Mexico we see a clear historic trend in improvement of energy intensity (see Figure 22). The recession in 2009 leaves Mexico with a small peak in energy intensity due to the fact that GDP declined more than energy use. Overall BAU development is expected to continue the trend, while implemented policies are expected to further reduce energy intensity by almost 7 % in 2030.

While the overall development is rather positive, projected developments in the electricity supply sector are less favourable (see Figure 23). The main reason for this is Mexico's growing developing, leading to increased demand for electricity from all sectors. The fuel mix is expected to significantly shift towards electricity. This indicates a clear demand for further measures to increase demand-side efficiency for electricity use and to promote renewable electricity generation.

Figure 23
Energy intensity projections for the electricity supply sector to 2030



Emissions intensity of the energy used has seen a modest but steady increase over time (see Figure 24). Reasons for this include the increasing level of development in Mexico, with increased emissions from landfills and increasing process emissions and non-CO_2 fugitive emissions in the industry sector.

Under business-as-usual we project a reversal of this trend, leading to a modest improvement of carbon intensity up to 2030. This development is largely due to a continuing trend to replace oil with gas in the building and industry sectors.

Implemented measures are expected to improve this further, by almost 0.4 $ktCO_2e$/ktoe in 2030, an improvement of around 10 %.

Table 14 gives a summary of the development of the most important parameters in Mexico both for historic data and the projected scenarios.

Figure 24
Carbon intensity projections to 2030
(emissions excl. AFOLU per unit of energy used)

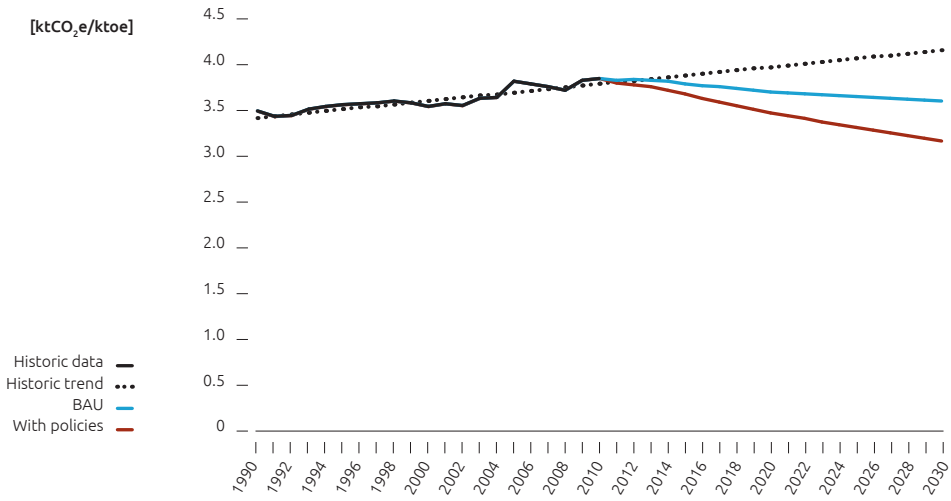


Table 14
Summary of historic and projected data per decade for main indicators

		Historic				Projections					
	Source/comments	**1971-80**	**1981-90**	**1991-00**	**2001-10**	**2011-20**			**2021-30**		
Population											
Total (million)	World Population Prospects: The 2010 Revision (UN)	61.11	77.13	93.03	107.27	119.30			131.38		
Average annual growth rate		2.8%	2.1%	1.7%	1.3%	1.1%			0.7%		
GDP											
Total (bi_2000_US_dollars)	World Bank World Development Indicators, International Financial Statistics of the IMF, HIS Global Insight, and Oxford Economic Forecasting	284.10	413.91	533.87	705.67	899.50			1359.65		
Average annual growth rate		6.9%	1.8%	3.5%	1.8%	3.7%			3.8%		
Primary Energy						**BAU**		**Policies**	**BAU**		**Policies**
Total primary energy supply (ktoe)	CAT			111,054	139,393	168,843		164,250	239,237		225,040
Average annual growth rate				3.2%	1.4%	3.1%		2.6%	3.3%		3.0%
						Current policies	New policies	450 scenario	Current policies	New policies	450 scenario
Average annual growth rate	WEO 2011	8.0%	3.0%	2.7%	1.7%	0.7%	0.6%	0.3%	0.3%	0.2%	-0.4%
Energy intensity (toe/Million US$)	CAT			206	196	188		183	176		166
Average annual growth rate				-0.3%	-0.5%	-0.6%		-1.0%	-0.5%		-0.8%
						Current policies	New policies	450 scenario	Current policies	New policies	450 scenario
	WEO 2011	1.1%	1.2%	-0.7%	-0.1%	-2.9%	-3.0%	-3.2%	-3.4%	-3.5%	-4.1%
	Garnaut 2011 (global)					-1.9%			-1.9%		
CO_2 emissions						**BAU**		**Policies**	**BAU**		**Policies**
Total emissions ($ktCO_2$-e)	CAT			393,480	520,102	641,976		698,942	873,930		789,961
Average annual growth rate				3.3%	2.2%	2.7%		0.8%	3.0%		1.4%
						Current policies	New policies	450 scenario	Current policies	New policies	450 scenario
Average annual growth rate	WEO 2011	9.1%	2.2%	2.7%	0.9%	0.4%	0.1%	-0.3%	-0.1%	-0.6%	-4.5%
Carbon Intensity (tCO_2/toe)	CAT			3.54	3.73	3.80		4.26	3.65		3.51
Average annual growth rate				0.1%	0.8%	-0.4%		-1.8%	-0.3%		-1.6%
						Current policies	New policies	450 scenario	Current policies	New policies	450 scenario
	WEO 2011	1.0%	-0.7%	0.0%	-0.7%	-0.3%	-0.4%	-0.7%	-0.3%	-0.8%	-4.1%
	Garnaut 2011 (global)					0.3%			0.3%		
CO_2 per capita (tCO_2/thousand)	CAT			4.2	4.8	5.38		5.9	6.65		6.01
Average annual growth rate				1.6%	0.9%	1.7%		-0.3%	2.2%		0.7%
						Current policies	New policies	450 scenario	Current policies	New policies	450 scenario
	WEO 2011	6.1%	0.2%	1.0%	-0.3%	-0.6%	-0.9%	-1.3%	-0.8%	-1.3%	-5.2%

Achieving the international pledge

The international "Cancún pledge" of Mexico is a 30 % reduction below BAU by 2020, conditional on international financial support. Applied to the BAU projection from the PECC at the time of the pledge this translates into pledged emission levels of 617 $MtCO_2e$ in 2020.

The CAT analysis delivers slightly lower BAU emissions in 2020 than the projections used in the national climate strategy (PECC) that formed the basis for the Mexican pledge. Applied to the CAT BAU projection the pledge translates to emission levels of 584 $MtCO_2e$ in 2020.

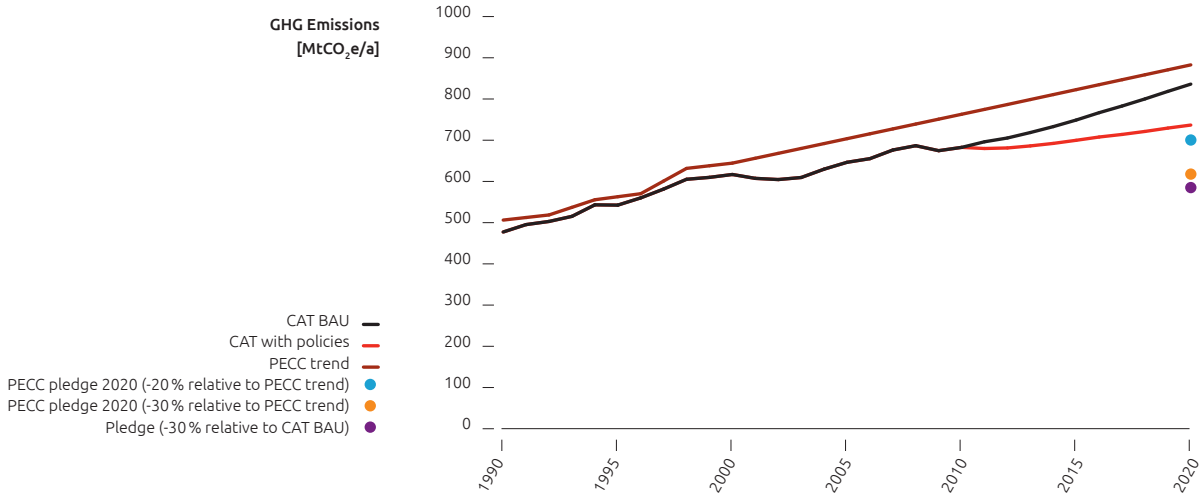
The strategy also provided an absolute target, representing a 20 % decrease below their trend projections. This original pledge was subsequently increased to a 30 % reduction below BAU by 2020.

Current national action will see Mexico achieving just over a third of its pledge in 2020 (see Figure 25). We project policies to deliver 12 % reductions below the CAT BAU.

The policies so far have largely been implemented unilaterally, with some programs receiving external support, for example from the World Bank.

The rest of the effort to achieve the Cancún pledge and the onset of a low-carbon future might be achieved by internationally funded reduction efforts. It is as yet undetermined to what extent Mexico will need and seek international funding.

Figure 25
Emissions and emission reductions for the policy scenario up to 2020 in comparison to Mexico's Copenhagen pledge



Analysing greenhouse gas emissions excluding LULUCF (Land Use, Land Use Change and Forestry)

The Mexican pledge is relative to total national emissions, i.e. it depends on highly uncertain developments in the LULUCF sector. It is therefore interesting to look at required developments in the other, non-LULUCF sectors.

For the overall emission scenario, the contribution of policies to emissions reductions is just short of 10 %.

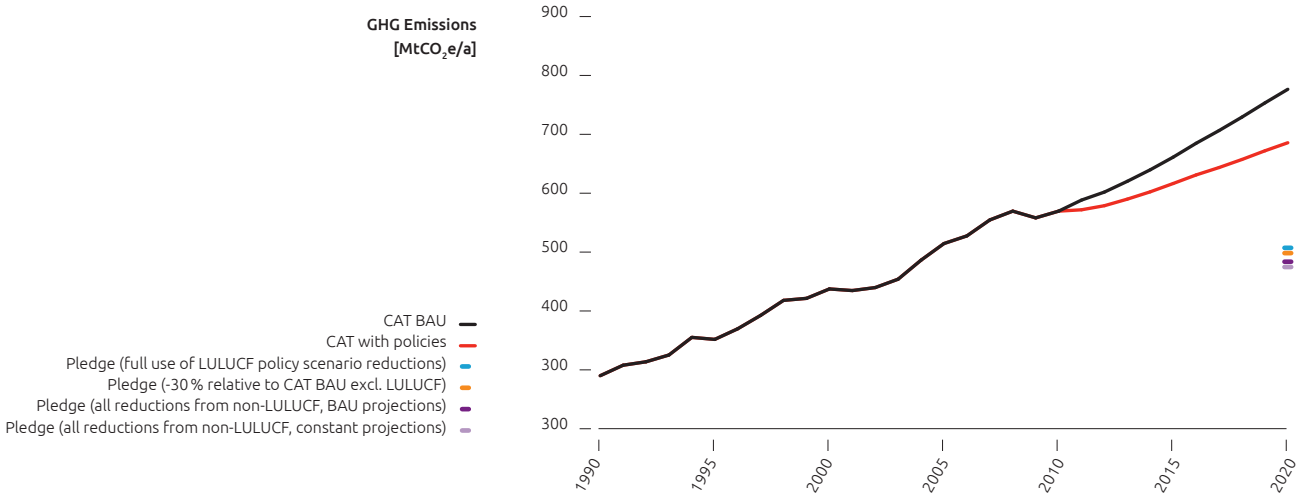
We have looked at the impact of different assumptions on LULUCF and the contribution from this sector on the mitigation needed from the other sectors.

There are different ways to translate the overall pledge into a target for the non-LULUCF sectors. With an equal contribution of -30 % of both LULUCF and the other sectors the target translates into roughly 556 $MtCO_2e$.

If we assume that LULUCF does not contribute to mitigation allowed emissions for the other sectors are 543 $MtCO_2e$ under the assumption of BAU development for LULUCF. Assuming a different development for LULUCF, for example a constant development at 2009 level, allowed emissions in the other sectors are 535 $MtCO_2e$.

This analysis shows that the impact of LULUCF for the achievement of the Mexican target is relatively limited, given the comparatively low share of total emissions under BAU in 2030 and the positive recent developments. The bulk of mitigation will need to come from the other sectors, mainly electricity production, industry and transport.

Figure 26
Emissions and emission reductions (excl. LULUCF) up to 2020 in comparison to a -30% decrease in industrial emissions



5.4 Potential options for further action

Below we provide options that Mexico could implement on its way towards a low carbon economy:

- Long-term planning of concrete measures to implement the 50 % reduction target by 2050 would increase predictability and ensure a stable policy environment for investment. A planning process is currently underway that could lead to such a result.

Obstacles to implementation

To achieve the transition to a low carbon economy it is essential to take a strategic approach across all economic sectors. This must be reflected also in a functioning institutional setup and processes that ensure an effective communication between different departments, stakeholders and interests. Providing a detailed information basis is a further prerequisite for successful policy implementation.

Taking action to provide this necessary basis does not deliver emission reductions in itself, but is a core requirement for effective implementation.

Mexico has taken significant steps to provide essential information and data and to ensure a functioning institutional setup. The strong commitment by the President and the setup of the Inter-Ministerial Climate Change Commission and the subsequent planning processes are essential elements in this.

Nevertheless communication between departments can be further improved and the low carbon strategy needs to be firmly embedded in the core tasks of each department. This also requires the allocation of sufficient funding within the individual department budgets to activities that help to transform the economy, and that in many cases create further non-climate related benefits.

Awareness of the issues related to climate change and the transition to a low carbon economy needs to be firmly embedded in all levels of the administration, not only at the ministerial level.

The envisaged change will not be possible without real ownership of this transformational process at all levels and within all departments.

Electricity sector

- CFE's least cost requirement enshrined in Mexico's constitution is a barrier to further implementation of electricity generation from renewable energy. This barrier could be removed. In addition Mexico could implement a broad based support mechanism for renewable electricity generation. A decentralised electricity production system could be promoted to facilitate development of remote areas that currently have no or limited access to the grid and where a connection to the central grid is technically and economically not feasible.

Industry

- Mexico could intensify its initiatives on energy efficiency and those that support the production of renewable energy in industry. Non-energy related emissions mainly derive from production processes and landfills. In particular fugitive emissions from oil and gas production are relevant for Mexico, which could be avoided at relatively low cost. Waste emissions can be targeted with policies that increase recycling rates to avoid landfilling and methane capturing at landfill sites. For some gases, e.g. N_2O, ambitious reduction plans exist until 2012. These could be continued and lined with concrete measures.

Buildings

- The attention in the building sector could focus more on the efficiency of the building envelope and equipment, not only on appliances. A national mandatory energy-efficiency code for new buildings would be a good starting point for this. This would need to go hand in hand with a robust enforcement system. The incentives could be complemented by loans provided for new buildings and for retrofitting of existing stock. The substantial electricity subsidies are a barrier to electricity savings. Removal of the subsidies, flanked by measures to compensate higher expenses for example for low income households, could be a step forward. Air conditioning will be the most important future electricity use - early steps to avoid this potential increase could include intelligent building design, building codes and efficiency standards. Renewable energy obligations already running in Mexico City could be rolled out across the country.

Transport

- The fuel price subsidy is a barrier to implementation of energy efficient cars. Removal of the subsidies in a socially acceptable manner could encourage use of more efficient cars. This could be further supported by mandatory standards for emissions and an emissions-based vehicle taxation scheme. The current measures to embed sustainable transport into an overall sustainable urban planning strategy provide a good basis for further strengthening and expansion of this process, while making the funds more accessible through improved administration and processes.

Land use

- Mexico could further align its mitigation plans of forestry and agriculture. In particular relevant are deforestation and forest degradation caused by agricultural activities. In addition, large proportions of emissions in agriculture are covered by a strategy but not yet covered by implemented policies. Existing measures need to be put in a long-term framework with medium and long-term goals and clear implementation strategies. This includes ensuring that measures for afforestation and reforestation are continued and expanded and implementing the defined REDD+ strategy with concrete measures.

ANNEX I | POLICY EVALUATION IN DETAIL

This annex provides detailed descriptions of the policies in place in Australia in the different sectors, the scoring for each indicator and the rationale for the assessment.

I.1 General climate strategy

Table 15
Policies and measures on a general climate strategy

Policies / measures		Rational for evaluation	Score
Does the country have a stringent and nationally binding GHG target or budget to 2050?	Mexico pledged to reduce its emissions by 30 % below BAU in 2020, but conditional on external funding after 2012. Furthermore, Mexico aims to reduce its emissions by 50 % below 2000 levels by 2050. (See also Climate Action Tracker; Estados Unidos Mexicanos 2012)	Mexico has a detailed plan to 2012 and a target for 2050 that is quite ambitious.	0 1 2 **3** 4
Does the country have an ambitious and comprehensive climate strategy towards a low carbon economy beyond 2020?	Mexico has a detailed plan (Special Programme on Climate Change, PECC, 2007-2012 (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b). A detailed plan after 2012 does not exist. The PECC is in line with the 2050 target but assumes moderate reductions in early years.	Mexico has a strategy to 2012 but not yet to 2020 or beyond, so it remains unclear how it will achieve the 2050 emissions reduction target.	0 **1** 2 3 4
Does an integrated long term innovation strategy tailored towards a low carbon development exist, with sufficient resources for research and development?	Elements of an innovation strategy exist in the Special Programme on Climate Change (PECC) (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b).	Elements of an innovation strategy exist but the current state of actual implementation is difficult to assess.	0 **1** 2 3 4
		Total	**1.8**
		corresponds to	**D**

I.2 Electricity and heat

Energy efficiency

Table 16
Policies and measures on energy efficiency in the electricity and heat sector

Policies / measures	Rational for evaluation	Score
Incentive to increase efficiency of fossil fuel power plants No direct incentives found. (Estados Unidos Mexicanos 2009; ABB and Enerdata 2011)	No direct incentives found but historically strong increase of efficiency, mainly due to increase of combined cycle natural gas plants due to lower costs.	**0** 1 2 3 4
Level of support for CHP The National Programme for the Sustainable Use of Energy aims to develop a strategy to promote the benefits of cogeneration and the identification of regulatory barriers to the use of cogeneration. The final impact is uncertain, yet, but energy savings of 2 TWh by 2012 and cumulated savings of 483 TWh by 2030 are estimated. (Garrison 2010). Pemex Gas and Petrochemicals Basic (PGPB) conduct a cogeneration project 300 MW that will start operating in 2011 (Estados Unidos Mexicanos 2009). Note: Assuming 6000 full load hours this would generate 1800 GWh/a, which is 0.7 % of 252773GWh total electricity production in 2009 (IEA 2010a).	There are projects to support CHP and government aims to support CHP further	0 **1** 2 3 4
Policies to reduce distribution losses Electric Infrastructure Investment Plan (POISE), 2011-2025, includes plans to reduce distribution losses. Mexico sets some standard for minimum efficiencies for transformers (0.1 % to 0.2 % below National Electrical Manufacturers Association (NEMA) TP-1 efficiency. Standard includes voluntary and mandatory elements. The Normas Officiales Mexicanas (NOM) defines minimum efficiency performance standards for transformers in the range from 5 to 500 kVA, and a compulsory test procedure for determining this performance. For each power category, maximum load and non-load losses are imposed) (Irrek et al. 2008).	Some measures are included in POISE 2011-2025. Electric power transmissions and distribution losses make up for 16 % to 19 % (world average 9 %) and are slightly increasing during the last years (TradingEconomics 2011 and ABB and Enerdata 2011, Comisión Federal de Electricidad (CFE) 2011).	0 **1** 2 3 4
Barriers		
Subsidies applicable in the electricity sector No direct subsidies for electricity producers.	No direct subsidies	-4 -3 -2 -1 **0**
	Total	**0.3**
	corresponds to	**G**

Renewables

Table 17
Policies and measures on renewable energy sources in the electricity and heat sector

Policies / measures	Rational for evaluation	Score
Level of support for RES-E There is an interconnection agreement for small scale PV to feed electricity into grid (Comisión Intersecretarial de Cambio Climático 2009b; Bahorich 2008; Garrison 2010). Since 2002 renewable electricity may be produced by the private sector for own use or to sell to other countries (e.g. USA) (Garrison 2010). Production for own use in industry is indirectly incentivized by relatively high electricity prices for industry, which makes it an attractive option. In addition, electricity not consumed on site can be fed into the grid and will be deducted from overall consumption from the grid. There are financial incentives for renewable sources: fiscal credit of 30 % for research and development, 100 % depreciation for all renewable energy capital investment in the first year (Bahorich 2008) Legal background: ▸ Law for the Use of Renewable Energy and Financing the Energy Transition (Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética (LAERFTE) from 2008, (Secretaría de Servicios Parlamentarios 2008a), provides the basis for the framework to promote and regulate renewable energy and cogeneration, leaving details to the Secretariat of Energy (SENER) and the Energy Regulation Commission (CRE). ▸ Law and Regulation on the Promotion and Development of Bioenergy (Ley de Promocion y Desarrollo de los Bioenergeticos, 2008), provides general support for bioenergy, such as the nomination of the Inter-secretarial Bioenergy Commission, e.g. for planning programmes to support the production, transport, distribution and marketing of bioenergy, and rules for blending (Food and Agriculture Organization of the United Nations (FAO) 2010; Estados Unidos Méxicanos 2008). ▸ The Special programme for the Use of RES (2009), which aims to increase the availability of information on renewable energy, develop a national inventory and a catalogue of pilot and demonstration alternative energy projects for rural communities and develop policy, regulatory and financing mechanisms to better take advantage of renewable sources (Garrison 2010).	There are some exceptions from the state monopoly, interconnection agree¬ments, legal basis for support and financial incentives. It led to production for own use by industry. Further action is planned but not yet included in the rating. Together with the World Bank Energy Sector Management Assistance Energy Sector Management Assistance Programme (ESMAP) Mexico plans to: 1. identify regulatory arrangements and develop policy approach (e.g. feed-in laws, financial incentives, etc), 2. develop a standard contract for RE purchase, 3. Develop a standardised pricing based on avoided costs or other principles, and 4. Develop arrangements of RE dispatch for transmission access. (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009a; Garrison 2010)	0 1 **2** 3 4
Support for different technologies A fiscal credit of 30 % is granted for research and development. No information found on explicit support for various technologies to encourage diversification (World Energy 2008). Research on different small scale renewable energy technologies (Instituto de Investigaciones Eléctricas (IIE) 2011).	Some financial incentives and some research exist, but these don't seem to provide comprehensive support.	**0** 1 2 3 4
Stringent framework for sustainable biomass import No regulations found on support or framework development for sustainable biomass import.	No regulations found	**0** 1 2 3 4

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Policies / measures	Rational for evaluation	Score
Barriers		
Administrative environment Mexico is aware of the unused potential of renewable energy sources. Several programmes have been in place for a long time. However, the public energy monopoly, combined with the demand to produce electricity at least cost while excluding external costs of fossil fuels, creates a difficult environment for renewables. This should be adjusted in the future. In addition, a large amount of permits is necessary, especially for small hydro (Garrison 2010). There is a legal basis for support and cooperation programmes with international partners (USA, World Bank). Note: In 2006 the Mexican government (SENER) conservatively predicted important increases in installed capacity for hydro (2,254 MW), Wind (592 MW) and geothermal (125 MW) for 2005 to 2014. By 2005 the government approved more than 50 RES projects. When completed by the end of 2007, they already accounted for 1400 MW of new capacity (Marks 2008).	Approval of several renewable energy projects in the past. There is international cooperation on renewable energy.	-4 -3 -2 **-1** 0
Stability of support There is long-term legislation to support renewables. There is a fiscal credit of 30 % for research and development. Favourable possibility to depreciate. Renewable energy vision to 2030. Cooperation with international partners (USA, World Bank) support long-term perspective. (Bahorich 2008; Secretaría de Energía (SENER) 2010f).	Mexico provides a good investment environment, especially when compared with other Latin-American countries.	-4 -3 -2 -1 **0**
Preferential grid access and congestion management for renewable electricity Since 1992, the Public Electricity Service Act has allowed private generation for self-supply, independent power production and trade with foreign countries (USA). A large-scale renewable energy project promotes grid-connected renewable energy in Mexico. However, fees and charges for transmission are not regulated. Prices for electricity, fed into the grid and bought by CFE (Federal Electricity Commission), are based on lowest costs (electricity production based on natural gas) (Renewable Energy and Energy Efficiency Partnership (REEEP) 2007).	Under some circumstances electricity can be fed into the grid but no congestion management.	-4 -3 -2 **-1** 0
Investment & implementation strategy for RE oriented grid structures Growth in wind energy recently partly due to availability of new transmission capacity in the Oaxaca region. During 2010, SENER issued a series of new regulations to strengthen the regulatory framework for renewable energy, including reductions in the transmission charges for private renewable energy developers. New models of interconnection contracts and agreements for renewable energy small-scale projects have created new opportunities for larger investments. (Global Wind Energy Council, www.gwec.net) No information found on a comprehensive implementation of RE oriented grid structure.	There have been some first attempts to include RE into the grid. A more comprehensive strategy would be needed	-4 **-3** -2 -1 0
	Total	**1.2**
	corresponds to	**E**

Low carbon

Table 18
Policies and measures on low carbon options in the electricity and heat sector

Policies / measures	Rational for evaluation	Score (low carbon)	Score (100 % renewable)
Policies that influence fuel choice No information on regulations found. Note: Requirement for state-owned producers to produce at lowest cost (which is currently leading to increasing use of natural gas).	No regulations found.	**0** 1 2 3 4	**0** 1 2 3 4
Incentives for biomass CCS No information found	No information found on incentives for biomass CCS	**0** 1 2 3 4	**0** 1 2 3 4
Barriers			
Incentives for coal CCS No direct incentives for coal-CCS found. But Mexico considers CCS as an important option in the long-term climate strategy. Note: CCS is already practiced for oil and gas (EOR /EGR, Enhanced Oil/Gas Recovery), research for future storage reservoirs, pilot projects for other CCS technologies planned (Halliburton 2011, Lacy 2011).	No information found, probably no running projects or concrete plans but considered in the long-term strategy.	-4 -3 -2 -1 **0**	-4 -3 -2 -1 **0**
Active support for nuclear energy Mexico runs two nuclear reactors, producing about 5 % of its electricity. Plans to build new nuclear power plants have been replaced by plans to build additional gas plants (Rodriguez 2011; World Nuclear Association 2011).	No support for new nuclear power plants.	-4 -3 -2 -1 **0**	-4 -3 -2 -1 **0**
	Total	**0**	**0**
	corresponds to	**G**	**G**

Note: Column "low carbon" indicated the score under a vision that would consider coal CCS and nuclear energy as best practice. Column "100 % renewables" indicates the score under a vision that would consider the development of nuclear and coal CCS as barrier to the development of renewable energy. See methodology report for details.

I.3 Industry

Changing activity

Table 19
Policies and measures on changing activity in the industry sector

Policies / measures	Rational for evaluation	Score
Support the redesign of products to be less material intensive, long lasting, 100% recyclable No information found on regulations for less material intensity or better recyclability of products. Note: Some support for energy efficiency of products: ▸ More efficient (household) appliances are target of the climate change strategy until 2030, actual policies are unclear (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b). ▸ Law on sustainable Use of Energy: Framework for energy efficiency labelling requirements and voluntary energy efficiency product certification (Secretaría de Servicios Parlamentarios 2008b).	No visible strategy on material intensity and recyclability of products.	0 1 2 3 4
	Total	**0**
	corresponds to	**G**

Energy efficiency

Table 20
Policies and measures on energy efficiency in the industry sector

Policies / measures	Rational for evaluation	Score
Schemes that lead to sufficient additional improvements in energy efficiency in industry Mexico has some energy efficiency standards which only have a partial direct effect on the industry sector (policies to increase efficiency of electric motors (3.5 TWH by 2012), standards for pumps and motor pumps for pumping clean water NOM-004-ENER-2008, Room air conditioners NOM-021-ENER/SCFI-2008, Compact fluorescent lamps (CFLs) autobalastradas NOM-017-ENER-2008, Mechanised tortilla machines NOM-019-ENER-2009) (Estados Unidos Mexicanos 2009; ABB and Enerdata 2011). The industry sector is not the main focus of the 2012 energy efficiency target (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b).	Some standards exist, but industry is not the focus of an energy efficiency strategy. Efficiency is indirectly supported by the relative high electricity price and no energy subsidies for industry.	0 1 **2** 3 4
Policies that support the demonstration of breakthrough technologies No information found	No information found on support of breakthrough technologies.	**0** 1 2 3 4
Barriers		
Subsidies, tax exemptions for energy-intensive industry for conventional fuel supply and consumption No subsidies (large amount of subsidies only for households and agriculture) (Johnson et al. 2009), although it could be argued that there could be hidden subsidies for the energy intensive oil industry PEMEX - the Mexican oil company being a public company. However, we did not find literature to support this.	There are no subsidies for energy in industry.	-4 -3 -2 -1 **0**
	Total	**1.8**
	corresponds to	**D**

Renewables

Table 21
Policies and measures on renewable energy sources in the industry sector

Policies / measures	Rational for evaluation	Score
Effective policies in place that lead to increasing the use of renewable energy in other industry The only support mechanism to increase renewable energy in industry is the possibility that industry can produce electricity and heat for own use. The fact that energy prices are high provides an indirect incentive to self-generation, but there is no direct financial incentive.	Industry is allowed to generate electricity for its own use. This lead to investments in renewable electricity in industries (e.g. wind turbines), but it remains marginal. There is no other specific renewable energy policy targeting the industry sector.	**0** 1 2 3 4
Stringent framework for sustainable biomass import No information found on support or framework development for sustainable biomass import.	No information found.	**0** 1 2 3 4
Barriers		
Subsidies, tax exemptions for energy intensive industry for conventional fuel supply and consumption No subsidies (large amount of subsidies only for households and agriculture) (Johnson et al. 2009).	No subsidies for energy in industry.	-4 -3 -2 -1 **0**
	Total	**0**
	corresponds to	**G**

Low carbon

Table 22
Policies and measures on low carbon options in the industry sector

Policies / measures	Rational for evaluation	Score (low carbon)	Score (100% renewable)
Incentives for coal / gas CCS development in industry No direct incentives found for coal-CCS. But Mexico considers CCS as important option in the long-term climate strategy. Note: CCS is already practiced for oil and gas (EOR /EGR, Enhanced Oil/Gas Recovery), research for future storage reservoirs, pilot projects for other CCS technologies planned. (Halliburton 2011; Lacy 2011)	CCA is already practiced. CCS considered in long-term climate strategy but currently no direct policies in place. Future impact difficult to asses.	0 **1** 2 3 4	-4 -3 -2 **-1** 0
Incentives for biomass and process emission CCS development in industry No direct incentives found for CCS on process emissions or biomass. But CCS is considered as important option in the long-term climate strategy. Note: CCS is already practiced for oil and gas (EOR /EGR, Enhanced Oil/Gas Recovery), research for future storage reservoirs, pilot projects for other CCS technologies planned. (Halliburton 2011, Lacy 2011).	CCS considered in long-term climate strategy but currently no direct policies in place, future impact difficult to asses.	**0** 1 2 3 4	-4 -3 -2 -1 **0**
	Total	**0.5**	**0**
	corresponds to	**G**	**G**

Non-energy

Table 23
Policies and measures on non-energy related emissions in the industry sector

Policies / measures	Rational for evaluation	Score
Policies to reduce N_2O emissions in industry Sour gas reinjection is a mitigation goal in the PECC (6.9 Mt CO_2 in 2012, 27.6 Mt CO_2e between 2008-2012)	Ambitious reduction plans exist for N_2O emissions in industry. But the status of implementation and perspectives after 2012 are unclear.	0 **1** 2 3 4
Incentives to reduce fugitive CH_4 emissions from oil and gas production Mexico is member of the Global Methane Initiative. While there are plans to promote the recovery and use of coal mine gas with security and environmental protection standards, implementation is unclear. Mexico seems to be only in the starting phase of monitoring emissions correctly. Mining Law (2006) allows coal companies to recover and use coal mine methane but status of linked regulation (to enable companies to implement specific measures) remains unclear. There are some initial reduction projects. Member of the Methane to Markets Partnership to promote capture options. (Estados Unidos Mexicanos 2009, Global Methane Initiative 2011, United States Environmental Protection Agency (EPA) 2010)	Fugitive emissions (1B) are identified as a key emission source in Mexico [about 10 % of total emissions in 2002 (own estimate)]. However, there is no detailed information available on the infrastructure of Mexico's natural gas and oil system, or direct measurements of emissions. Some measures and incentives do exist. Actual legal status of policies unclear. There are projects to reduce CH_4 from Gas (PEMEX) but no coordinated strategy visible.	0 **1** 2 3 4
Decrease in landfill gas emissions Some landfill projects, mainly as CDM. Mexico is member in the Global Methane Initiative but has not published a country action plan for this area so far (Climate Action Reserve 2011).	Some landfill projects	0 **1** 2 3 4
Policies to reduce F-gas emissions Mexico does not have an F-gas reduction strategy.	No information found. As with all developing countries, Mexico has to prepare an accelerated phase-out of CFCs and HCFCs covered by the Montreal protocol, but the state of implementation is unclear. Alternative substances for gases covered by the Montreal Protocol are often HFCs that are covered under the UNFCCC.	**0** 1 2 3 4
	Total	**0.97**
	corresponds to	**F**

I.4 Buildings

Changing activity

Table 24
Policies and measures on changing activity in the building sector

Policies / measures	Rational for evaluation	Score
Urbanisation policy that leads to energy efficient development Sustainably Integrated Urban Developments "Desarollos Urbanos Integrales Sustentables (DUIS)" is an initiative of the Mexican government to promote the integration of urban planning into the context of new housing developments, focusing on the areas where substantial housing developments are planned. The programme aims to coordinate the development of new projects in existing urban areas that plan to increase urban density and to supervise the development of "new" cities with large land extensions through projects that generate served land with infrastructure and sponsored by state governments or urban developers (house & land), aimed to sell big plots to small and medium size house developers.	So far, 4 DUIS projects have been approved representing a total investment of MX$ 77 billion for the construction of 250,500 houses. DUIS' projects will be monitored periodically by the same consultants in order to evaluate its evolution and to ensure that sponsors and each Government agency comply with their commitments (Wehner 2010).	0 **1** 2 3 4
	Total	**1**
	corresponds to	**F**

Energy efficiency

Table 25
Policies and measures on energy efficiency in the building sector

Policies / measures	Rational for evaluation	Score
Incentives for use of efficient appliances The Federal Law on Metrology and Standards, in its Article 40 establishes the mandate to implement mandatory technical standards (Normas Oficiales Maxicanas - NOM) which define "the characteristics and/or specifications products or processes must meet in the case they may constitute a risk for the human safety or could endanger human, animal or vegetable health, overall or working environment, or for natural resources preservation" (Congreso de la Unión 1997; De Buen 2009). To date, eight standards have been implemented for equipment and appliances that are used in residential buildings (room air conditioners, residential refrigerators and freezers, residential clothes washers, water heaters, thermal insulation, central-air condition, self contained commercial refrigerators, one-phase motors) (Comisión Nacional para el Ahorro de Energía (CONAE) 2008; De Buen 2009). The minimum performance standards (and their corresponding test procedures) for refrigerators and AC units have been harmonized with those of the US and Canada (De Buen 2007, 2009). Two standards have been issued for interior lighting systems and the exterior buildings´ envelope in non-residential buildings (Comisión Nacional para el Ahorro de Energía (CONAE) 2001; De Buen 2009). CFE has been involved in a number of demand side management (DSM) programmes since the early 1990s. One has been ILUMEX, a programme that helps install more than 2 million compact fluorescent lamps in Mexico´s largest cities and was later taken over by FIDE (De Buen 2009). Another programme was to thermally insulate roofs in Mexicali (Johnson et al. 2009).	These standards depend on the private sector for their implementation and are working well and having positive impacts (Sanchez 2006; De Buen 2009). Energy efficiency standards have represented significant energy savings. According to CONAE´s information, standards related to electricity end uses have saved an aggregate of 16,065 GWh to end-users by the year 2006 (equivalent to the power consumption of 10 million Mexican households in one year), and resulted in 2,926 MW of avoided power capacity (equal to 6 % of Mexico´s installed capacity by the end of 2006) (De Buen 2009). Standards for lighting and the buildings envelope have been in place for more than six years but have been poorly enforced. Incandescent lamps still account for about 85 % of the in-use residential light bulbs in Mexico, indicating a large potential for scaling up use of compact fluorescent lamps. Demand side activities have continued but at a low key level. There is room for more stringency of the minimum performance standards (MEPS). Based on the fact that there are a number of equipments that already have the same MEPS as US and Canada, Mexico could follow the lead of the US and Canada to strengthen its own standards still further	0 1 2 **3** 4
Level of energy and/or CO_2 taxes No taxes for building users, but subsidies	No regulation found	**0** 1 2 3 4

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Policies / measures	Rational for evaluation	Score
Ambitious efficiency standards for new buildings Mexico does not have a residential building energy-efficiency code (Johnson et al. 2009). While standards for the building envelope of non-residential buildings exist, they have been poorly enforced; no large city government has adapted them in its construction regulations (De Buen 2009). Mexico has 2,438 municipalities that could self-responsibly design and implement building codes and norms. Due to the dispersed nature of their activities and the decentralised political configuration in Mexico, there are a number of construction regulations but no unified building code (Wehner 2010). In 2007, the Comisión Nacional de Vivienda (CONAVI) developed a unified building code (CEV) to be used as model by local authorities. In 2010 the CEV was updated with enhanced chapters on energy efficiency and sustainability; the energy efficiency chapter includes a performance path and a prescriptive path. The enforcement lies in the hands of municipalities. CONAVI developed three more construction guidelines, but they are not enforced or not supervised (Asociación de Empresas para el Ahorro de Energía en la Edificación (AEAEE) 2006; Wehner 2010). One standard has been issued for the exterior buildings´ envelope (Comisión Nacional para el Ahorro de Energía (CONAE) 2001; De Buen 2009).	The energy efficiency standard for thermal insulation has been in place for more than six years but has been poorly enforced. No large city government has adopted it in its construction regulations (De Buen 2009). No trajectory towards zero emissions, no enforcement of the existing standards. Taking into consideration CONAVI's expansion plan to serve the future housing demand with green mortgages and subsidies, the total number of houses to be supported by CONAVI and INFONAVIT in 2020 would represent 6.1 % of the total housing stock in the same year. If we compare the total number of "sustainable houses" with the number of new houses constructed per year (approximately 576,000 houses), it means that approximately 35 % of the new housing stock by 2020 will be supported by one of the programmes. This calculation is based on the assumption that the number of subsidies provided by CONAVI will remain the same (approximately 95,000 subsidies per year as there is no plan to increase the subsidies/budgets) and the number of Green Mortgages will increase (Wehner 2010). The electricity savings that can be reached a through the implementation are about 10 % (Wehner 2010). No data was available on the energy savings (e.g. gas) that can be saved.	0 **1** 2 3 4
Sufficient incentive for high retrofit rates The Instituto del Fondo Nacional de la Vivienda para los Trabajadores Green mortgages programme, a public fund, provides loans for new dwellings or remodelling (refurbishment), e.g. solar water heater, thermal insulation, CFLs, high efficient A/C, low-flow showers (INFONAVIT 2008; De Buen 2009). Comisión Nacional de Vivienda (Conavi) – Esta tu casa program: CONAVI is a federal government institution that provides subsidies for low income housing to measures for sustainable housing (the same measures as Green mortgages program) (De Buen 2009; Wehner 2010). Another programme of CFE and FIDE's (part of the demand side management programme) has been aimed at the thermal insulation of roofs in Mexicali (De Buen 2009).	The *Green Mortgage* and CONAVI's *Esta tu casa* subsidy programme are strongly related and, in 2010, about 53 % who received the green mortgage also received the subsidy from CONAVI (Wehner 2010). The information available does not allow disaggregating by refurbishment and new construction rates. However; in 2010 the impact was about 100,000 dwellings (new constructed or remodelled) (De Buen 2009), i.e. in total less than 0.4 %/year received the subsidy (calculated on basis of existing building stock). This impact of the thermal insulation programme has not been quantified but is supposed to be low, given the limited regional coverage (De Buen 2009).	**0** 1 2 3 4
Policies for efficiency improvement for other than heating fuel uses Article 40 of the Federal Law on Metrology and Standards, establishes the mandate to implement mandatory technical standards (Normas Oficiales Maxicanas or NOM). This includes water heaters.	Energy efficiency standards for water heaters and industrial thermal insulation has resulted in energy savings of 36 PJ of LPG by the year 2006 (equal to 10 % of a years´ use by residential and commercial end-users) (De Buen 2009). No policy in place that enforces efficient cooking	0 1 **2** 3 4

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Policies / measures	Rational for evaluation	Score
Level of energy and/or CO_2 taxes Automatic tax cuts and subsidies when fuel prices rise. In case oil price is low there is tax on oil; however at the moment it is subsidised due a relatively high price.	If the energy price goes up, the fuel will be subsidised. This is a barrier to energy efficiency investments. However at low prices there is a tax on the energy price (Lundsgaard 2010).	**0** 1 2 3 4
Barriers		
Subsidies, tax exemptions for electricity use in buildings Two-thirds of all electricity subsidies in Mexico are directed at residential electricity customers, and this share has increased over time. The subsidies provided to residential customers have increased by 46 % since the last tariff reform in 2002. Time and again, efforts to reduce subsidies have been followed by the creation of new and more highly subsidised tariff categories to offset the burden on those residential customers whose tariffs were increased in the last tariff change (Kornives 2010). In the year 2006 alone, the government spent more than 10 billion US$ to cover the costs not recovered through the power utility bill (De Buen 2009, Irastorza 2006). Of this total, more than 50 % went to cover the difference in cost in the residential sector. More specifically, more than half of residential electricity consumers pay about 0.05 US$ per kWh, which is about a fifth of real costs (which is paid by about 10 % of all residential customers) (Irastorza 2006; Comisión Federal de Electricidad (CFE) 2008a, 2008b; De Buen 2009).	According to Kornives the weighted ratio of price of electricity that the customers pay to the average cost for electricity production is 1:2. The weighting has been done according to floor area in the building stock. In general, electricity price for residential buildings get the most subsidised tariffs, whereas public and commercial building are get less subsidised tariffs (Kornives 2010). This is an enormous barrier to the implementation of energy efficiency measures by the end users. Estimating electricity consumption and subsidies by income level in Mexico is challenging due to the lack of comparable data. Estimates of subsidy distribution by income decile show that residential subsidies disproportionately benefit non-poor households, with the subsidies provided through climate based tariffs (that is, 1A–1F) having the most regressive distributional incidence. While the bottom three income deciles account for about 21 % of total subsidies, the top three income deciles account for 38 % (Kornives 2010). Among Tariff 1F customers (the most highly subsidized customer group), more than one-quarter of total subsidies go to the top income decile alone. In contrast, ENIGH data suggest that the pilot program Oportunidades Energéticas has a very progressive distribution of resources across income classes, with nearly 75 % of the payments going to the bottom three income deciles (Kornives 2010).	-4 -3 **-2** -1 0
Subsidies, tax exemptions for fuel use in buildings Automatic tax cuts and subsidies when fuel prices rise. In case oil price is low there is tax on LPG; however at the moment it is subsidised due a relatively high price.	Where the energy price goes up, the fuel will be subsidised. This is a barrier to energy efficiency investments. However, at low prices, there is a tax on the energy price (Lundsgaard 2010).	-4 -3 **-2** -1 0
Solutions to the landlord tenant problem No solution, lack of capacity of project developers, facility managers, and owners.	No regulation found. The ownership structure of the residential building stock indicates that the landlord-tenant dilemma is only a minor problem. In 2000, 78.7 % of the residential buildings were owner occupied; in 2010 the share was 76.4 %. This corresponds to an annual decrease of about 0.1 % and indicates a very small tendency towards rising share of rented flats in the future (INEGI 2010b).	-4 -3 -2 **-1** 0

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Policies / measures	Rational for evaluation	Score
Barriers		
Proper implementation and enforcement of new buildings standards See "Ambitious efficiency standards for new buildings for all types of buildings"	See "Ambitious efficiency standards for new buildings for all types of buildings"	-4 -3 -2 -1 0
	Total	**1.4**
	corresponds to	**E**

Renewables

Table 26
Policies and measures on renewable energy sources in the building sector

Policies / measures	Rational for evaluation	Score (out of 4)
Policy instruments on use of renewable heating/cooling No regulation found	No regulation found	0 1 2 3 4
Cooking and hot water supply Since 2006 the Government of Mexico City has mandated, through an environmental standard, that all new public-use installations (such as hotels and sport clubs) have to heat 30 % of their hot water with solar energy (GDF 2006Secretaría del Medio Ambiente (SMA) 2006). The impacts of this standard have yet to be evaluated as enforcement has not been fully implemented. Three voluntary standards have been issued through a private sector standardization initiative with a solar energy mandate (NESO -13) (Comisión Federal de Mejora Regulatoria (COFEMER) 2004). These standards apply to solar water heating components, systems and installations. To date, three standards are in place: flat plate collectors, installations and terminology. These standards are not mandatory but can be adopted voluntarily for public and private programmes. To support the flat plate collector standard, a test laboratory has been installed and is already certifying solar collectors. Other standards under development apply to residential systems and to storage tanks.	No policy for cooking with sustainable, renewable fuels. The exact impact of solar water heaters on the total energy demand for hot water heating in Mexico is not known, but it is estimated to be limited because it has only been adapted in Mexico City. Additionally enforcement not fully implemented (De Buen 2009).	0 1 2 3 4
Level of energy and/or CO_2 taxes Automatic tax cuts and subsidies when fuel prices rise. Where oil price is low there is a tax on LPG, but at the moment it is subsidised due a relatively high price.	If the energy price rises, fuel will be subsidised. This is a barrier to energy efficiency investments. However, at low prices there is a tax on the energy price (Lundsgaard 2010).	0 1 2 3 4
Framework for sustainable biomass import No regulation found	No regulation found	0 1 2 3 4
Barriers		
Solutions to the landlord tenant problem No solution, lack of capacity of project developers, facility managers, and owners	No regulation found. The ownership structure of the residential building stock indicates that the landlord-tenant dilemma is only a minor problem. In 2000, 78.7 % of the residential buildings were owner occupied; in 2010 the share was 76.4 %. This corresponds to an annual decrease of about 0.1 % and indicates a very small tendency towards rising share of rented flats in the future (INEGI 2010b).	-4 -3 -2 -1 0
	Total corresponds to	**0.4** **G**

Low carbon

Table 27
Policies and measures on low carbon options in the building sector

Policies / measures	Rational for evaluation	Score
Switching from oil/ coal to gas Switching from use of biomass (not sustainable) to LPG. Increase in use of natural gas, as this is a more cost effective fuel option.	No regulation found (further information welcome and further analysis necessary)	0 1 **2** 3 4
	Total corresponds to	**2.0** D

I.5 Transport

Changing activity

Table 28
Policies and measures on changing activity in the transport sector

Policies / measures	Rational for evaluation	Score
Avoid traffic and to move to non-motorised transport Promotion of non-motorised transport in Mexico City: through investments in new bike lanes, with the aim to promote non-motorised transport for short trips in the central areas of the city. The plan will include the construction of 300 km of bicycle paths. When this measure is fully implemented the reductions estimated are 27,479 tons of CO_2eq per year. The 2008-2012 budget is $1,500million pesos; the "Travel by Bike" project aims to promote cycling through information and campaigns; since 2010 Mexico City has a bicycle sharing system (ECOBICI) that has generated more than 2 million trips (7500 daily trips). The Mexico City Bicycle Strategy establishes a goal of 5 % of the trips in the city done by bicycle for 2012. (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2008c; Perez 2009; Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2008c; T-Mapper project Team 2011; ECOBICI Sistema de Transporte Individual 2011	The measure is not yet fully implemented and restricted to Mexico City. Even though it is the largest city in Mexico this is expected to lead to a reduction of less than 0.5 % of total transport emissions (based on the 2006 emissions inventory).	**0** 1 2 3 4
Modal shift to low carbon transport modes Federal Mass Transport Programme (PROTRAM): aims to foster urban planning through the implementation of sustainable urban transport projects, the development of integrated public transport systems that are safe, efficient, cleaner, etc. The fund supports projects at federal, state and municipal levels, primarily for feasibility studies and project investment in infrastructure and transport equipment. It offers grants to sub-national governments to cover up to 100 % of studies and 50 % of infrastructure costs for public transport projects that meet certain criteria. Support can be recoverable or non-recoverable. Eligible projects can be suburban trains, metro, light train, trams, BRT and multimodal integration infrastructure. Currently 33 Cities have applied to the programme, and the projects being studied/planned include: 19 BRT, 7 suburban trains, 1 light train, 2 trams and 4 urban mobility plans. However, so far only 6 of the 33 proposals have been approved (Fondo Nacional de Infrastructura 2010; T-Mapper project Team 2011; EMBARQ 2010). Urban Transport Transformation Project (PTTU): includes a component to support low carbon bus technologies (OECD International Transport Forum 2011). The Mexican climate strategy (PECC) includes a goal to increase freight transport via rail, but there are no concrete measures implemented apart from some legistlative initiatives to avoid operational conflicts for intermodal transport. Mexico City has additional activities to promote public transport as part of their Climate Action Programme, including a programme for compulsory school transport, designed to be introduced gradually. Once it is fully operating, the estimated reductions will be around 470,958 tons of CO_2eq per year. Further activities include extensions of the BRT from 3 to 5 lines, starting construction in 2011 and a further 5 lines planned for the future without a determined time frame. A streetcar line was planned, but construction was cancelled. A new metro line is expected to reduce emissions by 400,000 tons of CO_2eq per year (Secretaría del Medio Ambiente (SMA) 2009; Martínez 2010; Secretaría del Medio Ambiente (SMA) 2010; Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2008b; Ciudad de México 2011).	The establishment of the programmes is certainly a step in the right direction. However, due to the administrative processes, implementation has not yet started and overall impact in 2020 will be low if continued at this pace. Although there are some good regional initiatives, especially in the largest city of Mexico City, implementation is again unclear and does not cover the largest share of emissions.	0 **1** 2 3 4

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Policies / measures	Rational for evaluation	Score
Level of energy and/or CO_2 taxes There are no explicit consumer taxes on transportation fuels. PEMEX, the Mexican national oil company, is the only wholesale distributor of gasoline and diesel. The Federal Government sets retail prices on a monthly basis. The fuel price includes all tax elements. Prices are set according to a fixed formula with current inflation as only changeable parameter. In times of high oil prices this system effectively leads to subsidies on transportation fuels. In 2008 these amounted to 2.4 % of the country's Gross Domestic Product (GDP). Isolating gasoline for automobile use, the subsidy was 0.27 % of GDP (Ministry of Finance 2010; The Global Subsidies Initiative 2008).	The subsidy was announced to be phased out by end of 2010. According to IEA fuel prices have increased steadily in 2011 as a result of the phase out (IEA 2011), but according to the Department of Finance (SCHP) latest estimates the subsidies will continue to grow in 2011 and 2012 (Arteaga 2011).	**0** 1 2 3 4
Barriers		
Incentives which promote higher fuel use Vehicle ownership tax rates vary with the price of the vehicle and decline over time, thus indirectly promoting the use of cheaper and older vehicles. (Legislación Federal de México 1999). The tax has no direct link to emissions, but provides mixed incentives. A highly efficient car using latest technology (e.g. hybrid) is more expensive than regular technology and is thus discouraged through the tax. Small cars, on the other hand, use less fuel and are usually cheaper and thus promoted through the system. At the same time older, less efficient cars are promoted. The tax is set to be phased out by the end of 2011, but states will continue to have the possibility to levy the tax (Secretaria de Gobernacion (SEGOB) 2010; Yeskett 2011)	The system provides mixed incentives. The overall effect is difficult to determine. Under the assumption that the tax will be phased out on national level we do not consider this a barrier for future efficiency development.	-4 -3 -2 -1 **0**
	Total	**0.3**
	corresponds to	**G**

Energy efficiency

Table 29
Policies and measures on energy efficiency in the transport sector

Policies / measures	Rational for evaluation	Score
Incentives to reduce light vehicle emissions per kilometre There are no efficiency requirements for new cars. The focus of activities has been on the renovation of the vehicle fleet and here is mainly related to freight and public transport. Efforts to reduce the average age of the vehicle fleet included the introduction of a customs duty of 10 % for imported vehicles which are 10 years or older in 2009. However, the constitutional court has recently suspended the regulation and it is unclear how the matter will move forward. Support scheme in Mexico City for renewal of taxis. The objective is to have 75,000 renewed vehicles by the end of 2012, with an estimation of reductions of 240,000 tons of CO_2eq per year. 4-year budget of 1,125million pesos ($86m) (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2008c).	The effects of scrapping programmes are complex. If old vehicles are replaced with larger vehicles with bigger motors, the effects on emissions could even be negative. However, the vehicle stock in Mexico, in general, is so old and inefficient that positive effects prevail. However, the scheme is limited to Mexico city taxis, which limits the overall effect.	**0** 1 2 3 4
Incentives to reduce heavy vehicle emissions per kilometre The National Scrapping Programme hopes to improve the competitiveness of the Federal road-transport, to reduce greenhouse gases, and to provide vehicle update and modernisation to all freight and passenger transport contractors. This is achieved by a tax incentive offered by the federal government (Asociación Nacional de Autobuses 2011, Secretaría de Gobernación 2009). The Eco-Driving Guide is a tool published by the National Commission for the Efficient Use of Energy (CONUEE) that provides information about different actions to helps reduce fuel consumption for freight (Comisión Nacional para el Uso Efficiente de la Enegía (CONUEE) 2009). Programa de Transporte Limpio (SMARTWAY): aims to decrease the fuel consumption of freight vehicles and passenger buses that have a federal plate. The programme has been in place since 2009 with around 8,000 subscriptions and emissions savings of around 473, 000 t CO_2 per year [Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) and (SCT) 2011]	In this case the scale of the programme is large enough to be expected to have an impact on reducing the average emissions of public vehicles. From the start of the programme in 2004 to March 2011 a total of around 16,000 vehicles were scrapped under the scheme (Asociación Nacional de Autobuses 2011), falling short of the goal of 15,100 vehicles per year in 2012 [Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b]. The average age of the federal fleet increased in 2009 and 2010 after years of steady decline, indicating that the policy is not very effective [Subsecretaría de Transportes (SCT) 2010]. Both the Eco-Driving Guide and the SMARTWAY programme are voluntary initiatives with limited effectiveness. There are no measures in place for new vehicles.	0 **1** 2 3 4
	Total	**0.2**
	corresponds to	**G**

Renewables

Table 30
Policies and measures on renewable energy sources in the transport sector

Policies / measures	Rational for evaluation	Score
Incentives to increase renewable energy sources There are two main laws related to bioenergy in Mexico, passed in 2008: a law to promote and develop bioenergy "Ley de Promoción y Desarrollo de los Bioenergéticos (LPDB)" (Estados Unidos Méxicanos 2008) and a law to support the deployment of renewable energy "Ley para Aprovechamiento de las Energías Renovables y Financiamiento para la Transición Energética (LAERFTE)" (Secretaría de Servicios Parlamentarios 2008a). The LPDB establishes an inter-ministerial Commission, including the Ministries of Agriculture (SAGARPA), the Environment (SEMARNAT), Energy (SENER) as well as Economy (SECON) and Finance (SHCP). The programme for the introduction of bioenergy (Programa de Introducción de Bioenergéticos) has the objective of achieving a share of bioethanol in gasoline of 7 % in the states of Guadalajara, Monterrey and Mexico DF in 2012 (Estados Unidos Méxicanos 2008). There is also a programme for scientific support of bioenergy use (Estados Unidos Méxicanos 2008; Ortega and García 2008; Riegelhaupt et al. 2010; Deutsch-Mexikanische Industrie- und Handelskammer AHK 2010).	Measures are in place, but no evidence could be found that these measures produce an effect in the desired scale.	0 **1** 2 3 4
Framework for sustainable biomass A national norm for the production of biofuels (NMX) is being defined and implemented within 2011. The system will be based on a voluntary certification scheme and currently does not foresee regulation of biomass imports. However, biomass potentials in Mexico are estimated to be huge. The main concern related to biomass in Mexico is the effect of biomass production on food security and on the environment (biodiversity, erosion, etc.) (Riegelhaupt et al. 2010; Comite Tecnico de Normalizacion Nacional de Medio Ambiente y Recursos Naturales 2011).	Mexico's focus is on sustainability of national production rather than on imports. However, also in this area there are no comprehensive measures in place and only a voluntary system is planned.	**0** 1 2 3 4
	Total	**0.8**
	corresponds to	**F**

Low carbon

Table 31
Policies and measures on low carbon options in the transport sector

Policies / measures	Rational for evaluation	Score
Support for fuel switch from oil to natural gas or other low carbon technologies No information on promotion of natural gas vehicles could be found.	No information available	0 1 2 3 4
Incentives for electric mobility No information on promotion of electric vehicles could be found.	No information available	0 1 2 3 4
	Total corresponds to	**0.0** **G**

I.6 Agriculture and Land Use, Land Use Change and Forestry (LULUCF)

Changing activity

Table 32
Policies and measures on changing activity from AFOLU

Policies / measures	Rational for evaluation	Score
Activities to promote sustainable consumption practices No information found on support of sustainable consumption practices.	No information found	0 1 2 3 4
Consistent land use strategy The Federal Government's Special Climate Change Programme (PECC, published 2009) sets specific AFOLU emission reduction targets for the period 2009-2012. Targets are set for sustainable forest management (incorporation of 2.95 million hectares to Sustainable Forest Management), environmental service programmes, a system of wildlife conservation units, stabilisation of the farming frontier. Objectives and goals in agriculture and cattle ranching are proposed and vulnerability and adaption and R&D are addressed. Programmes and action lines to realised to achieve the targets are: ProArbol Programme established 2007 with 12 sub-programmes to achieve emission reductions from actions aimed at protecting, conserving, restoring and sustainably using the resources of temperate and tropical forests and vegetation of arid zones (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2008a). Three REDD pilot projects under the National Commission for Natural Protected Areas (Comisión Nacional de Áreas Naturales Protegidas (CONANP) 2011). National Commission for the Knowledge and Use of Biodiversity (CONABIO since 1992). Programme for Sustainable Livestock Production and Management (PROGAN) with five activities to promote addressing soil conservation and other mitigation options under the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA).	A comprehensive strategy, however ▸ activity planning and quantitative definition of aims only until 2012, ▸ gaps between state level implementation and federal objectives regarding institutional development and activity implementation are identified, ▸ barriers (e.g. funding, public acceptance) to the implementation of specific objectives (e.g. PES schemes) are identified.	0 1 2 3 4
Policy tools to secure implementation of strategy General Law on Sustainable Forest Development (2003) General Law for Ecological Balance and Environmental Protection (1987, last modified 2010) (LGEEPA) Law on Agriculture (Ley Agraria) Law on Sustainable Rural Development (2001) Federal bodies are in charge of the regulation, advancement, protection and surveillance of forest resources. The Ministry of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales – SEMARNAT) is the institution in charge of regulating forest activities and authorising the use of forest resources through representatives in each of the 32 federal entities. The Federal Government Forest Policy (Comisión Nacional Forestal –CONAFOR) is the agency in charge of promoting the activities related to proper forest use, forest protection, plantation development and restoration, through economic resources allocated as subsidies. The Federal Attorney of Environmental Protection (Procuraduría Federal de Protección al Ambiente - PROFEPA) is the body in charge of enforcing the law and carrying out inspections and forest surveillance. The State Governments and municipalities collaborate and participate in carrying out advancement, restoration and forest surveillance programmes. State level Climate Change Programmes (PEACC) are planed in six, under development in eight and being implemented in two states, i.e. 16 states without PEACC plan and three states with both institutions and programme activity identified (as of April 2010). (Comisión Nacional Forestal (CONAFOR) 2010a)	Legislative and executive structures set up to realise political objectives. However the framework conditions to realise the mitigation potential embodied in the national targets and programmes are less favourable due to: ▸ unknown implementation effectiveness ▸ partly critical press review of implementing agencies' efficiency ▸ reported lack of transparency ▸ low level of civil society integration ▸ reported corruption in environmental programmes Little experience, literature exists on enforcement and jurisdiction of laws on long term emission reduction objectives.	0 1 2 3 4

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Policies / measures	Rational for evaluation	Score
Barriers		
Land use plan/register including a detailed forest inventory and protected areas Plan: State level land use planning exists in some cases. Register: The REDD Readiness Preparation Proposal (R-PP) includes a plan to build a national monitoring system for land use and forest (linked to UNFCC methodologies and tools) until 2013. National land-use and vegetation maps exist at a scale maps of 1:250,000. (Comisión Nacional Forestal (CONAFOR) 2010a)	Harmonization of agricultural development and climate change mitigation objectives in common land use planning procedures is considered key in achieving long term AFOLU emission reductions. Cross sector institutional engagement, the level of development and implementation are unknown.	-4 -3 -2 -1 **0**
	Total	**1.6**
	corresponds to	**E**

Non-Energy

Table 33
Policies and measures on non-energy related emissions from AFOLU

Policies / measures	Rational for evaluation	Score
Farming practices to reduce N_2O emissions from agriculture PECC 2009 (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b): (M.59,60) To develop and publish a manual of good practices for the use of fertilizers in 2008-2012. Objective 2.3.1 is the reconversion of low productive and degraded agricultural land. The action lines will be guided by the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), Ministry of Helth (SSA, and the Federal Government Forest Policy (CONAFOR) in diversification, agro-forestry and agro-silvipastoral programmes. INIFAP (Instituto Nacional de Investigaciones Forestales, Agricolar y Pecaurias) will conduct research on adaption to droughts under this objective. Expected results are 0.50 $MtCO_2e$ (2008-2012), 0.16 $MtCO_2e$ (in 2012) from reconversion of 298,200 hectare degraded land to perennials and diversified vegetation. Up to 125.000 hectare of maize shall be reconverted to productive forest under the ProArbol programme. This would lead to 0.23 $MtCO_2e$ (2008-2012), 0.11 $MtCO_2e$/ annual (in 2012). Objective 2.3.2. is to assist green harvesting of sugar cane on 188,000 ha of industrial sugar cane plantations (2008-2012). This will lead to annual reductions to 2012 of 0.43 $MtCO_2e$ (2008-2012), 0.14 $MtCO_2e$. Objective 2.3.3 aims at reducing N_2O emissions from fertilisers. SAGARPA will promote good agricultural practices to achieve this. SAGARPA-SA-INIFAP-FIRCO (Shared Risk Trust) will establish schemes to promote bio-fertilisers and –pesticides to improve productivity and reduce production costs. Bio-fertilisers and –pesticides applied to 2 million hectares (saving 15 % of fertiliser) would lead to 0.29 $MtCO_2e$ (2008-2012), 0.12 $MtCO_2e$ (in 2012). Objective 2.3.4 aims at increasing sustainable agricultural practices such as increasing carbon stocks. SAGARPA supports technology investments to achieve this goal (5000 machines working 250,000 hectares). SEMARNAT-CONAFOR-SAGARPA will realise practical conservation measures for soil conservation in forest and agricultural areas. SAGARPA will also engage in promotion activities of preventive sustainable soil management practices and the reconversion of conventional maize fields to organic production (497,339 hectares). This would lead to 0.42 $MtCO_2e$ (2008-2012), 0.17 $MtCO_2e$/ annual (in 2012) (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b).	A comprehensive strategy exists, however ▸ activity planning and quantitative definition of aims only until 2012, ▸ gaps between state level implementation and federal objectives regarding institutional development and activity implementation are identified, ▸ barriers (e.g. funding, public acceptance) to the implementation of specific objectives (e.g. PES schemes) are identified.	**0** 1 2 3 4
Farming practices to reduce CH_4 emissions from agriculture Livestock sector: Capture and use of methane from livestock farms, through the establishment of biogas digesters.	Implementation activities, status and results unknown.	**0** 1 2 3 4
Farming practices to reduce CO_2 emissions from agriculture Agricultural sector: Land conservation and productive reconversion; green harvesting of sugar cane to promote renewable energy use and development, rehabilitation and conservation of land grazing. Objective 2.3.5 aims at regeneration or improvement of vegetation – rehabilitation - cover in pasture lands. A planting target per animal unit is defined and Progamme shall support the activity. (30 plants per animal unit, overall estimated 353,000,000 plants leading to 0.09 $MtCO_2e$ (2008-2012), 0.07 $MtCO_2e$/annual (in 2012). Application of grazing plans on 5,000,000 hectare starting in 2009 (2.05 $MtCO_2e$ (2008-2012), 0.84 $MtCO_2e$/annual (in 2012).	A strategy exists, implementation activities, status and results unknown.	**0** 1 2 3 4

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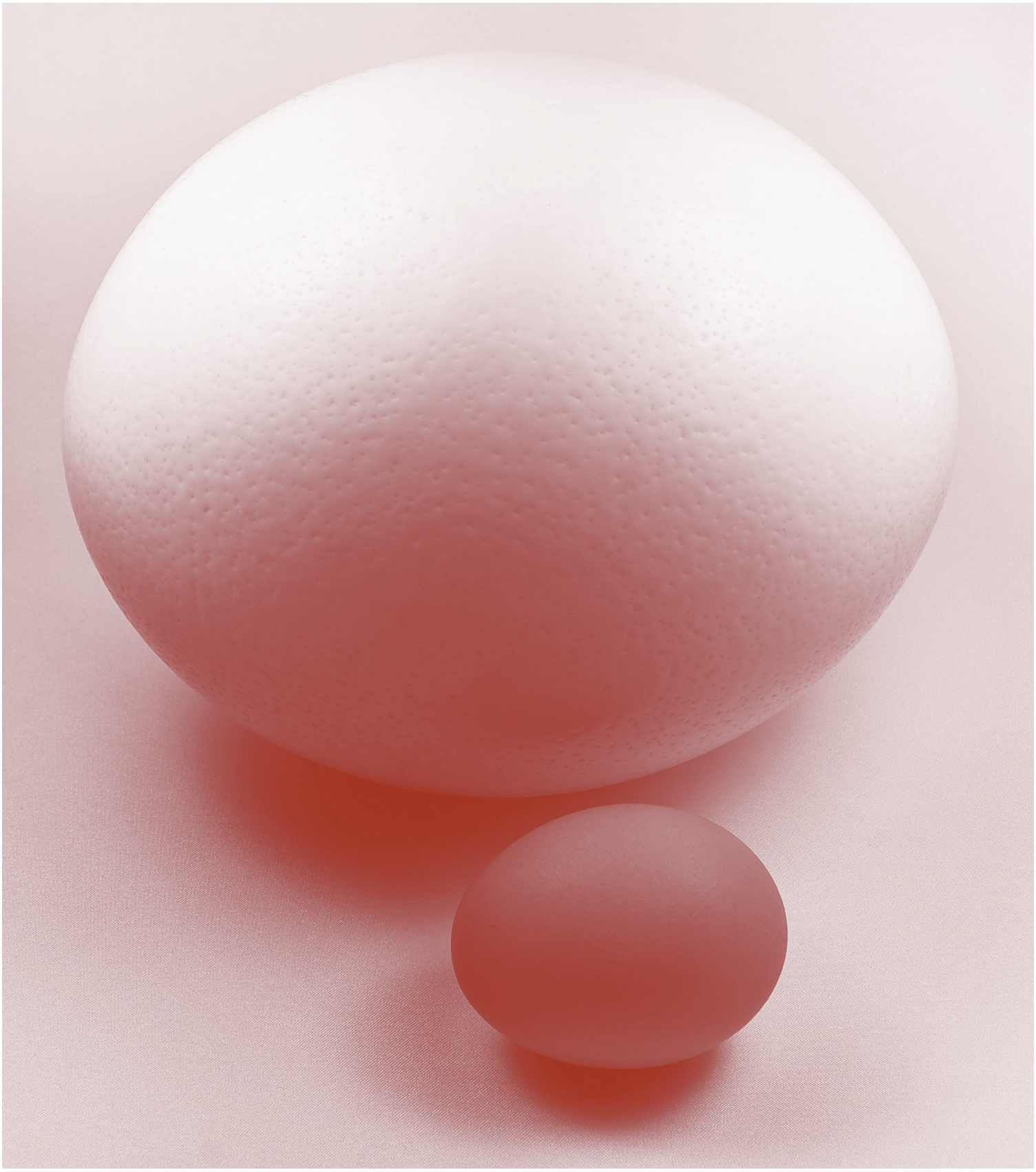
Policies / measures	Rational for evaluation	Score
Afforestation and reforestation (A/R) The National Forestry Commission (CONAFOR) intends to mitigate 38.9 Mt CO_2e from 2009 to 2012 and 12.54 Mt CO_2e annually by 2012, mainly through its ProÁrbol program. The National Climate Change Strategy (ENACC) defines the following forestry related actions and targets (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2007): ▸ Reforestation of 1.71 million hectares by 2012 and 3.9 million hectares by 2020 ▸ Extension of commercial forestry plantations by 0.6 million hectares by 2012 and by 1.4 million hectares by 2020 ▸ Restoration and reforestation of 0.69 hectares of degraded soil by 2012. The Special Climate Change Program (PECC) from 2008 does not defined medium or long term targets at this level of detail.	Most of the mitigation potential of afforestation and reforestation by 2030 will be achieved through already existing programs and activities. Long-term mitigation goals of existing programs and activities are not available, existing programs have short time horizons. Information on the expansion of reforestation and afforestation activities beyond existing programs and activities (that are already reflected in the very positive BAU development) is not available.	**0** 1 2 3 4
Reducing emissions from deforestation and degradation (REDD) A national REDD+ strategy is in initial stages of development. The goal for REDD+ is to achieve zero emissions from forest land-use change by 2020 and to significantly reduce forest degradation (Comisión Nacional Forestal (CONAFOR) 2010b). Achievements to date include the elaboration of the REDD Readiness Preparation Proposal (R-PP) which is expected to be implemented by 2012 (Comisión Nacional Forestal (CONAFOR) 2010a). Several REDD+ related activities are being undertaken at local, state and regional level and are expected to provide lessons learned for the implementation of REDD+ (The REDD desk 2011). Forestry related programs have been implemented in the country for many years and significant national resources, as well as multilateral and bilateral funding, are used to implement activities related to the development of the National REDD+ Strategy (The REDD desk 2011). In 2001, the ProArbol program was implemented to promote sustainable forest management practices, reduce deforestation and restore forest ecosystems. In 2003, a payments for environmental services (PES) scheme was implemented to provide financial incentives to prevent deforestation in high priority areas. Experience gained from the ProArbol program's benefit sharing mechanism will help in the design of inter-sectoral strategies that allow for the development of institutional arrangements and governance structures needed for the implementation of REDD+ instruments (The REDD desk 2011). In 2008, agricultural policies were restructured to enhance their sustainability (The REDD desk 2011); steps in this direction are important since agriculture is the most important driver of deforestation in Mexico.	The National REDD+ Strategy can be build on and/or extend a range of existing forest sector policies, policy instruments and programmes. However, since the REDD+ strategy still needs to be implemented, it is too early to predict to what extent the zero emissions goal can be achieved.	0 1 **2** 3 4
	Total	**0.4**
	corresponds to	**G**

ANNEX II | COMPARISON WITH EMISSION SCENARIOS FROM DIFFERENT SOURCES



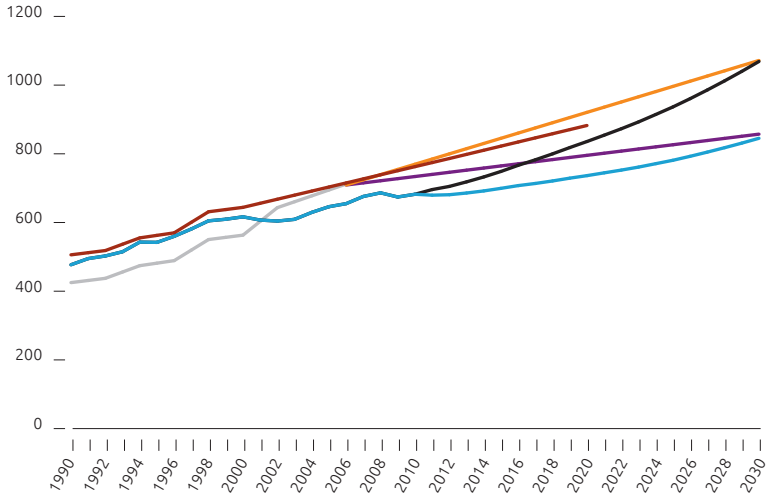
II Comparison with emission scenarios from different sources

In Figure 27 we compare resulting emission pathways from the Climate Action Tracker with national Mexican scenarios. In Figure 28 we show a similar comparison for energy consumption scenarios.

National Mexican emission scenarios show growth rates comparable to the CAT policy scenario. From 1998 to 2009 the CAT scenario is lower than official data (SEMARNAT), with higher growth rates post 2010. The difference between CAT and SEMARNAT data is about 54 $MtCO_2e$ in 2006. Most of this difference can be accounted to emissions from energy use and reflects the use of different efficiencies of power plants. Furthermore, there are some smaller differences in process emissions.

The CAT energy scenario is also slightly below national data. As final energy use data is taken from national sources, the difference must result from the power plant efficiency. There are no official numbers on this available for the general public.

Figure 27
BAU emission scenarios to 2030 from this analysis compared to pathways from other sources

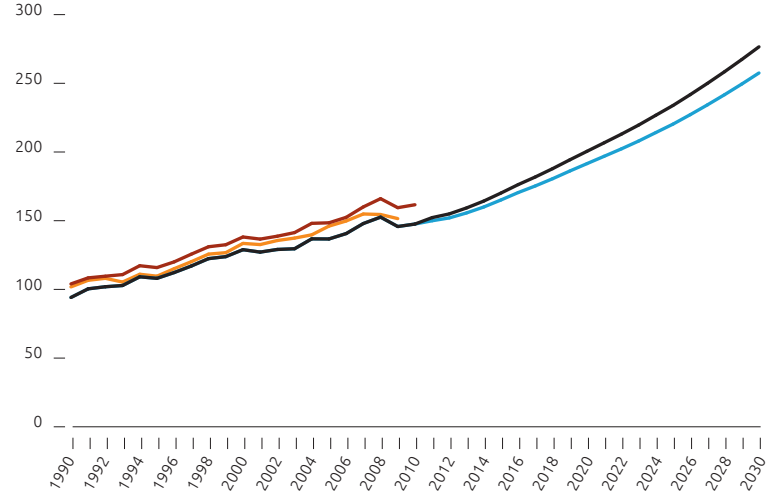


Source:
own calculations based on Secretaría de Energía (SENER) 2011b, International Energy Agency (IEA) 2011a, IPCC 2006, Instituto Mexicano del Petroleo 2006, UNFCCC 2012a, Usepa 2006, SENER (2010) projections; UNFCCC 2012a, Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009b, Comisión Intersecretarial de Cambio Climático 2009a[14]

* Data before 2002 excluding

[14] 4th National Communication Mexico, values for 2006 and 2030, other extrapolated LULUCF

Figure 28
BAU energy demand scenarios to 2030 from this analysis compared to pathways from other sources



Source:
International Energy Agency (IEA) 2011a, Secretaría de Energía (SENER) 2011b

ANNEX III | UNCERTAINTY ANALYSIS

III Uncertainty analysis

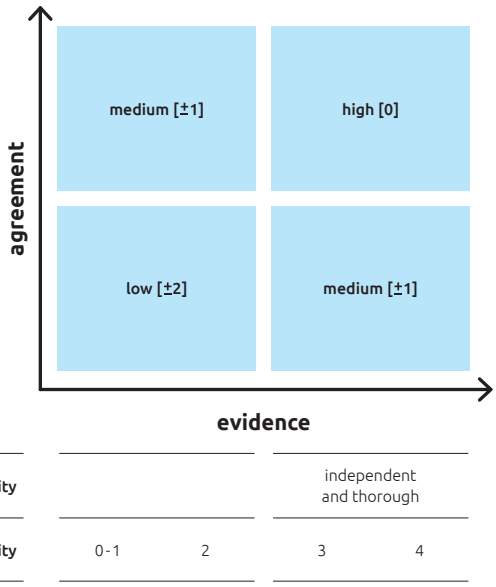
The analysis includes an indication of the confidence that we have in the evaluation of the relative stringency of the policies per sector and area. It also includes an indication of the uncertainty of the resulting emissions and the GHG impact of the policies.

In the uncertainty analysis, we vary the inputs relevant for the impact of policies. Those are especially the assessment indicators for all incentives and barriers and the maximum impact factors in each segment.

We set the range of possible values for the maximum impact factors to +- 20 % as default. Where this does not apply due to the nature of the factor, we adapt the range manually. The policy evaluator of each sector experts inserts the range of confidence of the assessment indicators when doing the evaluation in the policy input worksheet.

The matrix below guides the policy evaluator in his or her uncertainty judgement. The uncertainty levels are expressed by the confidence of a finding (thus a high confidence is equal to zero uncertainty, medium confidence has an uncertainty of one and low confidence leads to a deviation of two).

Figure 29
Guiding matrix for uncertainty assessment for policy evaluators



Quality			independent and thorough	
Quantity	0 - 1	2	3	4

Source:
own illustration based on IPCC 2010

In the best case (high confidence) the evidence found should be sourced from an independent institution (NGO, independent research institute, non-government etc.) and at least four different sources support this finding (high agreement = e.g. all sources had the same conclusion).

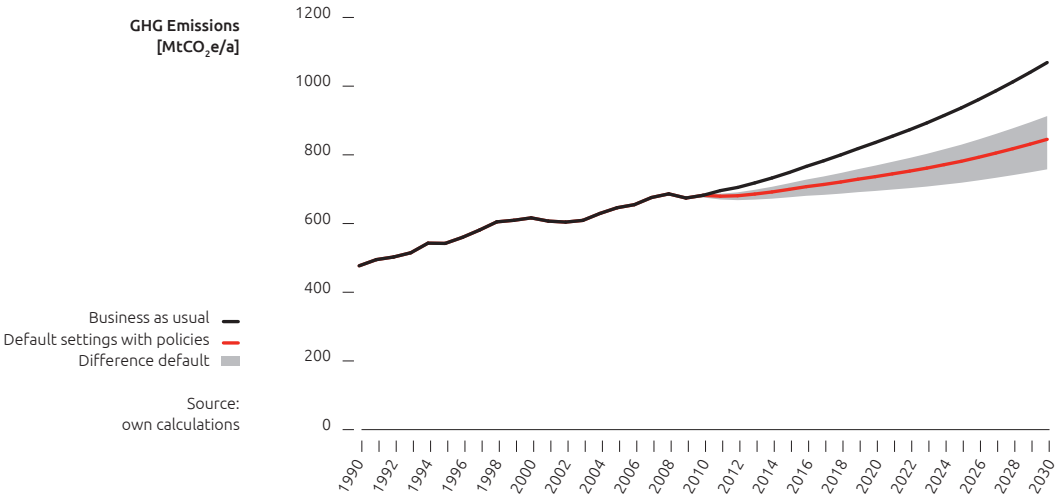
If the assessment of the policy is at one end of the extreme (0, 4 or -4), the range of the input can only extend towards one direction, because these limits cannot be passed. In this case, the indicator is excluded from the analysis.

The tool randomly chooses a combination of inputs and does the calculations. This process is then repeated. The user can vary the number of repetitions in the tool; for the results below, 1000 runs were made.

In the following figure, the projected emissions of our scenario including all implemented policies are shown with a 99 % confidence interval.

The results from the uncertainty analysis are within a range of +4 % and -6 % of the results with default settings. The fact that the positive deviation is slightly smaller than the negative leads to the conclusion, that the policy assessment was rather conservative in terms of the achieved emission reductions.

Figure 30
Uncertainty range for the policy scenario with 99 % confidence



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This “Climate Action Tracker” is an independent science-based assessment, which tracks the emission commitments and actions of countries. The report provides an assessment of individual national pledges to reduce their greenhouse gas emissions.

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