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OECD Environmental Performance Reviews: Mexico 2013

BETTER POLICIES FOR BETTER LIVES

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Preface

Rapid urbanisation, population growth and rising incomes are generating a range of pressures on Mexico's rich natural asset base, and compromising the environmental well-being of its citizens. In recent years the Mexican government has taken important steps to address these challenges. Environmental policies and institutions have been strengthened and investment in infrastructure has helped improve people's health by providing better access to water services. Mexico has also shown impressive leadership in international environmental co-operation, particularly climate change. Nevertheless, much remains to be done.

This Environmental Performance Review of Mexico *comes at an important time. This report provides the incoming administration with an assessment of environmental progress over the last decade, an analysis of remaining challenges and a number of targeted recommendations. Two issues are examined in depth: climate change; and biodiversity and forests. Progress in strengthening environmental policies and institutions is also examined, as well as the steps taken to integrate economic and environmental policies in order to promote green growth.*

Although the costs of environmental degradation and natural resource depletion fell from an estimated 10% of GDP in 2000 to 7% in 2010, the toll is still very high. As an emerging-market economy, Mexico has to confront difficult trade-offs in pursuing its economic, social and environmental goals. The report suggests that there is considerable scope for rebalancing the policy mix and promoting the transition to socially inclusive green growth in a more effective, efficient and equitable manner. Its main recommendations include:

- *Gradually reduce subsidies to energy use, agriculture and fisheries that harm the environment, and replace them with targeted cash transfers to low-income households and small farmers.*
- *Introduce an excise tax on transport fuels and energy products that reflects the environmental costs associated with their use, while providing targeted cash transfers to those adversely affected.*
- *Further develop sustainable urban transport systems by scaling up investment in low-carbon mass transit and strengthening capacity for the development of integrated transport and urban planning policies.*
- *Take the necessary measures to implement the recently adopted General Law on Climate Change, and put in place a system to adjust the measures needed to achieve its targets on the basis of systematic, regular and independent assessments of progress.*
- *Strengthen analysis of the economic and social aspect of biodiversity to support implementation of more efficient and effective policies.*
- *Strengthen the capacity to absorb and adapt cleaner technology, particularly in small and medium-sized enterprises, as part of a broader effort to strengthen innovation capacity.*

The third Environmental Performance Review of Mexico *is the result of a rich and co-operative policy dialogue between the Mexican authorities and other members and observers of*

the OECD Working Party on Environmental Performance. *We are confident that this collaborative effort will be useful to advance the policy debate on how to tackle the shared environmental challenges faced by OECD members and their partners.*

Angel Gurría
OECD Secretary-General

Foreword

The principal aim of the OECD Environmental Performance Review programme is to help member and selected partner countries to improve their individual and collective performance in environmental management by:

- helping individual governments to assess progress in achieving their environmental goals;
- promoting continuous policy dialogue and peer learning;
- stimulating greater accountability from governments towards each other and the public opinion.

This report reviews the environmental performance of Mexico since the previous *OECD Environmental Performance Review* in 2003. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals, or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Mexico's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions, and demographic trends.

The OECD is indebted to the government of Mexico for its co-operation in providing information, for the organisation of the review mission to Mexico City and Guadalajara (20-29 November 2011), and for facilitating contacts both inside and outside government institutions.

Thanks are also due to all those who helped in the course of this review, to the representatives of member countries participating in the *OECD Working Party on Environmental Performance,* and especially to the examining countries: Canada, Chile and the United Kingdom. A representative of Colombia participated in the review mission as an observer.

The team that prepared this review comprised experts from reviewing countries: Ms. Helena Olivas-Bosquet (Canada), Mr. Daniel Felipe Alvarez Latorre (Chile) and Ms. Paula Orr (United Kingdom); members of the OECD Secretariat: Ms. Ivana Capozza, Mr. Brendan Gillespie, Ms. Katia Karousakis, Mr. Reo Kawamura and Ms. Frédérique Zegel; and Mr. Roberto Martin-Hurtado (consultant). Ms. Carla Bertuzzi and Mr. Shayne MacLachlan (OECD Secretariat), and Ms. Rebecca Brite (consultant) provided statistical and editorial support during the preparation of the report. Preparation of this report also benefitted from comments provided by several members of the OECD Secretariat.

The OECD Working Party on Environmental Performance discussed the draft *Environmental Performance Review of Mexico* at its meeting on 10 October 2012 in Paris, and approved the assessment and recommendations.

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General notes

Signs

The following signs are used in figures and tables:

.. : not available

– : nil or negligible

. : decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Israel, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: peso (MXN).

In 2011, USD 1.00 = MXN 12.39

Cut-off date

This report is based on information and data available up to September 2012.

Executive summary

Mexico is among the largest economies in the OECD. Over the last decade, it experienced average growth and recovered swiftly from the global downturn. However, the gap in living standards with the rest of the OECD widened, mainly because of Mexico's relatively low productivity. In 2010, per capita income was among the lowest in the OECD, and Mexico was the second most unequal country in the OECD in terms of income. Mexico has a rich natural asset base and production and consumption patterns are less energy- and material-intensive than in more developed economies, although this gap has narrowed. However, rapid urbanisation, population growth and rising income are generating a range of environmental pressures.

Mexico has taken important steps to address these challenges by strengthening its environmental policies and institutions and increasing public investment in environmentally related infrastructure. It has also shown impressive leadership internationally in areas of global importance such as climate change and water. Nevertheless, the costs of environmental degradation and natural resource depletion were estimated at 7% of GDP in 2010, down from 10% in 2000. Further efforts are needed to improve the efficiency and effectiveness of Mexico's environmental policies, to scale up successful initiatives, and to reinforce the integration of environmental concerns into economic and sectoral policies. In promoting the transition to inclusive green growth, Mexico should identify ways to balance economic, social and environmental objectives in a more efficient and effective way.

Strengthening environmental performance

Over the past decade, environmental sustainability has been given a higher profile in Mexico's policy agenda. This was reflected in additional budgetary resources, the strengthening of environmental institutions and regulatory frameworks, and the establishment of inter-ministerial co-ordination mechanisms. Despite these improvements, significant challenges remain. At the federal level, there is a need to more clearly distinguish the policy development and regulatory functions from the policy implementation functions of Mexico's main environmental institutions. Further efforts are needed to improve enforcement and compliance with environmental law, and public participation in environmental decision making. The capacity of subnational environmental institutions remains weak, and there are significant institutional obstacles to efficiency and co-ordination.

Over the last decade, air quality has generally improved, helped by air quality management programmes. However, air pollution is the major environmental concern of the population and imposes significant costs on the economy. Standards for ozone and particulates are

persistently exceeded and respiratory diseases remain among the major causes of child mortality. Mexico experiences moderate water stress, though the level of stress varies widely across water basins. About 15% of current abstractions are from non-sustainable sources and water use efficiency remains very low. Mexico has made considerable progress in improving access to water services and decreasing mortality from water-related diseases. Investment in water infrastructure nearly tripled between 2000 and 2010, enabling Mexico to exceed the Millennium Development Goals on water and sanitation. However, substantial additional investment will be needed to bring the provision of environmental services up to the levels in other OECD countries.

Less progress has been made in waste management policies. Although waste per capita remains well below the OECD average, municipal waste generation increased faster than economic growth. Recovery only marginally improved. Mexico has the second-highest rate of landfilling among OECD countries. Despite an increasing share of controlled and sanitary landfills in total municipal waste treatment, compliance with environmental standards at landfills remains weak. On the positive side, capacity for hazardous waste treatment more than tripled.

Promoting the transition to a socially inclusive pattern of green growth

Mexico does not apply excise duties on energy products. Prices of transport fuels are regulated via a price-smoothing mechanism that results in an implicit subsidy at times of high world oil prices. Energy subsidies, including those for electricity consumption in the agricultural and residential sectors, averaged about 1.7% of GDP per year over 2005-09. Similarly, the tax treatment of motor vehicles encourages vehicle ownership and use. Extending the use of environmentally related taxes, and reforming environmentally harmful subsidies, could help generate revenues needed to implement Mexico's main policy priorities while reducing environmental pressures.

Many subsidies have long been in place to address social concerns. Mexico's poverty rate is the highest in the OECD, and is particularly high among indigenous people. However, most of these subsidies have not supported low-income households and farmers in an efficient manner, as they tend to benefit the wealthiest population groups. Mexico spends more on regressive, environmentally harmful energy and agricultural subsidies than on direct social transfers. Such transfers would be a more effective mechanism for relieving poverty and for reducing inequalities. Programmes such as the one to replace electricity subsidies for pumping irrigation water, with direct cash transfers illustrate the way forward and should be scaled up.

The federal budget continues to be the main source of funding for public environmental expenditure. Subnational governments have made limited use of their taxing power due to weak enforcement capacity and political disincentives. Failure to charge for water and waste at levels that cover the cost of service provision also undermines efforts to finance investment in much-needed green infrastructure. The private sector has played a limited role in the water sector, not always improving the efficiency, or reducing the cost, of service provision. Weaknesses in local waste management have allowed the informal sector to play an important role in provision of waste services, with negative consequences for both the quality of service and the living and health standards of the workers. Governance in the

water and waste management sectors needs to be strengthened in parallel with increased financing.

The need to boost the productivity and competitiveness of the economy through innovation has been recognised in Mexico for some time. However, the overall framework for innovation has not been effective, and Mexico has fallen short of its objectives. It has the least R&D-intensive economy in the OECD and one of the lowest private sector shares in gross expenditure on R&D. Innovation outcomes have been weak, though there have been somewhat higher levels of patenting activity for some environmental technologies and renewable energies. A widespread preference for imported technology has hindered technology diffusion and transfer to Mexican firms, particularly small and medium-sized enterprises.

Climate change

In 2008, Mexico had the world's 13th-highest GHG emissions (excluding land use, land-use change and forestry) and the country is highly exposed to climate change risk. Mexico has assigned a high political priority to tackling climate change. Since 2005, it has substantially strengthened the institutional framework, increased the resource allocation and promoted greater public awareness of climate change. The Inter-Ministerial Commission on Climate Change has developed a National Strategy (2007) and a Special Programme on Climate Change (PECC) (2009-12). By June 2012, nearly 95% of the PECC mitigation target and three-quarters of its general adaptation goals had been achieved. These efforts were consolidated by the adoption in June 2012 of the General Law on Climate Change. It confirmed Mexico's aspirational targets of reducing greenhouse gas (GHG) emissions to 30% below a business-as-usual scenario by 2020 and 50% by 2050 from the 2000 level, conditional on international financial support.

Despite these important initiatives, reducing GHG emissions is a major challenge. After a period of reduction in the 1990s, the carbon intensity of the economy increased between 2000 and 2010. Mexico has one of the lowest levels of CO_2 emissions per capita in the OECD. However, without additional policy measures, total GHG emissions could increase by 70% by 2050, compared to the 2000 level.

Mexico is among the few OECD countries not to have decoupled total primary energy supply from economic growth over the past decade. Various opportunities exist to improve energy efficiency at little or no cost, though they are weakened by the continued subsidy of energy. On the production side, there is significant potential for operational and energy-efficiency improvements in the energy industry. In end-use sectors, Mexico's Minimum Energy Performance Standards have been the country's most effective instrument for energy saving but more emphasis should be given to improving the energy efficiency of buildings.

Hydropower is the largest source of renewable electricity followed by geothermal energy. Since 2008, Mexico has adopted a law and programmes to promote renewable energy sources which have resulted in a significant increase in wind power capacity. In 2010, the country achieved the largest absolute increase in renewable energy investment in Latin America. However, much potential remains to be tapped, and the share of renewables in electricity production declined from 20% in 2000 to 18% in 2010. Fostering deployment of

renewables will require a better integration of environmental and social externalities in the cost of electricity.

The transport sector is the largest and the fastest growing energy consumer. Between 2000 and 2010, the rate of motorisation nearly doubled, driven by increases in income, a large supply of inexpensive used vehicles, the lack of fuel pricing incentives, urban sprawl and the lack of alternative transport modes. Programmes to promote sustainable urban transport have been successfully implemented in several big cities. However, they would need to be significantly scaled up to have an impact on car use. A package of measures should be adopted to reduce emissions from vehicle use, in conjunction with a gradual increase in fuel prices to reflect environmental costs. The government should address the social impact of rising fuel prices by introducing compensatory measures not linked to energy consumption.

Biodiversity and forests

Mexico is one of the most important countries globally in terms of biological diversity: it is home to 10-12% of the world's biodiversity. Forests cover one-third of the land area and provide a home for 11 million people living in extreme poverty. Between 1976 and 2007, the area covered by tropical forests declined by 10%, though the rate of deforestation has been significantly reduced over the last decade, particularly for primary forest. The conversion of natural ecosystems to crop and livestock production continues to be the main driver of deforestation and land use change. Around two-thirds of forests are fragmented, reducing quality and quantity of wildlife habitat. More than 2 600 species are listed under different categories of threat, and the share of known mammal and bird species threatened is high compared to levels in other OECD countries.

Over the last decade, Mexico has developed a number of strategies and programmes that, together with a strong set of institutions, provide a good basis for conservation and sustainable use of forests and biodiversity. Policy development and implementation have been supported by increased budget allocations and more comprehensive monitoring and reporting frameworks. The information base would be further strengthened by deepening the analysis of the economic aspects of biodiversity.

Mexico has a wide set of policy instruments to promote the conservation and sustainable use of biodiversity and forests. It is largely dominated by subsidies, many of which also aim to improve conditions of local and indigenous communities living in forests. Federal protected areas have increased significantly over the last decade and reached 12.9% of the territory in 2010. Further efforts will be needed to achieve the goal of 16% in 2020 and assure effective management of protected areas. The adoption of the National Ecological Land Use Plan in 2012, is an important step for the conservation and sustainable use of ecosystems.

Mexico has pioneered several economic instruments for the conservation and sustainable use of biodiversity including: one of the largest programmes of payment for ecosystem services in the world, covering 3.25 million ha of forests; a form of biodiversity offsets for projects involving deforestation; reforestation programmes; controls on illegal hunting of wildlife; and fishery buybacks for more sustainable fisheries management. These instruments have delivered mixed results. Their design should be reviewed with the aim of

enhancing their cost-effectiveness and achieving social and environmental objectives more efficiently.

A few voluntary approaches have been put in place, such as green certification of coffee production; about 10% of all coffee producers in Mexico participate in this agreement. While progress has been made in timber certification, efforts to promote sustainable approaches to tourism must be increased. More generally, opportunities exist to further engage the private sector in conservation and sustainable use of forests and biodiversity.

Conservation and sustainable use of biodiversity also require reform of policies in other sectors that exert significant pressures on ecosystems and biological resources, such as agriculture, tourism, fisheries and energy. For example, a variety of support programmes for farmers contribute to deforestation and the intensification of agricultural production. While agricultural subsidies have been reduced, half of the agricultural support programmes are still made up of production-related measures, which are the most environmentally damaging. Further efforts should be made to increase the uptake of agri-environment payments to support more environment-friendly farming practices.

PART I

Progress towards sustainable development

PART I

Chapter 1

Key environmental trends

During the 2000s, Mexico experienced average economic growth, poverty and inequality were among the highest in the OECD, and environmental degradation imposed significant costs on the economy. This chapter provides a snapshot of some key environmental trends in Mexico over the last decade, in the context of the transition towards green growth and sustainable development. It briefly describes Mexico's progress in using energy and natural resources efficiently; in managing its natural asset base, including renewable and non-renewable natural resource stocks and biodiversity; and in improving its people's environmental quality of life.

1. Introduction

Mexico is among the largest economies in the OECD. It experienced average growth over the last decade, and recovered swiftly from the global downturn, mainly driven by exports to US. However, it did not catch up to average OECD living standards in the last decade, and its rates of inequality and poverty are among the highest in the OECD (Box 1.1). In this period, Mexico strengthened its environmental policies and recorded progress in the conservation of biodiversity and natural resources, as well as in water resource management. It also showed leadership regarding international co-operation in these and other areas, including climate change. However, rapid urbanisation, population growth and rising income are generating a range of environmental challenges.

This chapter provides a snapshot of key environmental trends in Mexico over the review period (since 2000). It highlights some of the main environmental achievements and remaining challenges on the path towards green growth and sustainable development. The chapter is based on indicators from national and international sources, and broadly follows the OECD framework for monitoring progress towards green growth (OECD, 2011a). Accordingly, it describes Mexico's progress in using energy and natural resources efficiently, in managing its natural asset base and in improving its people's environmental quality of life. It provides a baseline for subsequent chapters that assess how effective Mexican environmental policies have been in affecting these trends and in using environmental objectives to generate economic opportunities.

Box 1.1. **The economic and social context**

- GDP increased by 17% over 2000-10, with a sharp fall (-6.2%) in 2009 due to the global economic recession and a strong recovery (+5.4%) in 2010. GDP is expected to have grown by 4% in 2011, with the rate slowing to 3.3% in 2012 (OECD, 2011b) (Reference I.A).
- The gap in living standards between Mexico and the rest of the OECD has widened due to the country's low productivity. In 2010, GDP per capita (in purchasing power parities) was the second lowest in the OECD (Reference I.A). The size of the informal economy[1] is estimated at 30% of GDP (OECD, 2011c).
- Despite recent progress, Mexico has the second highest level of income inequality in the OECD. The average income of the richest 10% of the population is 26 times that of the poorest (the OECD average ratio is 9) (OECD, 2011d). The poverty rate is the highest in the OECD, with poverty being especially elevated among indigenous peoples (Reference I.B).
- In 2010, industry[2] accounted for 34% of value added (including 8% from oil), well above the OECD average of 27%. Services accounted for 62% of value added and agriculture 3.6% (Reference I.A). Agriculture still employs 13% of the population, high by OECD standards.
- INEGI, the national statistics agency, estimates that costs of environmental degradation and natural resource depletion represented 7% of GDP in 2010, down from 10% in 2000 (Chapter 3).

Box 1.1. **The economic and social context** *(cont.)*

- International trade plays an important role in the economy. In 2010, exports of goods and services contributed 30% to GDP and imports 32%, above the OECD averages. Manufacturing accounted for three-quarters of exports, followed by fuels and mining products (17%) and agricultural products (6%). Around 80% of exports go to the United States; around 50% of the manufacturing exports are produced by so-called maquiladoras.[3]
- Mexico has the lowest tax-to-GDP ratio in the OECD due to its narrow tax base, high tax expenditure, low tax enforcement and large informal economy (OECD, 2011c) (Chapter 3). In 2010, tax revenue, of which about one-third was related to oil production, amounted to 18% of GDP. Although almost all taxes are collected by the federal government, there has been increased decentralisation of public expenditure to subnational governments (OECD, 2009a).
- Revenue from environmentally related taxes (mostly on energy products and vehicles) has been negative since 2006, except in 2009. This is due to the unique structure of the fuel tax, which is levied inversely to oil prices and becomes an expenditure above a certain level. In 2011, such tax expenditure amounted to 1.2% of GDP (Chapter 3).
- Responding to the global economic crisis, Mexico implemented a fiscal stimulus package accounting for about 1.6% of 2009 GDP (OECD, 2009b). Environment-related measures were estimated at 10% of the recovery package (Chapter 3).
- Over the past decade, public finances have improved, aided by higher revenue from higher oil prices (OECD, 2009a). With the crisis, the budget deteriorated but the combined deficit of the federal government and public enterprises is expected to fall from 5% of GDP in 2009 to 2% in 2013[4] (OECD, 2011b).
- The unemployment rate has remained well below the OECD average. However, it jumped to 5.5% in 2009 and has fallen only slowly since then (Reference I.B). Informal employment is estimated to represent 50% of total non-agricultural employment (OECD, 2009c).
- Mexico's population was 112 million in 2010 (2010 census); 16 million people identify themselves as indigenous, including 7 million who speak an indigenous language. The population density is above the OECD average, with higher density in central states (Reference I.B).
- The population is projected to continue to grow at a relatively high but declining rate. The growing share of population living in cities is exerting increased pressures on the environment. Mexico's population is comparatively young: half was under the age of 26 in 2010. In 2009, life expectancy at birth was 75.3 years, four years less than the OECD average.
- While Mexico has invested a lot in education in recent years, only 35% of the population aged 25 to 64 has at least upper-secondary education, among the lowest rates in the OECD (Reference I.B).

1. The Schneider definition estimates all market-based legal production of goods and services that are deliberately concealed from public authorities to avoid payment of income taxes and social security contributions, respect of legal labour market standards and administrative procedures.
2. Mining and quarrying, manufacturing, production of electricity, gas and water and construction.
3. *Maquiladoras* or export assembly plants import their inputs mainly from abroad (primarily the United States), assemble the inputs into final outputs and re-export them to the United States.
4. This translates into a balanced budget, based on the government's definition of the deficit, which excludes the national oil company's investment but includes a number of pure financing operations.

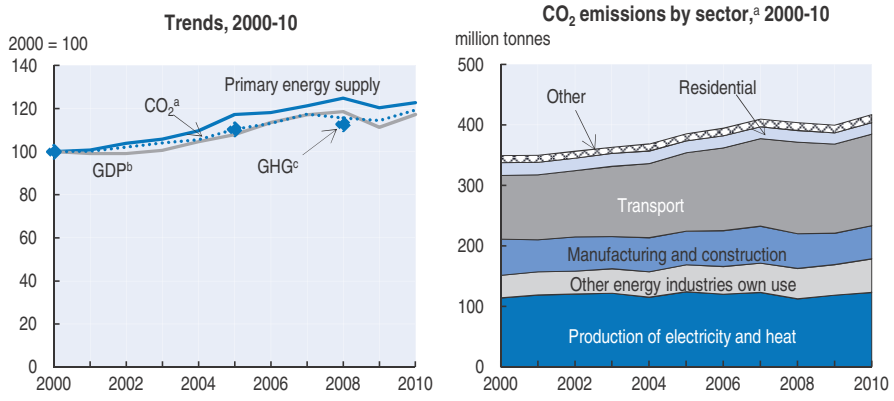
2. Transition to a low-carbon, energy- and resource-efficient economy

2.1. Carbon and energy intensities

Greenhouse gas emissions

- In 2008, Mexico contributed 1.3% of global greenhouse gas (GHG) emissions excluding land use, land-use change and forestry, the 13th-highest level in the world (IEA, 2011).
- According to IEA estimates, GHG emissions increased by 13% between 2000 and 2008 (Figure 1.1). In 2008, CO_2 was the dominant GHG (74%), followed by CH_4 (18%) and N_2O (7%). The remaining 1% was made up of HFCs and SF_6.
- Energy-related emissions accounted for 71% of total GHG emissions, and increased by 17% between 2000 and 2008. Population and economic growth and the related increased demand for transport have been the main drivers of CO_2 emissions. Fugitive emissions from production and transport of oil and gas were primarily responsible for the upward trend of CH_4 emissions (Figure 4.1; Chapter 4).
- In 2009, Mexico had the second lowest CO_2 emissions per capita in the OECD, reflecting its relatively lower income levels (Reference I.C). However, increased energy consumption has resulted in a narrowing of the gap with the OECD average for CO_2 intensity per unit of GDP.
- After a period of reduction in the 1990s, the carbon intensity of the economy increased between 2000 and 2010 (Figure 1.1). Demand-based CO_2 emissions[1] (including emissions embedded in imported products and excluding emissions embedded in exported products) increased faster than disposable income over 2000-05 (OECD, 2011a).

Figure 1.1. **CO_2 and GHG emissions**



a) CO_2 emissions from energy use only. Excludes international marine and aviation bunkers. Sectoral approach.
b) GDP at 2005 prices and purchasing power parities.
c) IEA estimates for 2000, 2005 and 2008. Excludes LULUCF other than forest and other vegetation fires.
Source: OECD (2011), *OECD Economic Outlook No. 90;* OECD-IEA (2012), *CO_2 Emissions from Fuel Combustion;* OECD-IEA (2012), *Energy Balances of OECD Countries.*

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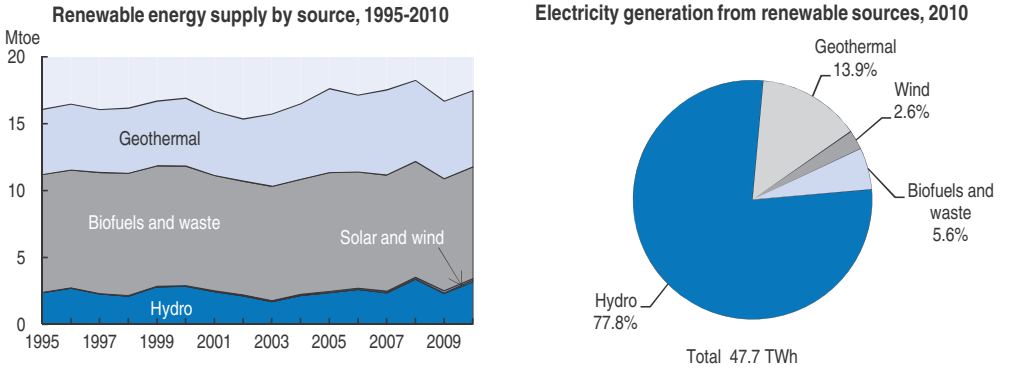
Energy intensity and renewables

- Mexico is among the few OECD countries that have not decoupled total primary energy supply (TPES) from economic growth over the past decade. TPES grew even faster than GDP over 2000-08. In comparison, total final energy (TFC) consumption changed in line with GDP. The difference in TPES and TFC trends is explained by the growing use of

energy for oil and gas extraction, oil refining and gas leakage. However, energy intensity remains below the OECD average (Figure 1.1; Reference I.A).

- Fossil fuels account for 89% of the energy supply, a share that is above the OECD average of 81%. Oil is dominant in the energy mix at 55%, but the proportion of natural gas grew from 20% in 2000 to 30% in 2010. Energy self-sufficiency is high compared to other OECD countries. However, forecasts suggest that Mexico will become a net oil importer by 2020 (Chapter 4; Reference I.A).
- The use of renewable energy increased only marginally over 2000-10. Biomass is the main type of primary renewable fuel (48%), while hydropower is the largest form of renewable electricity (78%), followed by geothermal energy (14%). Mexico is a world leader in geothermal power generation. Although wind power installed capacity increased from 2 MW in 2006 to 1012 MW in 2012, wind accounted for only 2.6% of renewable-based generation in 2010 (Figure 1.2).
- Over 2000-10, the transport sector was the fastest-growing consumer of energy (43%), followed by agriculture (24%). Energy consumption remained fairly stable in the residential, commercial and industrial sectors, though industrial energy consumption declined in 2009 with the economic slowdown (Chapter 4).
- Road vehicle stock has doubled in the last ten years. The rate of private car ownership rose from 10 vehicles per hundred inhabitants to 19 in 2010 (Reference I.A). More than half this increase is probably attributable to imports from the United States of cars that are more than ten years old (ITF, 2011).

Figure 1.2. **Renewable energy**



Source: OECD-IEA (2012), *Energy Balances of OECD Countries.*

StatLink http://dx.doi.org/10.1787/888932755547

2.2. *Resource efficiency*

Material productivity

- Mexico is among the OECD countries with the lowest material consumption (DMC)[2] per capita, reflecting the remaining gap in income level. However, it generates less economic wealth from each unit of material used than the OECD average (Reference I.C). The DMC is characterised by a relatively high proportion of biomass and a low share of fossil fuels.
- Between 2000 and 2008, domestic consumption of raw materials rose mainly due to increasing use of construction minerals, while consumption of fossil fuels and biomass

increased at a slower pace than GDP. Growing population and urbanisation, investments in infrastructure, and construction are the main drivers of this trend. As a result, total material productivity only slightly improved (+4%) over 2000-08 (Figure 1.3).

- Domestic extraction is the main source of material inputs to the economy. However, Mexico is a net importer of agricultural and forestry products as well as metals. Imports account for a growing share of fossil fuel consumption.

Waste generation and treatment

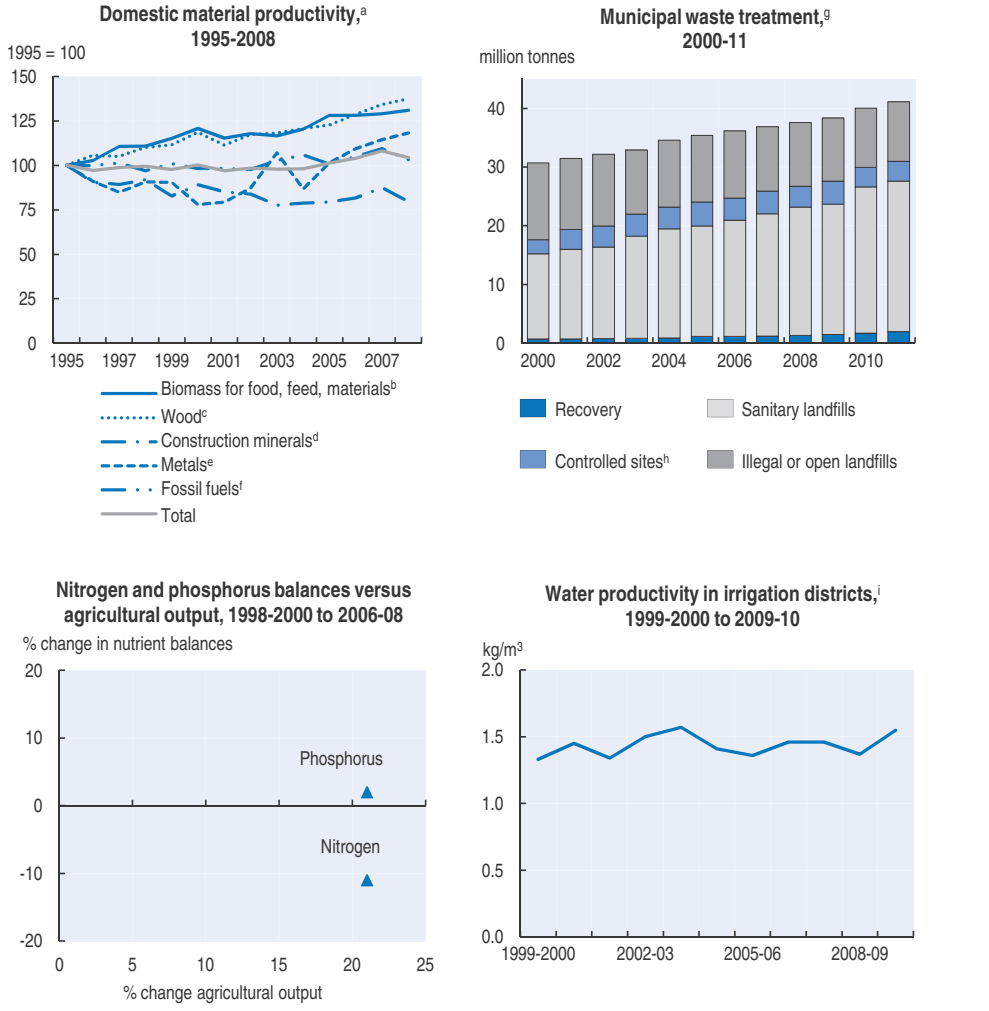
- Between 2000 and 2011, municipal waste generation increased by 34%, in line with private consumption and faster than economic growth. Over 2004-12, more than 1.9 million tonnes of hazardous waste was generated.[3]
- With 360 kg of municipal waste generated per capita in 2011, Mexico is well below the OECD average of 540 kg per capita, reflecting the remaining gap in income level (Reference I.C). Wide variations exist between the richest and poorest states and between urban and rural areas.
- Landfilling continues to be the predominant type of municipal waste treatment, accounting for 95% of total treatment, the second-highest rate among OECD countries. Limited municipal institutional capacity is a major obstacle to planning, implementing and operating efficient waste collection and management systems (Chapter 2). However, the share of controlled and sanitary landfills in total municipal waste treatment increased from 55% in 2000 to 72% in 2011 (Figure 1.3).
- As more than half of municipal waste collected is composed of organic material, there is a considerable potential for reducing GHG emissions from waste management. Methane capture and recovery from landfills was expected to contribute 4.4 million tonnes of CO_2 equivalent to the 2012 mitigation goal of the Special Programme on Climate Change (Chapter 4). By mid-2012, only 41% of the mitigation goal had been achieved (Table 4.1).
- Over the last decade, infrastructure for hazardous waste treatment has been developed and related capacity more than tripled to 17.6 million tonnes in 2011, exceeding the target set for 2012 in the programme for environment and natural resources.

Nutrient balance

- The volume of agricultural production rose by 21% between 2000 and 2010, with crop production increasing by 18% and livestock by 25%. Livestock manure is the largest contributor to nitrogen and phosphorus inputs.
- The use of phosphorus fertiliser has declined sharply, whereas nitrogen fertiliser use has increased. Mexico is among the main consumers of nitrogen fertiliser in Latin America (FAO, 2011). However, consumption per hectare is lower than the OECD average (Reference I.C).
- Nitrogen and phosphorus surpluses from agriculture remained well below OECD averages in the 2000s. The phosphorus surplus increased slightly until 2008 while the nitrogen surplus declined (Figure 1.3) (OECD, 2012).
- Farming is characterised by diverse structure and production systems. Large commercial arable farms, mostly in the north, are capital intensive and rely on irrigation and purchased inputs. There are also range-fed cattle and intensive pig and poultry

operations in the north. Subsistence farms, mainly in the centre and south, grow staples such as maize and beans. The southern tropical zone has plantations and subsistence producers of coffee, sugar cane and bananas (OECD, 2008).

Figure 1.3. **Resource productivity**



a) GDP per unit of domestic material consumption (DMC), where DMC is calculated as the sum of domestic (raw material) extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).
b) Domestic production from agriculture and fisheries, plus trade of raw and processed products from these sectors.
c) Domestic production from forestry, plus trade of raw and processed products from this sector.
d) Domestic extraction and trade of minerals used in construction (e.g. sand, gravel, stones).
e) Domestic extraction of metal ores, plus trade of metal ores (e.g. bauxite), metal concentrates (e.g. nickel matte), refined metals (e.g. steel, aluminium, copper), products mainly made of metals (e.g. vehicles, machinery, electronics and electrical equipment), and scrap.
f) Coal, crude oil, natural gas, peat and traded derived products (e.g. plastic and rubber).
g) Waste collected by or for municipalities, waste directly delivered and separate collection for recycling by the private sector. Includes household, bulky and commercial waste, and similar waste handled at the same facilities.
h) Intermediate type of treatment and control between sanitary and open landfills.
i) Productivity of the water used for food production; the indicator is affected by irrigation system efficiency and by the metereological conditions. Agricultural year: October-September.

Source: CONAGUA (2011), *Statistics on Water in Mexico*; OECD Environmental Data; OECD (2011), *Towards Green Growth: Monitoring Progress - OECD Indicators*; SEDESOL, 2011.

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3. Managing the natural asset base

3.1. Renewable stocks

Water resources

- Due to population growth, water availability per capita declined from 17 800 m^3 in 1950 to 4 100 m^3 in 2010. The central and northern regions, which contain 77% of the population, have only 31% of national water availability (Figure 1.4).
- On the whole, water stress is moderate, although the average intensity of water use is higher than in many OECD countries (Reference I.C). By basin, however, it varies from 1% of available resources in the Frontera Sur (Southern Border) basin to 133% in the Valley of Mexico basin (Figure 1.4).
- Agriculture accounts for 77% of water abstractions, industry 9% and public water systems 14%.
- To meet water demand, 11.5 billion m^3 is abstracted from non-sustainable sources (about 15% of total abstraction), including 6.5 billion m^3 from overexploited aquifers. It is estimated that abstraction from non-sustainable sources will double by 2030 in a business-as-usual scenario, or increase further to 36.3 billion m^3 if the projected impact of climate change is taken into account (CONAGUA, 2011a).
- Water-use efficiency remains very low. Between 2007 and 2011, Mexico modernised 1.03 million hectares under irrigation (out of a total of 6.5 million hectares), compared to the 2007-12 goal of 1.2 million hectares (SEMARNAT, 2012). However, subsidies for irrigation are not encouraging farmers' investments in more efficient water infrastructures (Chapter 3).
- In 2009, 21 river basins out of 1 471 were classified as heavily polluted according to at least one water quality indicator.[4] However, at the national level, the proportion of polluted monitoring sites has been reduced over the past decade. Beach water quality in tourist destinations has improved: nearly 99% of the samples complied with health quality criteria in 2009 (CONAGUA, 2011b).
- In 2011, 3.1 billion m^3 of municipal wastewater was treated, or 46.5% of collected wastewater, up from 36% in 2006. The 2012 projection is 55%, below the target of treating 60% of collected municipal wastewater. It is projected that by 2030 the sanitation gap will reach 4.3 billion m^3 (CONAGUA, 2011a).

Forest resources

- In 2010, forest covered 64.8 million hectares or 33% of the land area, of which 70% was *ejido* land owned by local communities (FAO, 2010).
- The net deforestation rate fell from 354 000 ha/year over 1990-2000 to 235 000 ha/year in 2000-05 and 155 000 ha/year in 2005-10. The overall rate of loss of primary forest was reduced from 187 279 ha/year in 2000-05 to 43 909 ha/year in 2005-10.
- Conversion of natural ecosystems to crop and livestock production continues to be the main driver of deforestation (Chapter 5).

Fish resources

- Mexico accounts for nearly 2% of world fish catches (Reference I.C). It is one of the major fishing countries in the OECD. Between 2000 and 2010, fishery production[5] grew by 20%. The share of aquaculture in fishery production increased from 4% to 8% (FAO, 2012).

- The Pacific Ocean provides more than three-quarters of the volume of Mexico's fish capture production and two-thirds of its value. The Gulf of Mexico, the Caribbean and inland waters account for the rest (INEGI, 2012).
- In 2010, overexploited fish stocks, mostly in the Gulf of Mexico and the Caribbean, represented nearly 4% of total captures. Brown shrimp, red snapper, lobster, rock cod and king mackerel were assessed as being exploited beyond their maximum sustainable yield in 2010 (Figure 1.4).

3.2. Non-renewable stocks

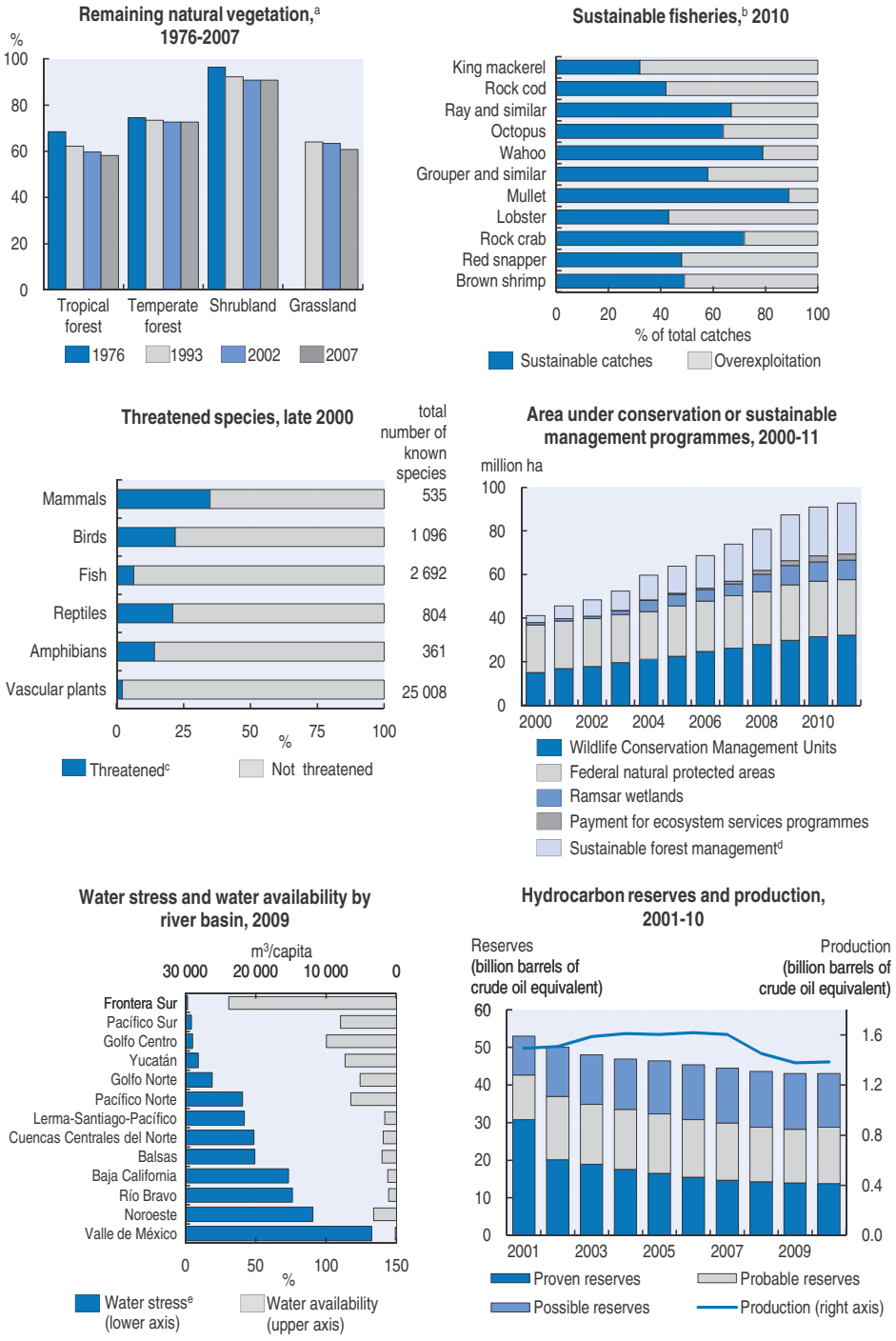
Hydrocarbon reserves

- In 2010, Mexico was the world's seventh largest oil producer and twelfth largest natural gas producer (PEMEX, 2011). At current rates of hydrocarbon production, the estimated life of proven reserves is 10 years and that of total reserves 30 years[6] (Figure 1.4).
- Declines in production and proven reserves reflect low efficiency, weak governance and under-investment (OECD, 2011c).
- Due to increasing demand, it is forecast that Mexico will become a net oil importer by 2020 (US-EIA, 2010). In 2010, Mexico was a net importer of gas and refined petroleum products.
- A government reform in 2008 allows PEMEX to pay subcontractors cash incentives to facilitate investment in the oil sector. In recent years, new discoveries have approached production levels.

3.3. Biodiversity and ecosystems

- With over 200 000 different species, Mexico is home to 10-12% of the world's biodiversity. It is one of several "mega-diverse" countries in the world (Chapter 5).
- Compared to levels in other OECD countries, the share of threatened species is relatively low for amphibians and vascular plants, average for reptiles, but high for mammals and birds.
- In 2007, 71% of the territory was under natural vegetation with the remaining area having been converted to agricultural, urban and other uses (Figure 1.4). Soil degradation is a major threat to ecosystems and agriculture is identified as its major cause (OECD, 2008). The main factors in agriculture-related soil degradation are overgrazing, excess irrigation, tillage burning, excessive tilling and inadequate adoption of soil conservation practices.
- Marine and terrestrial federal protected areas covered 25.4 million hectares or 13% of the national territory in 2010 (Chapter 5). Overall, the area under conservation or sustainable management has significantly increased over the past decade (Figure 1.4).

Figure 1.4. **Natural asset base**



a) As percentage of original natural vegetation area for each vegetation type.
b) Data refer to captures of 14 species, exploited beyond their maximum sustainable yields, expressed as percentage of total captures.
c) IUCN categories "critically endangered", "endangered" and "vulnerable" in percentage of known species. Fish: includes marine species.
d) Including PROCYMAF (improvement of forest ecosystem productivity) and PRODEFOR (forest development) programmes.
e) Volumes of water granted in concession as percentage of renewable water resources.
Source: OECD Environmental Data; CONAGUA (2011), *Statistics on Water in Mexico*; INEGI (2012), *Systema de cuentas nationales de México: Cuentas económicas y ecológicas de México, 2006-2010;* PEMEX (2011), *Statistical Yearbook 2011;* SEMARNAT (2012), *Sistema Nacional de Indicadores Ambientales*; SENER (2012), *Quinto Informe de Labores.*

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4. Improving the environmental quality of life

Air quality

- The second and latest national air emission inventory dates back to 2005.[7] Between 1999 and 2005, only CO emissions showed an absolute decoupling from GDP growth. Emissions of SO_2, PM_{10} and $PM_{2.5}$ grew by 9%, 2% and 3%, respectively, demonstrating a relative decoupling. Emissions of NMVOCs and NO_2 increased faster than economic growth, by 99% and 95%, respectively.
- Over the last decade, air quality has generally improved: the number of days exceeding environmental standards in major cities has decreased (Figure 1.5), helped by implementation of the ProAire programme to improve air quality in urban areas (Chapter 2).
- In 2009, the nine cities for which data were available were in compliance with SO_2, NO_2 and CO standards (INE, 2011). Major factors in this progress include limitation of the sulphur content of fuels, vehicle verification programmes,[8] fuel switching in power plants and the use of more advanced technologies (e.g. desulphurisation) in refineries. However, air quality standards are less stringent than international standards and above WHO recommendations.
- Pollution by ozone and particulate matter remains the major challenge. Despite reduction of PM_{10} concentrations in Monterrey and Guadalajara, and a decrease of ozone concentrations in the Valley of Mexico, standards for these pollutants were persistently exceeded in most monitored cities (Figure 1.5).
- In 2009, residents of Monterrey and Juarez were exposed, on average, to higher PM_{10} concentrations than the inhabitants of the seven other cities where such measures were available.[9] Inhabitants of the Valley of Mexico were exposed to higher ozone concentrations than any other city (Figure 1.5).
- In 2010, air pollution accounted for 57% of costs of depletion of natural resources and environmental degradation, representing about 4% of GDP, down from 8% of GDP in 2000 (INEGI, 2012).
- Mexico phased out its consumption of chlorofluorocarbons and halons in 2007, achieving the targets set by the Montreal Protocol three years in advance. In addition, consumption of methyl bromide has been reduced by 53% from the 1995-98 average baseline.

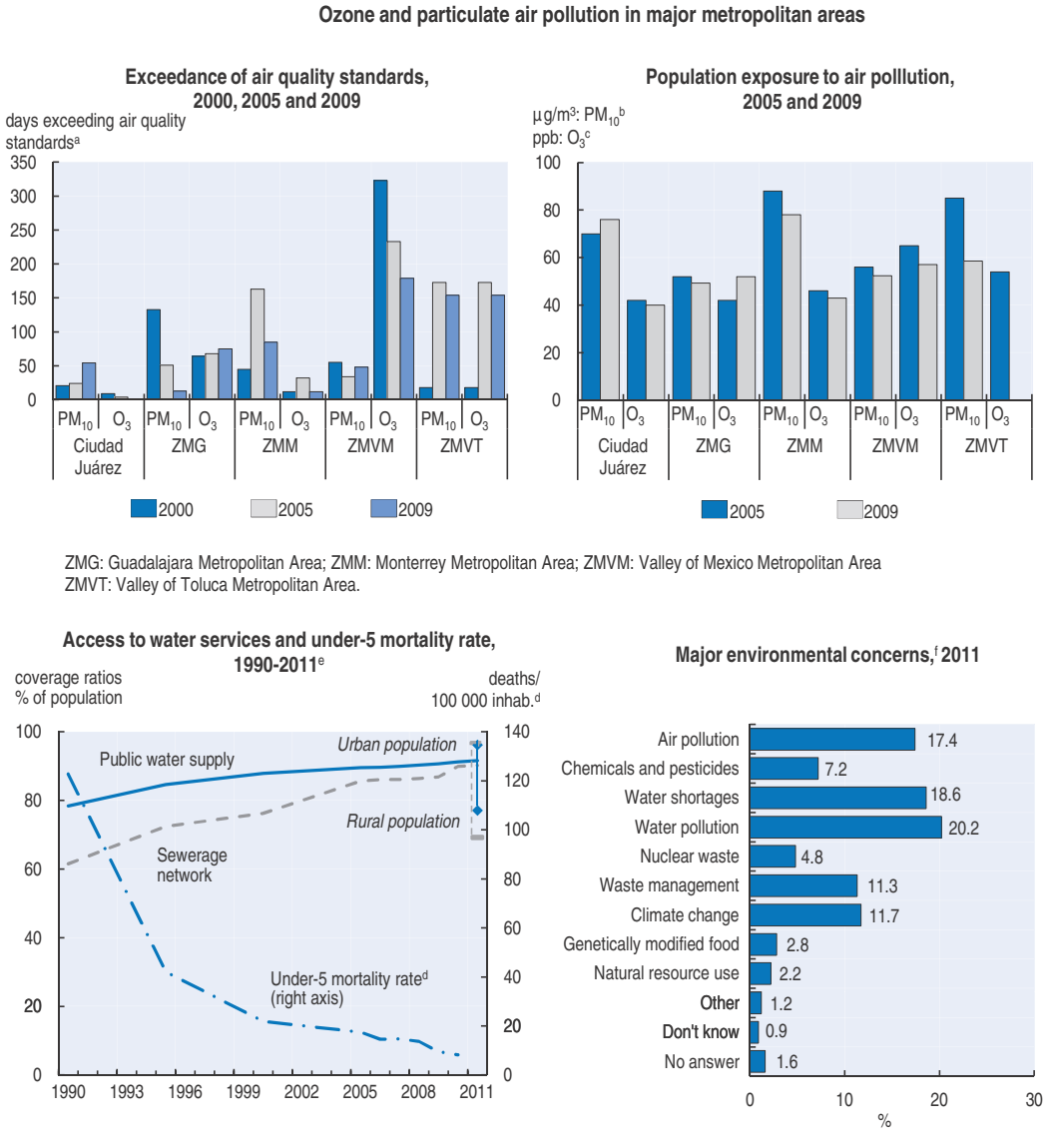
Water supply and sanitation

- Massive investment helped increase the share of the population with access to drinking water from 87.9% in 2000 to 91.6% in 2011, while sanitation coverage improved from 76.2% to 90.2% (Figure 1.5). Mexico exceeded the Millennium Development Goals on water and sanitation and has set more ambitious objectives for 2015. Despite this progress, Mexico still has the lowest rate of connection to public wastewater treatment plants in the OECD (Reference I.C). The rural population still has much lower access than urban dwellers. Expanding coverage rates requires significant additional funding in view of the growing population (Chapter 3).

Health effects

- Improved access to drinking water and sanitation as well as progress in reducing air pollution had positive health effects. Between 2000 and 2010, the under-5 child mortality rate due to diarrhoea was reduced by more than 60%, while the same indicator for respiratory disease was halved (Figure 1.5). However, infant mortality remains three times the OECD average, and respiratory and intestinal diseases are still among the major causes of child mortality.
- In 2012, 580 sites were recorded as being contaminated with hazardous substances.[10] The inventory of contaminated sites has been completed in 32 states, covering the entire population. Significant progress[11] has been achieved in remediating sites posing serious risks to human health.
- High levels of toxic contaminants (e.g. heavy metals, pesticides) have been found in soil, water and plant and animal species in some specific locations, and adverse effects on human health, especially in children, have been identified (INE-CINVESTAV, 2009; INE-UABC, 2009; Rubio-Andrade et al., 2011).
- Mexico is among the most vulnerable countries to the impact of climate change: 15% of the territory, 68% of the population and 71% of GDP are highly exposed to direct adverse effects of climate change (Chapter 4).
- The number of people whose lives will be affected by severe hydro-meteorological events is projected to increase from 0.8 million in 2011 to 1.8 million in 2030. In 2010, 194 municipalities were affected by hurricanes,[12] suffering economic losses equivalent to 0.7% of GDP. In 2011, Mexico faced the most severe drought ever recorded in the country, affecting indigenous people in northern states most acutely.
- For the Mexican population, environment (5%) ranks below public security (29%), education (26%), health (23%), economy (7%) and poverty (7%) among the most important issues facing the country (IMO, 2011). Within the environmental domain, air pollution is considered to be the biggest problem, but as regards family issues, people are more concerned by water pollution and water shortages. One-third of the population is very unwilling to pay higher prices or taxes to protect the environment.

Figure 1.5. **Environmental quality of life**



a) PM_{10}: 120 µg/m³ (max. daily mean value for the 98 percentile); O_3: 110 ppb (max. hourly value, equivalent to 216 µg/m³).
b) Population-weighted yearly average of daily mean concentrations of PM_{10} in metropolitan areas.
c) Population-weighted yearly average of daily 8-hour mean ozone concentrations in metropolitan areas.
d) Number of deaths of children under age 5 due to diarrhoeal disease per 100 000 children under-5.
e) 2011: preliminary data.
f) Results of a national opinion poll carried out between August and September 2011 reporting respondents' perception of major environmental problems in their area.

Source: CONAGUA (2011), *Statistics on Water in Mexico;* INE (2011), *Cuarto almanaque de datos y tendencias de la calidad del aire en 20 ciudades mexicanas*; INE (2007), *Tercer almanaque de datos y tendencias de la calidad del aire en nueve ciudades mexicanas;* IMO (2011), *Encuesta Nacional del IMO en México sobre Medio Ambiente*; SEMARNAT (2012), *Sexto informe de labores.*

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Notes

1. Including emissions embedded in imported products and excluding emissions embedded in exported products.
2. DMC is the sum of domestic (raw material) extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).
3. Generation reported by companies registered in the Registry of Producers of Hazardous Waste.
4. Five-day biochemical oxygen demand, chemical oxygen demand and total suspended solids.
5. Fish catches and aquaculture in inland and marine waters, including freshwater fish, diadromous fish, marine fish, crustaceans, molluscs and miscellaneous aquatic animals.
6. Including probable and possible reserves.
7. *http://sinea.semarnat.gob.mx/sinae.php*.
8. Setting maximum emission limits and requiring periodic emission check.
9. Excluding Mexicali, which registered the highest average PM_{10} concentrations during the past decade.
10. From oil activities (pipeline leaks, spills from tankers, thefts of oil from pipelines, spills of hazardous materials from storage tanks), improper disposal of hazardous waste, degradation of industrial sites, application of agrochemicals and mine tailing disposal sites.
11. Out of seven sites identified as critical for their potential adverse effect on environment and health, four have been remediated and significant progress has been made at the remaining three.
12. Between 1970 and 2009, 177 tropical cyclones hit the coasts of Mexico. Intense hurricanes have been more frequent in the Atlantic.

Selected sources

CONAGUA (Comisión Nacional del Agua) (2011a), *2030 Water Agenda*, March 2011, CONAGUA, Mexico City.

CONAGUA (2011b), *Estadísticas del agua en México*, edición 2011, CONAGUA, Marzo de 2011.

FAO (Food and Agriculture Organization of the United Nations) (2010), *Global Forest Resources Assessment 2010*, FAO, Rome.

FAO (2011), *Current World Fertilizer Trends and Outlook to 2015*, FAO, Rome.

FAO (2012), *Fisheries and Aquaculture Information and Statistics Service*, FAO, Rome.

IEA (International Energy Agency) (2011), *CO_2 Emissions From Fuel Combustion*, OECD-IEA, Paris.

IMO (Instituto de Mercadotecnia y Opinión) (2011), "Encuesta Nacional del IMO en Mexico sobre medio ambiente", survey conducted between August and September, 2011, covering population of 18 years and more, *www.imocorp.com.mx/Inicio/Estudios/02-11/IMO_ISSP_02_11.pdf*.

INE (Instituto Nacional de Ecología)-CINVESTAV (Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional) (2009), "Muestreo y análisis de Sustancias Toxicas, Persistentes y Bioacumulables (STPBs) en el sitio índice Ría Celestún en el estado de Yucatán en el Marco de la implementación del PRONAME", *Informe final*, Mexico, DF.

INE-UABC (Universidad Autónoma de Baja California) (2009), "Muestreo y análisis de Sustancias Toxicas, Persistentes y Bioacumulables (STPBs) en el sitio satélite Valle del Yaqui en el estado de Sonora en el Marco de la implementación del PRONAME", *Informe final*, Mexico, DF.

INE (2011), *Cuarto almanaque de datos y tendencias de la calidad del aire en 20 ciudades mexicanas (2000-2009)*, INE, Mexico, DF.

INEGI (Instituto Nacional de Estadística y Geografía) (2012), *Sistema de Cuentas Nacionales de México : Cuentas económicas y ecológicas de México, 2006-2010*, INEGI, Aguascalientes.

ITF (International Transport Forum) (2011), "Implementing Sustainable Urban Travel Policies in Mexico", *Discussion Paper*, No. 2011-14, ITF, Paris.

OECD (2008), *Environmental Performance of Agriculture in OECD Countries since 1990*, OECD, Paris.

OECD (2009a), *OECD Review of Budgeting in Mexico*, Volume 2009/Supplement 1, OECD, Paris.

OECD (2009b), *OECD Economic Surveys: Mexico 2009*, OECD, Paris.

OECD (2009c), *Is Informal Normal? Towards More and Better Jobs in Developing Countries*, OECD, Paris.

OECD (2011a), *Towards Green Growth: Monitoring Progress: OECD Indicators*, OECD, Paris.

OECD (2011b), *OECD Economic Outlook*, Vol. 2011/2, OECD, Paris. *http://dx.doi.org/10.1787/eco_outlook-v2011-2-en*.

OECD (2011c), *OECD Economic Surveys: Mexico 2011*, OECD, Paris, *http://dx.doi.org/10.1787/eco_surveys-mex-2011-en*.

OECD (2011d), *Divided We Stand: Why Inequality Keeps Rising*, OECD, Paris, *http://dx.doi.org/10.1787/9789264119536-en*.

OECD (2012), *Food and Agriculture, OECD Green Growth Studies*, OECD, Paris, *http://dx.doi.org/10.1787/9789264107250-en*.

PEMEX (Petróleos Mexicanos) (2011), Statistical Yearbook 2011, PEMEX, Mexico City.

Rubio-Andrade *et al.* (2011), *Follow-up study on lead exposure in children living in a smelter community in northern Mexico*, Environmental Health 2011 10:66. doi: *10.1186/1476-069X-10-66*.

SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) (2012), "Sexto Informe de Labores", SEMARNAT, Mexico, DF.

US-EIA (U.S. Energy Information Administration) (2010), *International Energy Outlook 2010, EIA*, July, 2010, Washington, DC.

PART I

Chapter 2

Policy-making environment

In the last decade, environmental sustainability has been recognised at federal level as a key dimension of Mexico's development. There have also been significant advances in environmental policy integration. This chapter reviews the main strategies and initiatives that were launched during the decade in the areas of sustainable development and environmental management. It examines Mexico's environmental governance and the mechanisms in place to improve horizontal and vertical co-ordination. Other environmental governance issues examined include: enforcement and compliance; mechanisms to evaluate the environmental impact of public policies; and promoting environmental democracy, through better access to information, improved public participation and access to justice.

Assessment and recommendations

In the last decade, environmental sustainability has been recognised at federal level as a key dimension of Mexico's development. It was identified as one of the five pillars of the 2007-12 National Development Plan and received additional budgetary resources (in particular for water and forest management). There have also been significant advances in environmental policy integration – including the establishment of a unit in SEMARNAT, the environment ministry to lead the environmental policy integration agenda, the implementation of tools to monitor line ministries' contribution to environmental objectives and the development and implementation of the Special Programme on Climate Change, involving multiple ministries. However, further measures should be taken to better co-ordinate the federal ecological land-use plan (mostly indicative) and development plans of states and municipalities.

The institutional framework has improved, but significant challenges remain. At federal level, a climate change directorate has been set up within SEMARNAT, and the National Water Commission (CONAGUA) has been empowered to act as a water authority. The key challenges relate to the distribution of policy-making, regulatory and implementation functions among SEMARNAT and other environment sector agencies. In addition, there are policy-making gaps, for example in biodiversity and coastal zone management, a regulation gap in water management, and low enforcement capacity. While there has been progress in creating inter-ministerial co-ordination mechanisms (such as the Inter-Ministerial Commissions on Climate Change, on Biosafety of Genetically Modified Organisms and on Sustainable Management of Coastlines and Oceans), no environment units have been created in other ministries.

At subnational level, all but two states have ministries with environmental functions and some have developed environmental legal frameworks. Although the Environment Institution Development Programme provides useful support, the capacity of subnational environment institutions remains weak in general. Overall, there are significant institutional obstacles to efficiency and co-ordination. These include the proliferation of subsector laws, inflexible budgets, the earmarking of resources to specific programmes and states, multiple representations of federal agencies at state level, and rules of operation for environment programmes that hinder exploitation of synergies among them. In addition, mayors serve three-year terms and cannot be re-elected, which contributes to the weak environmental planning and performance of municipalities.

There have been significant efforts to increase the quality of environment policies and programmes. Most programmes have been designed to be results-oriented (in particular, this is the case for 50 out of 80 SEMARNAT programmes) and a number of them are being developed in an integrated fashion – both vertically between government levels and horizontally between federal environment agencies. Policy instruments have started to be evaluated (so far 16 out of 122 Mexican Official Norms). Voluntary instruments such as the National Environmental Audit Programme and the Programme on Environmental

Leadership for competitiveness have been developed to promote compliance and productivity.

The information base for the environmental policy-making process has been further strengthened, particularly for pollutant emissions, contaminated sites, climate, biodiversity and biosafety. The Mexican system of economic and environmental accounts – an area where Mexico has been a front-runner – has been refined and is regularly updated. There have been important advances in raising public awareness and participation. The latest National Development Plan and Environment Sector Programme were formulated through intense consultation, which resulted in the adoption of a strategy on public participation. Mexico has created a National Consultative Council on Sustainable Development that reaches out to all 32 states. Urban environmental issues are being discussed in citizen councils, and rural populations are encouraged to participate in conservation and sustainable management of natural resources in protected natural areas.

Recommendations

- More clearly distinguish the policy development and regulatory functions of SEMARNAT for natural resource and ecosystem management (coastal zone management, forests and biodiversity – including marine and freshwater ecosystems) from the policy implementation functions of its deconcentrated agencies (such as issuing permits, processing EIA applications and enforcing compliance with legislation).
- Further strengthen environmental policy integration by: *i)* introducing strategic environmental assessment for sector programmes and state and municipal development plans; *ii)* incorporating environmental criteria in the evaluation of public policies by the National Evaluation Commission; *iii)* inviting other sector ministries to provide input to the formulation of federal environment programmes; and *iv)* pursuing environmental policy integration in state development plans.
- Strengthen public participation in environmental policy making by: *i)* extending the public participation strategy from the federal to other levels of government; *ii)* providing environmental information to the public in a way that can be better understood; *iii)* rationalising the system of consultative councils and providing them with sufficient resources to fulfil their role; and *iv)* providing appropriate responses to citizens' enquiries.
- Improve the efficiency of environment sector programmes by: *i)* expanding results-based programming; *ii)* reforming the operational rules of federal environment programmes to favour the development of "integrated packages" that exploit synergies among programmes; and *iii)* evaluating the impact and cost-effectiveness of environment programmes.
- Strengthen environmental policy implementation by: *i)* fully implementing the requirements of the environmental impact assessment system to include cumulative impacts, and ensuring that simplification of procedures does not result in weakened requirements; *ii)* targeting enforcement programmes on activities with the greatest risk; and *iii)* strengthening the human and financial resources for environmental enforcement and compliance.
- Reduce environmental sustainability gaps between states, and support the development of more effective and long-term environment plans in states and municipalities by: *i)* earmarking additional budgetary resources for those states where capacity deficits impede the development and implementation of environment plans; and *ii)* expand the Environment Institution Development Programme.

1. Key environmental and sustainable development initiatives

The policy profile of environmental sustainability has increased in recent National Development Plans (NDPs). Through these plans, each new presidential administration identifies its priority policies and programmes for its six-year term. The 2001-06 NDP gave a higher profile to environmental issues than those in the 1990s. The 2007-12 NDP went further and made environmental sustainability one of the five axes used to organise the action of the federal government.[1] NDPs are further developed through sector programmes, which specify objectives, indicators, targets and lines of action. The 2007-12 Environment and Natural Resources Sector Programme details the objectives and strategic orientations to be followed by the federal environment sector. It supports the 14 objectives of the environmental sustainability axis of the NDP (Box 2.1), as well as 23 objectives detailed in the other four axes. At the same time, other sectors are expected to help achieve the environmental sustainability objectives through their respective programmes.

Box 2.1. **Mexico's 2007-12 environmental sustainability goals**

1. Increase coverage of water supply and sanitation services.
2. Achieve integrated and sustainable water management.
3. Halt forest and jungle degradation.
4. Conserve ecosystems and biodiversity.
5. Integrate the conservation of natural capital with social and economic development.
6. Guarantee effective, efficient, speedy and transparent management and enforcement of environmental legislation and incentivise sustainable investment.
7. Assure the use of environmental criteria in the Federal Public Administration.
8. Achieve close co-ordination and integration of efforts between the bodies of the Federal Public Administration, the three levels of government and the three powers of the Mexican Union.
9. Identify and exploit the productive potential of the territory through ecological planning and environment-compatible actions that guarantee the sustainable use of natural resources.
10. Reduce greenhouse gas emissions.
11. Promote climate change adaptation measures.
12. Reduce the environmental impact of waste.
13. Generate scientific and technical information on priority environmental issues to aid decision making and facilitate informed and responsible public participation.
14. Develop in Mexican society a solid environmental culture focussed on valuing and acting with ample respect towards natural resources.

Source: 2007-12 National Development Plan.

Mexico has shown international leadership on climate change (Chapter 4). In 2010, it hosted the 16th Conference of the Parties to the UN climate change convention (COP-16) in Cancún. It has made great efforts in the last decade to address climate change, taking a countrywide, mainstreaming approach rather than a narrow environment sector perspective. Mexico's efforts include high-level political commitment (an inter-ministerial

commission was created upon presidential request in 2005), an aspirational target to reduce greenhouse gas (GHG) emissions by 50% in 2050 compared to 2000 levels, a national strategy on climate change in 2007, a dedicated federal Special Programme on Climate Change in 2009 and state-level plans, of which four are now in place. The Special Programme on Climate Change seeks to reduce GHG emissions by 51 Mt CO_2 eq by 2012 compared to a baseline scenario. It includes 105 objectives and 294 targets for mitigation and adaptation. Mexico has been a leader in identifying approaches for water-related adaptation in the international agenda (for instance, by organising the Dialogs for Water and Climate Change in the framework of COP-16) while also introducing national measures such as standards for the artificial recharge of aquifers. In Cancún, Mexico presented its "Vision on REDD+", a key step towards a national strategy to reduce emissions from deforestation and forest degradation, to be finalised in 2012. The policy framework for climate policy implementation was further consolidated with the adoption in 2012 of the General Law on Climate Change.

Over the last decade, Mexico has increased its efforts to tackle a challenging water agenda. The framework programme for water management is the 2007-12 National Water Programme. While water supply and sanitation are constitutionally municipal responsibilities, the federal government decided to take a more active part in addressing service gaps and tripled investments over the decade through several programmes providing additional resources to municipalities to: *i)* improve efficiency and develop infrastructure (PRODDER);[2] *ii)* modernise water service providers (PROMAGUA);[3] *iii)* build new water supply, wastewater collection and wastewater treatment infrastructure in urban areas (APAZU);[4] *iv)* enhance sustainability of rural water and sanitation services (PROSSAPYS);[5] *v)* increase wastewater treatment (PROSANEAR);[6] and *vi)* improve drinking water quality (Agua Limpia).[7] One important programme that cuts across several water issues is the Programme on Water Sustainability of the Mexico Valley Basin, which includes two of the world's largest water projects.[8] In the area of water resource management, there are important programmes aimed at increasing irrigation water efficiency, rehabilitating irrigation districts, expanding irrigation infrastructure, and protecting and maintaining federal basins and federal water infrastructure. CONAGUA, the national water agency, is also making significant efforts to improve intelligence, administration and enforcement in the context of limited water resources outside investment programmes. In 2011, the federal government issued the Water Agenda 2030, an ambitious strategic planning framework and long term vision for the sector (Box 2.2).

Mexico has introduced a number of important initiatives over the past decade to more comprehensively address biodiversity and forest conservation objectives. These range from the establishment of new monitoring and reporting frameworks to changes in the institutional framework and the application of several policy instruments for biodiversity and forest conservation (Chapter 5). The 2000 National Biodiversity Strategy has been complemented by the Mexican Strategy on Plant Conservation (2008, revised in 2012) and the National Strategy on Invasive Species (2010), although there is still no action plan to implement the National Biodiversity Strategy. During the review period, Mexico expanded the use of regulatory instruments such as protected areas and ecological land use plans, and it has shown leadership in the application of economic instruments – in particular via the National Programme of Payments for Ecosystem Services (PES) established in 2003. "ProÁrbol" is the main federal umbrella progamme that supports sustainable forestry, providing subsidies to landowners to carry out protection, conservation and restoration

Box 2.2. **The Water Agenda 2030**

Recognising that water challenges cannot be solved in a single presidential administration, CONAGUA has led the development of a long-term indicative programme that aims to serve as a flexible framework for the consolidation of a sustainable water policy. The Water Agenda 2030, issued in March 2011, identifies 38 initiatives articulated around four themes: basins in balance, clean rivers, universal coverage of water and sanitation services, and safe settlements. It is estimated that its implementation will cost MXN 51 billion per year.

The Water Agenda 2030 is also a process, which includes expert and public participation in the formulation of the original document as well as in the annual review of its implementation. While the Water Agenda 2030 does not commit future presidential administrations, it provides a framework that can be used to continue to define, gain support for, and undertake water policy reforms.

In 2012, CONAGUA asked the OECD to support implementation of the Water Agenda 2030 by carrying out a review of the Mexican water sector and bringing in expertise from other OECD member countries. The OECD recommendations are being delivered to the incoming presidential administration in January 2013.

actions as well as sustainable use of forests, rainforests and arid zones; in addition to the PES programme, another important component of "ProÁrbol" is the reforestation programme. Additional initiatives include the Forest Land-Use Change Compensation mechanism (a type of biodiversity offset), introduced in 2005, and the Promotion of Conservation and Sustainable Use of Wildlife, through Management Units for Wildlife Conservation (UMAs) and Facilities for Wildlife Handling (PIMVS) in rural areas.

In the area of coastal and marine management, Mexico has adopted a National Strategy for the Ecological Land Use Planning of Mexico's Coastlines and Oceans (2007) and a National Strategy for the Conservation and Sustainable Development of Mexican Island Territories (2012).

2. Institutional framework for environmental and sustainable development policies

2.1. The environment sector at federal level

Mexico is a federal country that is still highly centralised but has embarked on a process of decentralisation.[9] The federal government collects most of the national budget income. More than half the federal budget is transferred to states and municipalities through a mix of conditional and unconditional transfers. Traditionally, the executive branch has been more powerful than the legislative and judicial branches. The federal government is structured around 19 ministries (*Secretarías de Estado*).

The current environment sector, as in many other countries, is the product of organic growth rather than design (Box 2.3). As a result, the Ministry of Environment and Natural Resources, SEMARNAT, combines policy-making, regulation and implementation functions, while some deconcentrated bodies also have policy-making functions. In terms of policy making, in recent years SEMARNAT has created a climate change directorate and an environmental policy integration subdirectorate, but there remains a gap as regards biodiversity policy. Having implementation functions (such as running the environmental

impact assessment procedure) at SEMARNAT, rather than in a more independent environment agency, may also generate a risk of political influence on technical decisions. Potential conflicts of interest could be avoided, and greater institutional clarity achieved, by a clearer separation of functions. In line with the practices followed in many other OECD countries, SEMARNAT should focus on policy development and normative functions, while deconcentrated bodies should focus on implementation.

Box 2.3. **The structure of the environment sector in Mexico**

The Ministry of Environment and Natural Resources (SEMARNAT) is the leading environment institution. SEMARNAT has three main subdivisions: Environmental Planning and Policy (which includes directorates responsible for information, planning and evaluation, policy integration, and climate change); Promotion and Regulation (which includes directorates responsible for regulation and for overseeing the energy, industry, agriculture, and urban and tourism sectors); and Environmental Management (which includes directorates dealing with air quality, forestry and soils, hazardous substances, environmental impact and risk, wildlife, and federal coastal areas). SEMARNAT has delegations in each state charged with supervising local implementation of federal programmes and co-ordinating with local environment authorities.

The environment sector at federal level includes deconcentrated and decentralised bodies. Deconcentrated bodies are autonomous in decision making but controlled by SEMARNAT in administrative issues such as human resources and finances. They include the National Water Commission (CONAGUA), the National Protected Areas Commission (CONANP), the National Ecology Institute (INE) and the Federal Attorney for Environmental Protection (PROFEPA). Decentralised bodies exist as legal entities with their own budgets. They include the Mexican Institute of Water Technology (IMTA) and the National Forestry Commission (CONAFOR).

Political commitment to the environment has been evidenced in increased financial resources for the environment sector (Chapter 3). The bulk of the increase has been for water and forests. The environmental policy and management functions have also experienced significant increases, with the notable exceptions of enforcement (PROFEPA's budget has increased less than GDP) and the Federal Delegations (whose budgets have shrunk even in nominal terms) (Table 2.1). The increase in financial resources has not been matched by a parallel increase in human resources. CONAGUA accounts for nearly three-quarters of SEMARNAT's budget, and CONAFOR for a further 13%, due to the investment-heavy nature of the water and forestry programmes and the high priority given to those subsectors.

2.2. Horizontal co-ordination

Mexico is increasingly placing environmental mainstreaming (*transversalidad*) at the core of its environmental policy framework. All other sectors are expected to help achieve the environmental sustainability objectives through their respective programmes. A dedicated unit in SEMARNAT's Planning Department co-ordinates the contributions of the various sectors to the NDP environmental sustainability objectives. An information system tracks the sectors' progress towards the federal environmental objectives every two months, and an annual report on mainstreaming environmental issues in public policies

Table 2.1. **SEMARNAT budget, by administrative unit**

Administrative unit	Budget 2002		Budget 2011	
	Million pesos[a]	Share (%)	Million pesos[a]	Share (%)
Minister's office	451	2.0	1 811	3.5
Administrative support (*Oficialía Mayor*)	1 534	6.7	710	1.4
Environmental Planning and Policy Dept.	331	1.4	994	1.9
Promotion and Environmental Regulations Dept.	70	0.3	566	1.1
Environmental Management Dept.	533	2.3	1 157	2.3
Federal Delegations	1 036	4.5	571	1.1
INE (environmental research)	351	1.5	290	0.6
IMTA (water research)	314	1.4	251	0.5
PROFEPA (environmental protection)	944	4.1	1 013	2.0
CONAGUA (water commission)	14 711	64.0	36 399	71.1
CONANP (protected areas commission)	353	1.5	998	1.9
CONAFOR (forestry commission)	2 363	10.3	6 463	12.6
Total	**22 990**	**100.0**	**51 222**	**100.0**

a) 2011 prices.
Source: SEMARNAT.

StatLink http://dx.doi.org/10.1787/888932756041

has been published since 2008 (SEMARNAT, 2010). Putting this arrangement in place is already a significant achievement. The challenge for the future is to ensure that the objectives to which every sector commits continue to go beyond what they would achieve under a business as usual scenario. In addition, there is a need to increase the level of co-ordination for environmental mainstreaming at subnational levels – for instance, in state environmental plans.

For more specific environmental issues, Mexico has continued to strengthen horizontal co-ordination at the federal level by setting up co-ordinating bodies. Inter-ministerial commissions are high-level co-ordinating bodies. They include the Inter-Ministerial Commission on Climate Change (established in 2005), the Inter-Ministerial Commission on Biosafety of Genetically Modified Organisms (2006) and the Inter-Ministerial Commission for the Sustainable Management of Coastlines and Oceans (2008). At a lower level are the inter-ministerial working groups, such as the Working Group on Climate Change (2009) and the Working Group for the General Ecological Land Use Programme (2010).

Synergies between federal environmental programmes are generally not exploited. One reason is the design of the programmes' current rules of operations. The rules could be modified to favour packages of programmes that exploit synergies. Experience with biological corridors provides an example of how this can be done. The structure of the federal environmental administration might be another factor limiting opportunities to exploit synergies in policy implementation.

2.3. *Vertical co-ordination*

Mexico has seen progress in the development of an institutional framework for environmental sustainability at subnational level. The environmental responsibilities of each level of government are specified by the General Law on Environmental Protection (LGEEPA). An increasing number of states are paying attention to environmental sustainability. Currently 25 of the 32 states have specific, ministry-level institutions dedicated to environmental issues (SEMARNAT, 2011a). SEMARNAT has supported their

institutional development through the Environment Institution Development Programme. There is, however, a significant divide between the more economically-advanced states, which tend to have realised the importance of environmental issues sooner and have more capacity to deal with them, and less-developed states that are lagging in this area.

At municipal level, the situation in terms of awareness and capacity is even more complicated. Municipal environmental responsibilities include water and sanitation services and parks, while environmental protection is a joint responsibility with the state and federal governments. Significant efforts are needed by all three levels to ensure that municipalities fulfil their assigned environmental roles. The fact that, constitutionally, mayors serve three-year terms and cannot be re-elected impedes the development of long-term municipal environmental plans and programmes. At the same time, there are some good examples of inter-municipal co-operation for environmental protection (Box 2.4).

Box 2.4. **Junta Intermunicipal del Río Ayuquila (JIRA)**

JIRA is an inter-municipal, decentralised environment agency formed in 2007, grouping ten municipalities along the Ayuquila River. Its main objective is to offer technical and managerial assistance on environmental policies and programmes. It serves as a local governance model, with interaction by federal, state and municipal governments, as well as research institutions and civil society organisations. JIRA's environmental agenda includes environmental education, social participation and waste management.

JIRA has been able to leverage resources from the Jalisco state government, federal institutions (SEMARNAT and CONAFOR) and international donors (French Development Agency and Spanish Agency for International Development Co-operation). Benefits of the JIRA model include: *i)* local-level management with integrated regional territorial development; *ii)* collaboration of key multi-level government and social organisations; and *iii)* transparency in the use of the resources due to its status as a decentralised agency, which can be an incentive for bilateral and multilateral donors.

Following this model, two inter-municipal agencies were recently created in the state of Jalisco (Río Coahuayana and Sierra Occidental y Costa) to address issues related to conservation and sustainable management of forest.

Source: World Bank (2011).

Mexico has continued and expanded its efforts to develop programmes involving different levels of government to tackle key environmental issues. One long-standing example of joint action between federal and state authorities is the programme called ProAire, which has been significantly expanded since 2000 (Box 2.5). More recent examples include the National Programme for the Prevention and Integrated Management of Waste (SEMARNAT, 2009) (which has resulted in 30 state and 84 municipal programmes for integrated waste management and prevention, as well as the establishment in 2004 of the GIRESOL Network), the development of state and city programmes on climate change (Chapter 4) and the formulation of regional and local marine environment regulations. The federal government signs co-ordination agreements for environmental investments with state and municipal governments. However, limited municipal institutional capacity has prevented better vertical co-ordination – for example, it is not sufficient to plan, implement and operate efficient waste collection and management systems, and it is one of the main obstacles to effectively implementing the climate change strategy in Mexico City (OECD, 2010).

Co-ordination of environmental policy development and implementation at state level operate through two channels. The Federal Delegations of SEMARNAT and the state ministries of environment (or agencies in two states) co-ordinate their policies and actions through bilateral dialogue. In addition, the delegations take part in state development planning, participating in the planning committees for state development (COPLADES).

Effective co-ordination between federal and state programmes is hampered by the lack of state environment plans and by the way the federal budget is formulated. There are some state environment programmes but they reflect actions to be taken by state governments; they are not state environment plans that combine action by all government levels. In this context, when the national deputies negotiate in Congress to obtain budget earmarks for the states they represent, they do not always take into account the internal logic of federal programmes or the state's environmental priorities.

Box 2.5. **Addressing air quality in urban areas: ProAire**

In Mexico, air pollution is responsible for the largest share of the costs of environmental degradation, representing about 4% of GDP (INEGI, 2012). The Air Quality Improvement Programmes (ProAires) are one of the principal public policy instruments to curb the deterioration of air quality and protect human health. ProAires provide measures to abate, reduce and control emissions from industrial, mobile and diffuse sources. They encourage the integration of land-use planning, transport and air quality management policies; support the development of air quality monitoring systems; and promote local (state and municipal) capacity building. For example, the 2002-10 ProAire for the Metropolitan Zone of the Valley of Mexico (ZMVM), jointly designed by the federal government, the Federal District (Mexico City) and the Mexico state government, comprised 89 measures, such as financial incentives to replace old taxies and buses, development of a new public transport system and the combination of a vehicle verification system with a "no driving day" programme[1] (Hoy No Circula).

The first ProAire was begun in 1990 in the ZMVM[2] and the concept has been developed in other big cities since then. Fourteen ProAires were adopted between 2000 and December 2011. The Environment and Natural Resources Sector Programme (2007-12) set a target of having 12 ProAires in force by 2012, operated with the three levels of government. Since 2007, ProAires have been developed in metropolitan areas where air quality was deteriorating, and where standards for ambient air pollutants were exceeded. By 2011, ten ProAires were in force[3] and five[4] were in development, covering, respectively, 42% and 10% of the urban population (SEMARNAT, 2011b).

In the ZMVM, ProAire implementation has resulted in significant progress in reducing air pollution (Chapter 1). It is estimated that between 1997 and 2005, 1 928 deaths were averted due to the reduction in PM_{10} concentrations and 794 due to reduction in ozone concentrations. Studies have shown that full compliance with the PM_{10} standard could avert 400 deaths a year, and that enforcing a 10 $\mu g/m^3$ stricter standard could avert 1 000 more deaths (UAM-A, 2010).

1. The first integral programme to reduce air pollution (PICCA) was adopted in 1990. It was followed by the ProAire I, adopted in 1996 to cover 1995-2000.
2. Programme restricting circulation of private cars on certain days, depending on the registration plate and age of the vehicle.
3. Metropolitan Zone of the Valley of Mexico, Mexicali, Metropolitan Zone of Guadalajara, Comarca Lagunera Region, Victoria de Durango, Metropolitan Area of Monterrey, Metropolitan Zone of Cuernavaca, León, Salamanca, Ciudad Juárez.
4. Metropolitan Zone of Querétaro, Tijuana – Rosarito – Tecate, Metropolitan Zone of Puebla, Metropolitan Zone of Villahermosa, Metropolitan Zone of the Valley of Toluca.

3. Regulatory framework and enforcement and compliance

The 1998 LGEEPA remains the key piece of legislation. By 2000, Mexico had a well-developed legal framework. Since 2000, the Mexican Constitution has been amended to include regulation on collective action, recognition of judicial procedures and damage repair mechanisms (2010); damage repair and environmental degradation as responsibility of the generator; and recognition of access to sanitation and water supply as a fundamental right (2012). New laws have been decreed, such as: the General Law on Wildlife (2000); the Law on Sustainable Rural Development (2001); the General Law on Sustainable Forest Development (2003); the General Law on Waste Prevention and Integrated Waste Management (2003); and the Law on Biosafety of Genetically Modified Organisms (2005). All of these laws have been partially amended and regulations have been developed such as those with LGEEPA on pollutant emission and transfer (2004), with the General Law on Sustainable Forest Development (2005), with the Wildlife General Law and with the Waste Prevention and Integrated Waste Management (both in 2006), and with Biosafety of Genetically Modified Organisms (2008). The legal framework has also been completed through the approval of state laws – for example, 27 states now have a forestry law. Additional recent legislation includes the recognition of the right to water in the constitution (2011) and the adoption of a General Law on Climate Change (2012); in addition the Mexican Senate approved a bill on environmental liability in 2011.

Mexico has made progress on consolidation of the regulatory framework and the use of regulatory instruments in several policy areas. Progress on climate change and on biodiversity and forest management is discussed in Chapters 4 and 5. Progress in other policy areas has included the following:

- **Urban air quality management.** The policy framework is still largely based on regulatory instruments. Since 2002, eleven Official Mexican Norms (NOMs) relating to air quality and air pollutant emissions have been issued or reviewed.[10] There were improvements in enforcement of regulations aimed at stationary sources: the rate of serious violations detected declined from 1.4% to 1.1% of inspected cases from 2002-10. Less progress was made in inspection and verification of mobile sources – a state responsibility – with vehicle inspection programmes implemented in metropolitan areas and some municipalities in only 15 states.
- **Waste management.** The regulatory framework was developed with the publication in 2003 of the General Law for Prevention and Integrated Management of Waste (regulations in 2006).[11] Between 2007 and 2011 most of the states and more than 250 municipalities issued their respective waste regulations.
- **Water management.** The regulatory framework was improved with the publication of several reforms to the Law on National Waters, most importantly in 2004. However, there was little progress in enhancing the regulatory framework for water and sanitation service providers.[12] In the area of water resource management, there were efforts to improve the water licensing system, though enforcement capacity remains very low,[13] and decentralise management to river basin councils and their auxiliary bodies. The regulations to implement the 2004 reform to the Law have not yet been approved.

Environmental regulations have been influenced by the government-wide drive for better regulation. The Federal Law on Administrative Procedure requires drafts of new laws and regulations to include an *ex ante* assessment of regulatory impact (including estimated costs and benefits) and they must undergo review by the Federal Commission on

Regulatory Improvement. A manual on how to conduct regulatory impact analysis was issued in 2010.

There are some tensions between the roles of the state as economic actor and regulator. For example, deadlines for reducing sulphur in fuels have been pushed back due to lack of funds for technological conversions at facilities of PEMEX, the state oil company.

3.1. Environmental standards

Mexico's main regulatory instruments are the Official Mexican Norms, which are compulsory product, process and services standards. In addition to the NOMs, there are voluntary standards known as Mexican Norms (NMXs). Out of the 782 NOMs issued since 1993, 122 are related to environmental protection. Since 2003, 37 new environmental protection standards have been developed by SEMARNAT and other ministries (particularly the Ministry of Health but also the ministries of energy, transport and agriculture) in areas including air quality, pollutant emissions from motor vehicles, waste management, water management, forest management, wildlife protection, ecotourism and beach sustainability. However, Mexico still lacks compulsory standards on issues such as vehicle fuel economy and energy efficiency in buildings. Mexico has started an innovative process of evaluating the application of NOMs (see Evaluation subsection below). LGEEPA allows the states to issue environmental regulations as long as they do not conflict with LGEEPA or impinge upon SEMARNAT's exclusive responsibilities.

3.2. Environmental permitting

Industrial facilities are required to obtain a number of permits and licences in order to operate. The type and number of permits are determined by location, process complexity and any chemicals used, as well as regulations that may apply to a particular industrial sector. The main environmental permits in Mexico include environmental licences for industrial operation, permits for water extraction and wastewater discharge and land use change permits that are granted following environmental impact and risk assessments. In order to obtain permission to operate, industrial facilities are also required to register pollutants emission and transfer and, if applicable, to produce a waste management plan and to report on hazardous waste generation.

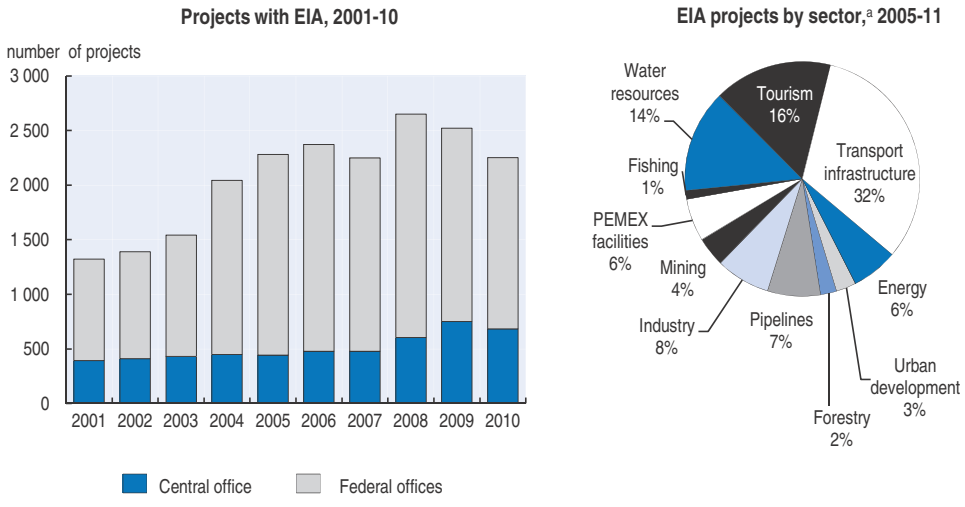
The concept of a single environmental licence (LAU) was introduced in 1997. The LAU is the main element of an integrated system of direct regulation and environmental management (SIRG). It co-ordinates environmental administrative procedures regarding water abstraction, wastewater discharges, occupation of federal zones, emissions to the atmosphere and waste generation. SEMARNAT is in charge of approving LAUs for installations identified as fixed emission sources under federal jurisdiction, while the states are responsible for approving LAUs for other fixed emission sources. As of July 2011, 876 installations were regulated through federal LAUs.[14] The use of this instrument has allowed Mexico to reduce pollutant emissions by 20% (GoM, 2011).

The system of environmental permitting is being reviewed and reformed under government-wide efforts at better regulation. Administrative procedures have been removed, merged or improved in order to simplify them and increase their quality. By June 2011, the number of environmental administrative procedures had been reduced from 258 to 154. To simplify the process of obtaining permits, SEMARNAT changed its dedicated micro-website in April 2011. Another example is the introduction by the state of Jalisco of a "one-stop shop" policy aiming to reduce the time necessary to obtain a LAU.

3.3. *Environmental impact assessment*

Environmental impact assessment (EIA) was introduced by LGEEPA and revised in the 2001 implementing regulations. Since 2001, over 20 000 projects have undergone EIA. In recent years, around 500 procedures have been handled per year by SEMARNAT's central offices and around 2 000 by the SEMARNAT delegations in all 32 states (Figure 2.1). The rejection rate has fluctuated between 47% (2003) and 27% (2010 and 2011). The Mexican experience with EIA shows a positive impact on awareness of project sponsors. A key challenge, however, is to determine the degree of compliance with the conditions set in the permits: that is, to what extent is the EIA system actually leading to reduced environmental impacts. Mexico has no strategic environmental assessment of policies, plans and programmes, and the requirements of the EIA system to include cumulative impacts are not fully implemented. Some observers worry that the simplification of EIA procedures as part of the government-wide better regulation initiative may result in the EIA system losing effectiveness.

Figure 2.1. **Environmental impact assessment**



a) Applications handled by SEMARNAT's central office.
Source: SEMARNAT, 2012.

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3.4. *Ecological land use planning (ordenamiento ecológico)*

Ecological land use planning is an environmental policy instrument that aims to regulate or influence land use and the location of productive activities in order to assure environmental protection and the sustainable use of natural resources.[15] It takes into account the potential use as well as trends in degradation. In a country like Mexico, which is still experiencing significant population and economic growth, this instrument could play a significant role in achieving environmental objectives. The adoption of the National Ecological Land Use Plan (ELUP) in 2012 is a significant achievement. The number of ecological land use plans decreed increased from 12 in 2000 to 85 in July 2012, with an additional 10 under way. However, effective use of this tool is hampered by a perception, particularly at subnational level, that environmental goals conflict with development

goals. Municipal authorities favour development and rarely take into account the recommendations of ecological land use planning when developing local development plans. Increased co-ordination between the two approaches, particularly during planning and enforcement (through the responsible administrations as well as through increased public participation), remains a major challenge.

Protection of natural areas is also an important regulatory instrument, given Mexico's size, biodiversity and the pressures it faces. Since 2000, Mexico has significantly increased the total area under federal protection to 25.4 million hectares (13% of the territory) (Chapter 5).

3.5. Environmental enforcement

Several bodies[16] carry out environmental enforcement. The main enforcement agency is PROFEPA, which has around 650 inspectors and in 2010 resolved 57% of the administrative enforcement cases initiated that year. But there is a growing backlog of administrative proceedings – in 2010, 15 055 new proceedings were started and 13 508 resolved. As a result of PROFEPA's enforcement efforts in 2010, 21 enterprises were partly closed and 71 enterprises were entirely closed. PROFEPA co-ordinates enforcement activities with other federal bodies such as CONAGUA, CONAPESCA and the ministries of economy and labour, as well as with the states and with international bodies such as the North American Commission for Environmental Co-operation and Interpol. CONAGUA finds it very difficult to meet its responsibilities enforcing water regulations (particularly as regards limits on water abstraction), having 150 inspectors to control 475 000 registered users and many more illegal actors. In the last decade, the number of state environmental enforcement agencies has increased from 3 to 12. While the states are responsible for vehicle inspection programmes, only 15 states have such programmes in place and half of them are voluntary.

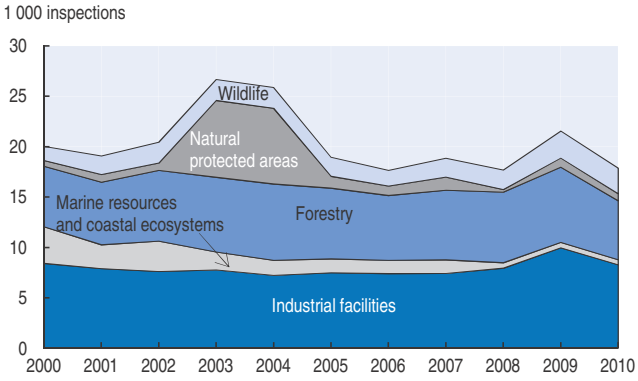
Enforcement of environmental regulation remains a major challenge. A recent evaluation of regulations (Table 2.3) examined enforcement aspects as one of four variables. Out of 16 regulations evaluated, half showed no or little degree of compliance and enforcement, 25% showed a medium degree and 25% showed a high degree.[17] Despite the estimated high level of non-compliance, the number of inspections has remained relatively stable over the last decade (Figure 2.2). At the same time, non-compliance rates, at least in industry, decreased in the second half of the decade (Table 2.2).

Mexico continues to make significant efforts to promote compliance, through the National Environmental Audit Programme managed by PROFEPA. Since 2003, the number of installations certified under this programme has increased by 2.5 times. To face the growing demand by companies to participate in the programme, the government streamlined the process and reduced the response time through the 2010 regulation on self-regulation[18] and environmental audits. Since 2008, SEMARNAT has been implementing the Environmental Leadership for Competitiveness Programme to help companies go beyond regulations and reap the benefits of improved resource efficiency. By July 2012, the 2 540 participating companies had reported MXN 2.6 billion in annual savings and 0.6 Mt of CO_2 emissions avoided per year.

Mexico is also making strides in enforcement of natural resource management regulations. While most enforcement attention has long focussed on the pollution agenda, PROFEPA is now paying more attention to green issues. Examples include the 2007-12 Zero Tolerance of Illegal Logging Initiative, nationwide specific surveillance operations and the

Figure 2.2. **Change in number of inspections, selected sectors**

2000-10



Source: SEMARNAT, 2012.

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Table 2.2. **Trends in non-compliance rates**

2000-10 (% of industrial inspections that found irregularities)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total	77.8	77.4	73.7	72.1	75.5	71.8	70.4	65.4	59.1	57.2	62.5
Major irregularities only	1.89	1.97	1.37	1.47	1.31	1.16	0.88	0.89	0.97	0.65	1.11

Source: Rates calculated from SEMARNAT data.

StatLink http://dx.doi.org/10.1787/888932756060

establishment of voluntary committees for environmental surveillance. CONAGUA is developing and implementing new compliance assurance and enforcement strategies to achieve greater results with its limited resources; examples include introducing universal metering of water abstraction and focussing on controlling illegal wells at community rather than individual level.

The key challenges of environmental enforcement in Mexico are to build public trust and engage citizens in enforcement efforts, to further modernise enforcement strategies and inspection methods using risk-based approaches, to add the municipalities to the enforcement efforts, and to ensure that the enforcement agencies (PROFEPA and state authorities) remain autonomous.

4. Evaluation mechanisms

Attempts to develop an evaluation system started around 1990, and significant advances have been made in the last decade. Since 2008, within the framework of the programme and budget process, the Federal Public Administration has implemented a performance evaluation system that aims to measure fulfilment of strategic goals. Federal programmes also undergo *ex post* external evaluation following guidelines issued in 2007 by the National Commission for the Evaluation of Social Development Policy (CONEVAL) and the ministries of finance and public administration, the goal being to influence resource allocation.

Monitoring, reporting and evaluation of environment programmes increasingly occur but do not yet focus enough on environmental outcomes. The 2007-12 Environment Sector

Programme includes a detailed list of indicators and targets that enable monitoring and monthly, bimonthly or quarterly reporting of progress on implementation of activities, but much less on outcomes. Reporting takes place through activity reports, national development plan implementation reports, and annual working programme implementation reports. By the end of 2010, SEMARNAT had carried out 97 evaluations of 37 budgetary programmes, and in 2011 it carried out a monitoring exercise with 51 matrixes of result indicators which together contain 693 strategic and management indicators. Some evaluations are already providing useful feedback – for example, the evaluation of the Valley of Mexico ProAire programme suggests that air quality standards could be made more stringent to reap additional health benefits, and that there is a need to strengthen compliance with particulate standards. Good practice also exists in evaluation of the environmental benefits of management actions – for example, PROFEPA estimates annually the environmental benefits (in physical and economic terms) of the National Environmental Audit Programme and Environmental Leadership for Competitiveness.

The NOMs are expected to undergo *ex ante*, mid-term and *ex post* evaluations. The *ex ante* evaluation includes preparation of a regulatory impact review which calculates the economic and social effects of the standard, compares the benefits with the costs, compares the standard against a counterfactual scenario, reviews its relationship with other national or international policy instruments to avoid conflict and duplication, and considers to what extent to incorporate comments elicited in the public consultation process. A mid-term evaluation is to be carried out after five years to check whether technical specifications are still valid and compliance is being enforced. *Ex post* evaluations are to be carried out after periods greater than ten years. They should consider whether the instrument has generated the expected changes in behavior and environmental conditions. *Ex post* evaluations of environmental regulatory instruments started in 2007 as part of the government's policy on regulatory improvement, with 16 NOMs evaluated by mid-2011 (Table 2.3). The results show that NOMs vary greatly in terms of net benefits, applicability

Table 2.3. **Evaluation of environmental regulatory instruments**

	Topic	Regulation	Rating
2008	Concentrations of pollutants in wastewater discharges	NOM-001-SEMARNAT-1996	0.75
2009	Concentrations of pollutants in reused wastewater	NOM-003-SEMARNAT-1997	2.25
2008	Use, transport and storage of forest soil	NOM-027-SEMARNAT-1996	1.50
2008	Emission of air pollutants from concrete production	NOM-040-SEMARNAT-2002	3.25
2008	Emission of exhaust gases from gasoline-powered vehicles	NOM-041-SEMARNAT-2006	2.50
2009	Emission of exhaust gases from diesel-powered vehicles	NOM-045-SEMARNAT-2006	0.75
2008	Measurement equipment and methodology for verifying exhaust gases	NOM-047-SEMARNAT-1999	2.50
2009	Storage of hazardous waste	NOM-055-SEMARNAT-2003	0.75
2009	Mitigation of biodiversity impacts of land use change from forestry to agricultural use	NOM-062-SEMARNAT-1994	0
2009	Municipal waste disposal	NOM-083-SEMARNAT-2003	1.50
2009	Waste incineration	NOM-098-SEMARNAT-2002	3.25
2009	Oil drilling	NOM-115-SEMARNAT-2003	3.50
2009	Mining in dry and temperate climate	NOM-120-SEMARNAT-1997	0
2008	Use of equipment and materials containing polychlorinated biphenyls	NOM-133-SEMARNAT-2000	1.25
2008	Sulphur emissions from desulphurising plants	NOM-137-SEMARNAT-2003	3.25
2008	Water intakes and related dams	NOM-141-SEMARNAT-2003	2.50

Note: The evaluation considers four dimensions: impact, quality of the norm, effectiveness (compliance and enforcement) and efficiency. The possible ratings range from 0 (none) to 4 (very high).
Source: SEMARNAT (2011c).

and compliance levels. On average, the NOMs' performance is "regular" as regards quality and efficiency, but between "regular" and "poor" for effectiveness (compliance and enforcement) and impact.

5. Stakeholder involvement

Mexico has increased the emphasis on public participation in environmental decision making, and as a result participation is playing an increasing role. There was intense public participation in the formulation of the 2007 National Development Plan and the 2007-12 Environment Sector Programme. One key outcome was the formulation of the 2008 National Strategy for Public Participation in the Environment Sector (ENAPCi), which aims to have public participation that is well-informed and can effectively influence the formulation, execution and evaluation of environmental policies.

Mexico has several mechanisms for public participation in environmental matters. Fourteen consultative bodies facilitate such participation at national level, each focussing on specific themes such as environmental education, wildlife management and conservation, natural protected areas, forestry, climate change, water management. For example, the National Consultative Council on Sustainable Development (CCSD), created in 2008, includes a national council, six regional councils and, in each state, a consultation council "nucleus". These bodies, however, face several challenges. One is lack of financial resources. Another is related to lack of communication between consultative bodies. There is an opportunity to use the CCSD at state level as a public participation mechanism to discuss state policies and progammes, not just federal policies and programmes. Public participation at local level takes place through citizen councils in several cities, where environmental topics are often on the agenda. Rural populations are encouraged to participate in conservation and sustainable management of natural resources in protected areas through the Programme of Conservation for Sustainable Development (PROCODES).

Other mechanisms include river basin committees, which enable consultation and consensus building and include several subsidiary bodies, such as technical committees for groundwater management. In addition, under the North American Agreement on Environmental Co-operation (the environmental counterpart of the North American Free Trade Agreement), a citizen advisory council as well as a mechanism to enable citizen submissions on enforcement matters have been established.

Access by the public to environmental information has been bolstered by a general move by the government towards increased transparency. This results from the approval in 2002 of the Federal Law on Transparency and Access to Public Government Information and the creation of the Federal Institute of Information Access and Data Protection. The 2007 NDP included as one its objectives the generation of information to facilitate informed and responsible public participation in environmental decision making. The public now has access to the annual working plan implementation reports. Between 2007 and 2011, SEMARNAT addressed more than 20 000 applications for environmental information (SEMARNAT, 2011a). Mexico has further improved its national system of information on most environmental topics (e.g. climate, biodiversity, pollutant release and transfer, contaminated sites). A geographic module has been developed and added to the SEMARNAT website, and efforts are being made to integrate existing systems. In the early 1990s, Mexico was among the first countries to develop and implement a system of economic and environmental accounts, and it has been updated regularly since then.

The country is developing a set of green growth indicators based on the OECD proposal (OECD, 2011). While more environmental information is reaching the public and civil society representatives, further efforts are needed to raise environmental awareness and to strengthen the role of environmental information in policy making.

Mexico has made substantial progress on environmental education. In 2005, the ministers of environment and public education signed the National Commitment on Education for Sustainable Development. In 2006, SEMARNAT published the Strategy of Environmental Education for Sustainability. One objective of the 2007-12 NDP was "to develop in Mexican society a solid environmental culture focussed on valuing and acting with ample respect towards natural resources". In 2009, the National Council of Environmental Education for Sustainability was set up as a consultative body to advise SEMARNAT and work with other institutions. The Sustainable Development Training Centre has been very active in implementing the national environmental education agenda in both formal and informal education, often in co-operation with other environmental institutions such as INE, CONAGUA, CONABIO, IMTA, CONAFOR and CONANP. It has supported the incorporation of environmental education in the national curriculum in an inter-disciplinary manner and promoted the Green Schools programme of environmental certification of schools. It has also developed public awareness campaigns, a website for children, a programme for evaluating environmental education and cultural centres, audiovisual instruction materials for farmers (on sustainable agriculture, water management and biodiversity conservation for farmers), and distance learning courses on climate change for public employees.

Notes

1. The other four axes are "rule of law and security", "a competitive and job-creating economy", "equality of opportunities", and "an effective democracy and a responsible foreign policy".
2. Programme for Reimbursing Duties.
3. Water Utility Modernisation Project.
4. Programme for Drinking Water, Sewerage and Sanitation in Urban Zones.
5. Drinking Water Supply and Sanitation Sustainability Programme.
6. Federal Wastewater Sanitation Programme.
7. Clean Water Programme.
8. The Atotonilco Wastewater Treatment Plant (which will serve 12 million people) and the Eastern Drainage Tunnel.
9. Mexico is a federal country composed of 32 federal entities (31 states plus the Federal District of Mexico City). The third level of government is composed of 2 441 municipalities and the 16 delegations of the federal district.
10. The areas concerned were public health (NOM-022-SSA1-2010), monitoring (NOM-156-SEMARNAT-2012), mobile sources (NOM-041-SEMARNAT-2006, NOM-042-SEMARNAT-2003, NOM-044-SEMARNAT-2006, NOM-045-SEMARNAT-2006), stationary sources (NOM-040-SEMARNAT-2002, NOM-098-SEMARNAT-2002, NOM-137-SEMARNAT-2003, NOM-148-SEMARNAT-2006) and fuel quality (NOM-086-SEMARNAT-SENER-SCFI-2005).
11. The instruments included NOM-083-SEMARNAT-2003 for the location, design and operation of disposal sites and the closure of dumps, as well as several related to hazardous waste management (defining characteristics of hazards NOM-052-SEMARNAT-2005, waste management PROY-NOM-160-SEMARNAT-2011, disposal NOM-055-SEMARNAT-2003 and polychlorinated biphenyls NOM-133-SEMARNAT-2000).

12. Several new standards were published in 2000 and 2001 regarding water supply networks and domestic sanitation equipment (NOM-09-CONAGUA-2001, NOM-10-CONAGUA-2000, NOM-11-CONAGUA-2000).

13. New standards were published regarding aquifer recharge (NOM-014-CONAGUA-2007, NOM-015-CONAGUA-2007), and one on ecological flows is well advanced.

14. Of these, 286 are in the oil and petrochemical sector, 215 apply to hazardous waste treatment plants and 160 to the chemical sector, 131 to metallurgy, 27 to the automotive sector, 20 to paints and inks, 16 to electricity generation, 9 to asbestos, 8 to cellulose and paper, 2 to cement and lime, and 2 to the glass industry.

15. Ecological land use plans can be developed at municipal level, state level (with application to a full state or just to part of it, e.g., the coastal zone), regional (e.g., the Gulf of Mexico) and national level.

16. Including the Army, the Navy, Federal Police, and Federal Highway Police, as well as state security forces.

17. In the original study the term "effectiveness" aggregates both compliance with and enforcement of the norms.

18. In Mexico, self-regulation is defined as a voluntary process in which a company not only complies with compulsory environmental laws and regulations but also improves its environmental performance by adopting other activities and meeting complementary or stricter norms. Performance improvements can be evaluated with environmental auditing.

Selected sources

CONAGUA (Comisión Nacional del Agua) (2011), "Logros en el sector hídrico 2007-2010", CONAGUA, Mexico, DF.

INEGI (Instituto Nacional de Estadística y Geografía) (2012), *Sistema de Cuentas Nacionales de México: Cuentas económicas y ecológicas de México, 2006-2010*, INEGI, Aguascalientes.

GoM (Government of Mexico (2011), "Quinto Informe de Gobierno", GoM, Mexico, DF.

OECD (2010), *Cities and Climate Change*, OECD, Paris.

OECD (2011), *Towards Green Growth: Monitoring Progress: OECD Indicators*, OECD, Paris.

SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) (2009), *Programa Nacional para la Prevención y Gestión Integral de los Residuos, 2009-2012*, SEMARNAT, Mexico, DF.

SEMARNAT (2010), *Logros de la Instrumentación de la Estrategia de Transversalidad de Políticas Públicas para el Desarrollo Sustentable en la Administración Pública Federal (APF) en 2009*, SEMARNAT, Mexico, DF.

SEMARNAT (2011a), "OECD Environmental Performance Review of Mexico", Response to the Questionnaire.

SEMARNAT (2011b), "Programas de Gestión de la Calidad del Aire", *www.semarnat.gob.mx/TEMAS/GESTIONAMBIENTAL/CALIDADDELAIRE/Paginas/programas.aspx*, accessed 11 May, 2012.

SEMARNAT (2011c), *Evaluación de Instrumentos Normativos del Sector Ambiental*, SEMARNAT, Mexico, DF.

UAM-A (Universidad Autónoma Metropolitana-Azcapotzalco), Álvarez, V.M., J.J. Figueroa Lara and A.H. Moreno (2010), *Evaluación y Seguimiento del Programa para Mejorar la Calidad del Aire en la Zona Metropolitana del Valle de México 2002-2010*, UAM-A, Mexico City.

World Bank (2011), "Project Appraisal Document on a proposed loan from the IBRD in the amount of USD 350 million, Strategic Climate Fund-Forest Investment Program (SCF-SIP) in the amount of USD 16.34 million and a proposed grant from the Strategic Climate Fund-Forest Investment Program (SCF-SIP) in the amount of USD 25.66 million to the United Mexican States for the Forests and Climate Change project", 21 December, World Bank, Washington, DC.

PART I

Chapter 3

Towards green growth

Mexico has to confront difficult trade-offs in pursuing its economic, social and environmental goals. This chapter examines Mexico's use of taxation policy to pursue environmental and social objectives and progress in removing environmentally harmful subsidies. The chapter also looks at other economic instruments to implement the polluter-pays and user-pays principles and to recover the cost of providing environmental services. Mexico's innovation performance, including on environment, is also assessed. Finally, the chapter briefly reviews the environmental dimension of Mexico's development co-operation and mechanisms for environmental co-operation in trade agreements.

Assessment and recommendations

In its transition to green growth, Mexico needs to address challenges that affect both developing and developed countries. On the one hand, population and income growth, urban sprawl and higher motorisation rates are placing growing pressures on natural assets and public health. On the other hand, the gap in living standards between Mexico and the rest of the OECD has widened, and Mexico's income inequality and poverty rates are among the highest in the OECD. Mexico has a rich natural asset base and production and consumption patterns are less energy- and material-intensive than in more developed economies, although this gap has narrowed over the last decade. The economic costs of environmental degradation and natural resource depletion have declined, but they still represented about 7% of GDP in 2010. As in other OECD countries, massive investment will be needed to support the transition to a low-carbon, resource-efficient economy and to enhance quality of life in Mexico.

As the last *OECD Economic Survey* recommended, Mexico needs to rebalance its tax structure by raising non-oil-related taxes and broadening the tax base. Extending the use of environmentally related taxes, and reforming environmentally harmful subsidies, could contribute to achieving this objective while also reducing environmental pressures. For example, Mexico does not apply excise duties on energy products. Prices of transport fuels are regulated via a price-smoothing mechanism that results in an implicit subsidy at times of high world oil prices. This subsidy represented net expenditure of 1.2% of GDP in 2011, despite the fact that the government progressively raised fuel prices in the late 2000s. Overall, energy subsidies, including those for electricity consumption in the agricultural and residential sectors, averaged about 1.7% of GDP per year over 2005-09. This policy is costly and inhibits incentives to reduce energy use.

There is also considerable scope to improve the tax treatment of motor vehicles. Vehicle taxes, while less economically efficient than fuel taxes and road charges in reducing emissions, can help renew the fleet in favour of cleaner vehicles. Mexico levies taxes on purchase and ownership of vehicles, but related revenue is lower than in most other OECD countries. In 2012, states were authorised to levy the annual vehicle ownership tax, but fewer than half have done so. While new electric and hybrid cars are exempt, tax rates are not linked to the environmental performance of vehicles. These taxes have not fostered the use of more efficient, lower-emission vehicles, and generally favour the better off. In addition, other distortionary incentives for road transport are in place. They include a 50% tax credit on road tolls paid by transport businesses and very favourable tax treatment of company cars and parking spaces for employees. Overall, this mix of incentives encourages vehicle ownership and use, exacerbating congestion, accident risks and environmental problems.

Wider use of market-based instruments, in addition to promoting more efficient use of energy and other resources, would help finance much-needed environmental infrastructure. Investment in water infrastructure nearly tripled between 2000 and 2010,

enabling Mexico to exceed the water and sanitation Millennium Development Goals. However, substantial additional investment will be needed to bring the provision of environmental services up to the levels in other OECD countries. Mexico has made some progress in implementing water charging systems: abstraction charges vary according to water availability, and pollution charges are based on the status of water bodies and type of pollutants, thereby applying the polluter-pays principle. However, these charges have provided limited incentives to reduce water losses and improve efficiency of water use. Water abstraction for agriculture is virtually free of charge. Tariffs for public water services remain relatively low and do not allow service providers to cover their costs. The private sector has played a limited role in the water sector, not always improving the efficiency, or reducing the cost, of service provision. Very few cities charge for waste services, and investment in waste management fell by a third between 2000 and 2009. Weaknesses in local waste management have allowed the informal sector to play an important role in provision of waste services, with negative consequences for both the quality of service and the living and health standards of the workers. Governance in the water and waste management sectors needs to be strengthened in parallel with increased financing.

Mexico has continued to reform its support policy to agriculture and fisheries: the level of support has declined since the early 2000s and is well below the OECD average. However, subsidies linked to production still account for half of overall agricultural support, which is higher than in a number of other OECD countries. As these forms of support stimulate production and input use, they provide environmentally harmful incentives and encourage intensification and expansion of agriculture. Overall, many energy and agricultural subsidies have been intended to address social concerns. However, they have not efficiently supported low-income households and farmers: the poorest 20% of the population captures only 11% of residential electricity subsidies and less than 8% of transport fuel subsidies; similarly, 90% of agricultural price support and 80% of electricity subsidies for water pumping benefit the richest 10% of farmers. All these subsidies could be replaced by direct social spending. Programmes such as the one to replace electricity subsidies for pumping irrigation water with direct cash transfers illustrate the way forward and should be scaled up.

Tackling poverty and improving affordability of basic services have long been high on the political agenda in Mexico. New targeted cash transfer programmes such as "Oportunidades" have helped improved education and health outcomes. In the late 2000s, SEMARNAT launched a programme for indigenous people and the environment. The government also implemented programmes, such as "ProÁrbol", that aim to alleviate poverty in rural communities by promoting sustainable management of their natural resources. However, Mexico spends more on regressive and environmentally harmful energy and agricultural subsidies than on direct social transfers.

The need to boost the productivity and competitiveness of the economy through innovation has been recognised in Mexico for some time. However, the overall framework for innovation has not been effective and Mexico has fallen short of its objectives. It has the least R&D-intensive economy in the OECD and one of the lowest private sector shares in gross expenditure on R&D. Innovation outcomes have been weak, though there have been somewhat higher levels of patenting activity for some environmental technologies and renewables. A widespread preference for imported technology has hindered technology diffusion and transfer to Mexican firms, particularly small and medium-sized enterprises.

Programmes to promote sustainable urban transport and efficient buildings have potential for creating green markets.

Mexico receives very limited official development assistance (ODA), equivalent to about 0.02% of GDP over the last decade. However, it has received increased support for climate change since the Copenhagen pledges, in sectors such as forestry, which could play a strategically important role in leveraging domestic efforts. Mexico is among the most active countries in triangular co-operation in Latin America, particularly on environment, climate change and green growth. In 2011, a law on development co-operation was passed and an aid agency was established with the obligation to report on ODA flows both received and granted. Trade agreements have also provided mechanisms for environmental co-operation and compliance. However, further efforts could be made to better integrate environmental and trade policies.

Recommendations

- Gradually replace the diesel and petrol price-smoothing mechanism with an excise tax on transport fuels; introduce excise duties on other energy products; differentiate the excise tax rates to reflect the environmental externalities associated with the use of these products, including their contributions to greenhouse gas (GHG) emissions and local air pollution; where needed, provide social transfers for those adversely affected by increased energy prices.
- Restructure vehicle taxes to take account of vehicles' environmental performance, including emissions of GHGs and local air pollutants; ensure that the vehicle ownership tax is applied in all states; reduce perverse incentives for vehicle use by removing tax credits for fuel use and road tolls, and by reforming the tax treatment of company cars and parking spaces.
- Regularly assess the environmental, social and economic impacts of existing and proposed direct and indirect subsidies in an integrated way, with a view to improving transparency and identifying trade-offs and subsidies that could be removed, reduced or redesigned; replace perverse subsidies to energy use, agriculture and fisheries with targeted cash transfers to low-income households and small farmers (e.g. building on the "Oportunidades" programme).
- Building on the 2030 Water Agenda and the OECD-Mexico water dialogue, develop a strategic financing plan for the water supply and sanitation sector, based on a projection of the medium-term public expenditure required and a gradual introduction of pricing based on sustainable cost recovery; implement the proposed policy and institutional reforms; identify ways to ensure that even the poorest people have adequate access to water services.
- Extend the waste charging system; develop a sound waste management system that includes the participation of workers currently part of the informal waste sector; promote and monitor the performance of public-private partnerships in waste management.
- Strengthen innovation capacity, including by greater support for higher education, international co-operation in science and technology, and public-private partnerships; strengthen the capacity to absorb and adapt cleaner technology, particularly in small and medium-sized enterprises.
- Develop a strategy for development co-operation focussing on areas where Mexico has expertise, such as forestry, biodiversity and climate change; speed up the development of the Mexican Information System on International Co-operation for Development in line with international methodology and guidelines.
- Continue to promote integration of environmental and trade policies, including by enhancing co-operation to address environmental issues in the northern border region; reinforce efforts to assess the environmental impact of trade, including by involving the public.

1. Introduction

Green growth policies can provide a means of addressing some of the main economic challenges many countries face today – low growth, high unemployment, budget deficits – while also reducing some of the key environmental pressures that could undermine sustainable economic development. Reflecting this perspective, Mexico has assigned high priority to green growth, particularly at international level. It made green growth a priority issue during its presidency of the G20 in 2011-12; it hosted the inaugural conference of the Green Growth Knowledge Platform, which is intended to strengthen analysis of economy-environment links; and, it established a Centre for Research on Sustainable Development and Climate Change. Mexico was also one of the first countries to apply the OECD set of green growth indicators to its domestic situation.

Mexico's commitment to green growth is a response to the complex nexus of economic, social and environmental challenges it faces. The economy has been growing in line with the OECD average over the last decade, but, in 2010, GDP per capita (in purchasing power parities) was still the second lowest among OECD countries. Mexico is the second most unequal country in the OECD in terms of income, and the poverty rate is the highest in the OECD, with poverty especially high among indigenous people. Thus growth is crucial for Mexico's overall development strategy and for alleviating the poverty that millions of its citizens endure. Addressing these challenges requires Mexico to develop a growth strategy that includes provision for further extension of environmental services (clean water, basic sanitation, sanitary waste disposal) in line with levels in other OECD countries, investment in the green infrastructure required to facilitate the transition to a low-carbon, resource-efficient economy, and establishment of a policy framework that provides adequate incentives to develop and deploy clean technology. Wider dissemination of efficient technology is particularly needed to help boost Mexico's productivity, which lags behind that of other OECD countries.

Mexico has also recognised that a growth strategy that does not take sufficient account of the environment can impose significant costs on the economy. It has been estimated that the cost of environmental degradation and natural resource depletion represented 7% of GDP in 2010 (Chapter 1). Environmental factors that can be particularly costly include the health impact of air pollution and of scarce and poor-quality water, and the impact of extreme weather events. Strengthened environment policies in Mexico can also play an important role in addressing issues of global significance. As Mexico is a mega-diverse country, its policies to protect biodiversity have implications for global genetic stocks and conservation of unique flora and fauna (Chapter 5). In addition, Mexico is currently the 13th largest producer of greenhouse gases (GHGs). Analysis has shown that, without policy change, GHG emissions may be 70% higher in 2050 than in 2000 (Chapter 4).

Over the last decade, Mexico has significantly strengthened its national environment policies and demonstrated impressive international leadership in areas such as climate change and water management. Nevertheless, as an emerging economy, Mexico has to confront difficult trade-offs in pursuing its economic, social and environmental goals. In striking this balance, there has been a tendency to use indirect subsidies to help the poor rather than direct social transfers in the form of, for example, lower prices for energy and water. This approach has not always been effective for achieving its main policy goals. Thus there is considerable scope to rebalance the policy mix and to promote the transition to a socially inclusive form of green growth in a more effective and efficient manner.

2. Greening the tax system

Mexico's tax system stands out among OECD countries in several respects, including the low tax-to-GDP ratio, the reliance on oil-related tax revenue, the extended use of tax benefits, the low tax collection rate and the low level of local taxation (Box 3.1). The *2011 OECD Economic Survey of Mexico* recommended reforming the tax system so as to secure the substantial resources the country needs to effectively promote economic growth and alleviate poverty and inequality. Tax reform should primarily aim at raising non-oil-related tax revenue and broadening the tax base by removing most tax expenditure.

Box 3.1. **Key features of the Mexican tax system**

In 2010, total tax revenue accounted for about 18% of GDP, the lowest tax-to-GDP ratio in the OECD.[1] The total includes revenue from taxes on oil production and sale, which averages about a third of the government budget receipts. This reliance on oil-related tax revenue leads to volatility and uncertainty, and affects public spending cycles, because revenue depends on world oil price fluctuations. In addition, maintaining the current level of oil production (and revenue) in coming decades will require high investment in exploration (OECD, 2011a).

Several factors contribute to keeping non-oil tax revenue low. They include the large informal economy and the large share of low-income households, which make it difficult to raise revenue from income taxes. Another factor is the extended use of tax expenditure,[2] which narrows the tax base, generates revenue loss and introduces complexity in the tax system. Government estimates indicate that tax expenditure accounts for 4% of GDP and around 20% of government revenue. Tax expenditure takes the form of zero and reduced VAT rates, special tax regimes for some economic activities, exemptions on fringe benefits and a special tax mechanism for transport fuels (which is discussed further in this chapter). Tax revenue of subnational governments is also low and covers a limited share of their spending. Subnational governments have some taxing power, but have made limited use of it due to weak enforcement capacity and political disincentives (OECD, 2011a).[3]

1. For comparison, the OECD average was about 34% in 2009.
2. Tax expenditure is defined as provisions of tax law, regulation or practice that reduce or postpone revenue for a comparatively narrow population of taxpayers relative to a benchmark tax. They may take a number of different forms: allowances, exemptions, rate relief, tax deferral, and credits.
3. For example, local property taxes make up for a lower share of revenue than in other Latin American countries (OECD, 2011a). State and local authorities prefer to lobby for higher transfers from the federal government instead of bearing the political cost of tax increases (see also Chapter 2).

Extending the use of environmentally related taxes and removing environmentally harmful subsidies (Section 4) would substantially contribute to this objective and generate environmental benefits, such as GHG emission abatement, water savings and preservation of ecosystem services. The government has acknowledged this in policy documents such as the Special Climate Change Programme 2009-12 (Chapter 4). Also, the greening of typical local taxes, such as those on property, and better use of service charges could help strengthen the budgets of local governments, which are responsible for providing basic environmental services.[1] As the following section explains, there is wide scope to improve environmentally related taxation while addressing the distributional impact through targeted social benefit programmes.

2.1. Environmentally related taxes

As in all OECD countries, environmentally related taxes largely coincide with taxes on energy use and vehicles.[2] However, Mexico does not apply fixed excise duties on energy products used for transport and stationary combustion. Instead, since 2000 it has applied a price-smoothing mechanism to diesel and petrol. In practice, the government sets domestic fuel prices every month. If they are higher than international reference prices, the differential effectively represents an excise duty, known as the Impuesto Especial Sobre Producción y Servicios (IEPS). However, if domestic users pay prices below the international reference prices, the IEPS becomes an implicit subsidy.[3]

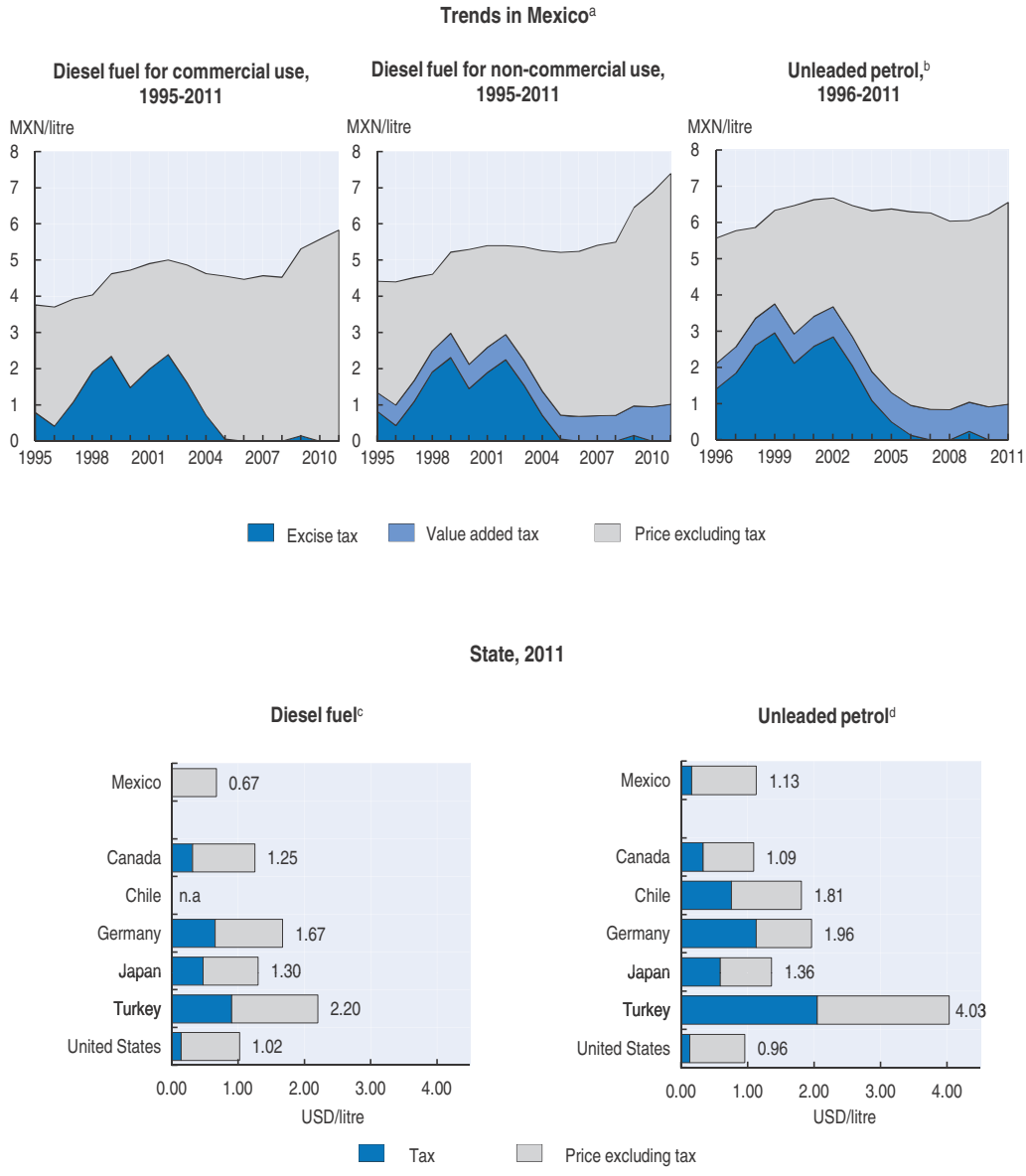
Figure 3.1 shows the application of this mechanism: real fuel prices were kept nearly constant between 2000 and 2008, which resulted in declining or even zero (or negative) tax rates in 2003-08, while world oil prices were rising. This mechanism cancelled the potential incentive to reducing fuel use that higher fuel prices would have provided. In a welcome move, the government has gradually raised consumer prices since 2008.[4] Preliminary estimates by the National Ecology Institute (INE) indicate that this price increase may have resulted in reducing petrol consumption by between 10 billion and 44 billion litres (depending on the assumptions) from 2006 to 2011, resulting in lower emissions of GHGs and local air pollutants (Muñoz Piña et al., 2011). However, transport fuel taxes and prices remain lower than in most OECD countries, although less so when differences in purchasing power are taken into account (Figure 3.1).

This price-smoothing mechanism results in annual variations of revenue from energy taxes and from overall environmentally related taxes (Figure 3.2). In 2002, when oil prices were low, revenue from energy taxes and environmentally related taxes reached 1.6% and 1.9% of GDP, respectively. This was in line with the corresponding OECD averages that year. However, with high oil prices in 2008, the Mexican price-setting method resulted in net expenditure for fuel subsidies of 1.8% of GDP. According to an OECD estimate, this was equivalent to subsidising CO_2 emissions from transport at a rate of USD 234 per tonne of CO_2 (OECD, 2012a). Despite the subsequent increase in fuel prices, energy and environmentally related tax revenue continued to be negative in 2010-11, while environmentally related taxes averaged about 1.6% of GDP in the OECD (Figure 3.2).

Mexico should let diesel and petrol prices be freely determined by the market, and replace the price-smoothing mechanism with an excise tax on transport fuels. This would lead to additional revenue as well as environmental and welfare gains. For example, Parry and Timilsina (2009) estimated that an excise duty of USD 1 per gallon of petrol (or about MXN 3.6 per litre) would increase annual welfare by a value of about USD 80 per capita in Mexico City due to reduced congestion, pollution and GHG emissions.[5] In addition, Mexico should levy excise duties on other energy products that are not currently taxed, such as electricity, natural gas and coal, and remove a number of tax credits and direct subsidies to energy use (see Section 4). Ideally, energy tax rates should include a component reflecting the carbon content of fuels to ensure that a form of carbon price emerges across the economy. Tax rates should also be differentiated according to the content of other pollutants, such as sulphur. There have been some government proposals to tax energy products while increasing social welfare programmes, but they have always met strong political opposition.

Taxes on vehicle purchase and ownership are the other main component of environmentally related tax revenue, although they play a minor role. Revenue from

Figure 3.1. **Road fuel prices and taxes**



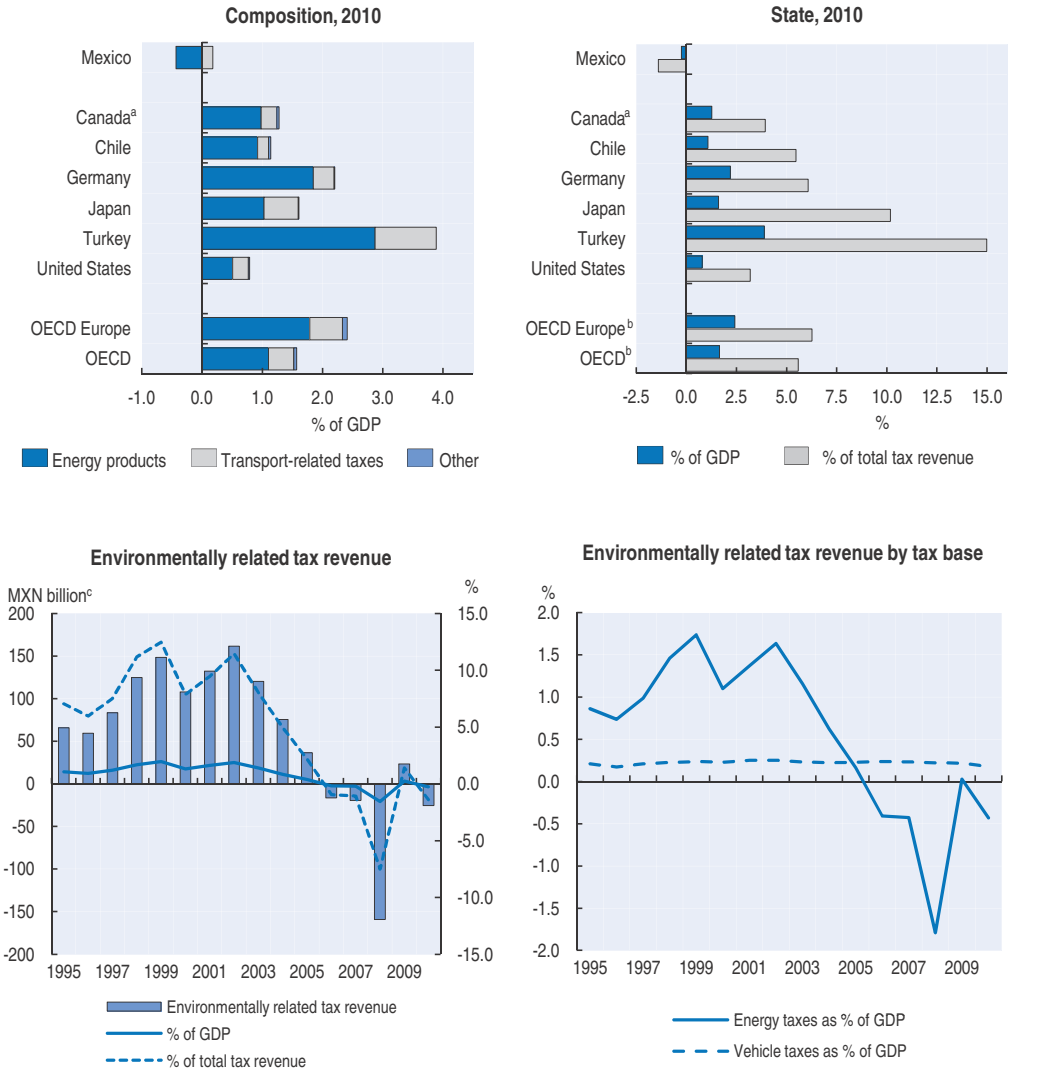
a) At constant 2005 prices.
b) Regular unleaded.
c) Automotive diesel for commercial use at current prices and exchange rates.
d) Unleaded premium (95 RON) at current prices and purchasing power parities. Mexico and Japan: Unleaded regular.
Source: OECD-IEA (2012), *Energy Prices and Taxes*.

StatLink http://dx.doi.org/10.1787/888932755661

vehicle taxes hovered around 0.2% of GDP between 2000 and 2010, one of the lowest shares among OECD countries and about half the OECD average.

Mexico levies a one-off tax on purchases of new passenger vehicles (including imports), the *Impuesto Sobre Automóviles Nuevos* (ISAN). The rate is progressive, rising with the vehicle purchase prices, and exemptions are granted to cheaper vehicles. Another tax, the *Impuesto Sobre Tenencia o Uso de Vehículos* (ISTUV), used to be paid annually on vehicles less than ten years old, at rates depending on vehicles' value and passenger capacity or

Figure 3.2. **Environmentally related taxes**



a) 2009 data.
b) Weighted average.
c) Constant 2005 prices.
Source: OECD-EEA(2012), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management;* OECD (2011), *OECD Economic Outlook No. 90.*

StatLink http://dx.doi.org/10.1787/888932755680

weight. The tax was repealed in 2012 at federal level, but states can now levy the tax and collect the full revenue. Fewer than half the states (among them the Federal District) have exercised this power, and tax competition among states has eroded the tax rates. While neither tax takes vehicle environmental performance into account, in 2008 the government introduced an exemption for new electric and hybrid cars.

Overall, these taxes have not provided sufficient incentives to shift to smaller, more efficient and lower-emission vehicles. Estimates indicate that in 2000-08 the fuel economy of new cars purchased in Mexico improved less than in other countries, such as European countries, partly due to an increase in the market share of heavier vehicles (Sheinbaum-Pardo

and Chávez-Baeza, 2011). A shift towards smaller and more fuel efficient new vehicles has been observed in recent years, however, probably due to the impact of the 2009 recession (Islas Cortés et al., 2012; see also Chapter 4). In addition, as the ISAN applies only to new vehicles and both taxes are progressive in terms of purchase price, they encourage purchases of cheaper and older used vehicles, which tend to be less technologically advanced and therefore potentially more fuel and emission intensive. Used vehicles represent a relatively large share of the vehicle fleet, especially in the northern border regions: in the late 2000s, some 80% of vehicles in use in these regions were relatively old used vehicles imported from the United States of America (INE, 2011).

Mexico should restructure both vehicle taxes to take account of vehicles' environmental performance, as many other OECD countries do. With many parts of the country, including the capital, suffering from high air pollution and being prone to photochemical smog, the tax rates could be partly based on emission levels of local air pollutants and GHGs, as is done in Israel, for example (OECD, 2011b). At the same time, vehicle fuel efficiency or CO_2 emission standards should be introduced in addition to the existing pollutant emission standards (Chapter 4). While taxes on vehicle ownership are theoretically less economically efficient than fuel taxes and road charges in reducing emissions (OECD, 2009a), the experience of many countries shows that such taxes help renew the vehicle fleet in favour of cleaner vehicles.

3. Extending the use of other market incentives for environmental policy

Mexico has made some progress in using market-based instruments other than taxes to create incentives for using natural resources more efficiently and reducing pollution and environmental damage. Overall, economic instruments have primarily taken the form of environmentally motivated subsidies. Charging systems have been implemented mainly in the area of water and, to a lesser extent, biodiversity management. As discussed below, the pricing mechanisms in place have a number of weaknesses.

3.1. Water charges and prices

Water abstraction and pollution charges have long been in place (OECD, 2003), in an effort to reflect the value of the water resource and to apply the polluter-pays principle (Box 3.2). However, charges vary significantly depending on use, and water abstracted for agriculture is mostly not charged. Overall, the water abstraction charges do not provide sufficient incentives to reduce water losses and improve efficiency of water use, which remains very low in both agricultural and urban areas (Chapter 1). The incentive function is also virtually nullified by some subsidy programmes, especially in the agricultural sector (Section 4).[6] At the same time, difficulties enforcing pollution charges undermine their effectiveness. In addition, water charges are not systematically adjusted for inflation. As a result, revenue from water abstraction and pollution charges declined as a percentage of GDP in the 2000s; in 2010, it represented less than 0.1% of GDP.

Tariffs for household water supply and sanitation services remain relatively low and benefit from a zero VAT rate. Averaging about MXN 7 (USD 0.50) per cubic metre in 2008, they were the lowest in a sample of 20 OECD countries (CONAGUA, 2010a; OECD, 2010a). The national average hides wide variations among municipalities,[7] but generally the tariffs do not reflect the water stress of the service area. Also, they cover operating costs for only a minority of water service providers (Box 3.2). This shortfall undermines service efficiency and the ability to invest in infrastructure development.

Box 3.2. **Water pricing**

Water charges are set by the Federal Duties Law and are collected by the National Water Commission (Comisión Nacional del Agua, CONAGUA). They include water administration charges (e.g. for processing water concession titles or water discharge permits) and water abstraction charges. Part of the revenue from the latter is earmarked for national programmes of payment for ecosystem services (Chapter 5). The abstraction charges are volumetric and apply to abstraction of both underground and surface water to be used in public water supply, agriculture, industry self-supply, thermal power generation and hydropower. They vary according to the classification of municipalities in nine zones of availability, ranging from MXN 1.6092/m^3 to MXN 20.5042/m^3. Water service providers pay charges for raw water for domestic use at significantly lower levels, ranging from MXN 0.047/m^3 to MXN 0.40620/m^3 depending on zone. Those charges are doubled when per capita consumption in the service area exceeds 300 litres per day. Rural population centres of less than 2 500 people and agricultural water users are exempt from water use charges and from water administration charges. Agricultural users only pay for water use that exceeds the licensed amount, at a rate of MXN 0.1452/m^3. There are also charges for non-consumptive use, such as hydropower generation, aquaculture and spas.

Water pollution charges are applied to users discharging wastewater above pollution levels, which vary according to status of water body (three levels) and type of pollutant (chemical oxygen demand and total suspended solids). Two federal programmes reimburse water charges to water utilities to pay for investment in water supply and sanitation (PRODDER) and reimburse water pollution charges to users who invest in water pollution control equipment (PROSANEAR).

Tariffs for water supply and sanitation services are set independently by each municipality. Water tariffs generally have an increasing-block structure, with between 5 and 17 blocks in the main cities, and are differentiated by type of final user. In Mexico City, tariffs are also differentiated by affordability criteria (Section 5). In 2006, the average tariff covered some 45% of total costs; thus most water utilities are not financially self-sufficient and over half did not even recover operating costs. Moreover, water tariffs often do not keep up with inflation; from 2006 to 2007, out of a sample of 32 cities, four increased tariffs but by a rate less than inflation, five did not change tariffs and one reduced them. In the last decade, increasing attention has been paid to increasing billing and bill collection rates; between 2002 and 2007, the bill collection rate increased from 72% to 84%.

Source: Cámara de Diputados (2011); CONAGUA (2010a); OECD (2010a).

3.2. Paying for biodiversity benefits

As Chapter 5 discusses in more detail, Mexico applies several economic instruments for biodiversity conservation and sustainable use. They include an internationally renowned programme of payment for ecosystem services (PES), targeting multiple ecosystem services. It takes a relatively sophisticated approach, channelling financing to forest areas with high watershed benefits, high risk of deforestation, and globally significant biodiversity. However, evidence on the effectiveness of the PES, for example in terms of reducing deforestation, is mixed (Chapter 5; OECD, 2012b). The Forest Land-Use Change Compensation Mechanism is similar to biodiversity offsets, and requires developers of infrastructure projects to compensate for loss of forest area by paying into a compensation fund. Pricing instruments, such as fees for access to protected areas and for sport hunting and fishing licences, are also in place. The number of protected areas

charging access fees steadily increased over the 2000s. These charges have helped finance conservation activities and accounted for some 7% of the federal budget allocated to protected areas in 2010. Their use could be further extended to cover growing financing needs, as only 40% of protected areas currently charge an entrance fee. Overall, Mexico should broaden its array of economic instruments for biodiversity policy, introducing instruments that can encourage sustainable use of natural resources as well as generate revenue. Examples include taxes/charges on agricultural inputs, duties on fishing licences and royalties on harvested timber (OECD, 2012c).

3.3. Waste charges

Mexico is lagging in the use of economic instruments for waste management. Deposit-refund systems have been implemented for beer bottles and for car batteries, oil and tyres, with mixed results. Only seven cities have imposed charges for household waste collection, and in only four of them (Aguaprieta, Merida, Puebla, and Tehuacan) is billing effectively, albeit not fully, enforced: only in Merida, the waste bill collection rate reaches 80%. These cities levy flat-rate charges differentiated by city area, with lower rates for the service provided in poorer areas.[8] The charges are not quantity based, however, so they do not encourage waste reduction. Still, despite being very low, they have helped generate some revenue to cover a part, albeit very limited, of the cost of service provision (SEMARNAT, 2009a). Such charging systems could usefully be extended to other cities.

The 2009-12 National Programme for the Prevention and Integrated Management of Waste envisages the introduction of economic instruments, including waste collection tariffs, based on evaluation and feasibility studies. The programme also foresees increased participation of the private sector in the provision of waste management services, with a view to implementing an integrated waste and material management approach (SEMARNAT, 2009a). However, little progress has been made in this regard. Limited municipal institutional capacity and the large role of informal workers (*pepenadores*) in the waste sector constitute a barrier to wider implementation of waste charges. In some cities, including the capital, household waste charges are prohibited by law. While there is wide social resistance to paying for formal waste collection, a large part of the population pays tips to informal waste pickers. The government calculates that, in some cases, the tips are higher than municipal waste charges would be. As the programme recognises, formally involving the pepenadores is necessary to assure implementation of effective municipal waste-management systems, as well as to improve the social, health, and living standards of these workers.

3.4. Greenhouse gas emission trading

The 2012 Climate Law opens the possibility of establishing a domestic trading system and linking it to those of other countries (Chapter 4). This could enable Mexico to sell emission rights to countries participating in such systems that have more expensive abatement options. However, such instruments generally entail high start-up administrative and transaction costs and a steep learning curve, and require sound monitoring and enforcement procedures. A careful evaluation of the costs and implications of such a system will, therefore be needed. A form of carbon tax, as mentioned in the previous section, could be an easier option to implement, as a system for collecting taxes is already in place. Mexico has extensively used the clean development

mechanism since 2005. However, more consideration could be given to projects with large emission reduction potential, such as those in the electricity and oil industries (Chapter 4).

3.5. *Rewarding environment-friendly goods and activities*

In general, in the area of pollution control and climate change mitigation, including energy efficiency, Mexico has primarily used subsidy-based instruments to reward the purchase of supposedly more environment-friendly goods. The instruments have included soft loans and tax deductions for businesses' environment-related investment (including in renewable energy sources); zero tariffs on imports of pollution control equipment;[9] and tax credits for scrapping of buses and heavy goods vehicles. A vehicle scrapping programme ran between 2009 and 2010 (Chapter 4).[10] Measures to improve energy efficiency in the residential sector have included subsidies to replace old home electric appliances and loans to low income households for purchases of energy- and water-efficient houses or for home retrofitting (*hipotecas verdes*). The contribution of these measures to reducing energy consumption and GHG emissions is discussed in Chapter 4 (see also Table 4.1).

All these mechanisms can encourage businesses and consumers to make more environment-friendly purchases by raising awareness, reducing upfront costs and/or improving access to credit. However, they come at a cost to the budget and discriminate against households and businesses that cannot afford such purchases and investments. From an environmental perspective, these measures are generally less efficient than instruments such as taxes that directly incorporate the cost of environmental damage into market prices. Among other effects, by targeting a limited range of "cleaner" products or activities, subsidy-based measures encourage firms and consumers to adopt the subsidised solutions even when other options would be more effective (OECD, 2012d). And the funds they free up can be used to increase consumption of energy and natural resources, thereby offsetting the potential efficiency and environmental gains at product level (rebound effect). This is of particular concern in Mexico, where energy prices are kept artificially low. Such incentives would be less necessary or more effective if a number of subsidies to energy use were removed, as discussed in the next section.

4. Removing environmentally harmful subsidies

As the following sections discuss in more detail, Mexico spends a considerable amount on support measures that have the potential to harm the environment. They include direct and indirect subsidies to energy use, agriculture, fishery and car use. Many of these subsidies contravene the polluter-pays and user-pays principles, distort competition, lock in inefficient technology and lead to inefficient allocation of resources. They weigh on current public finances, and can entail additional expenditure to compensate for their distortive effects and to remediate the potential environmental and health damage. Many subsidies have long been in place to address social concerns. However, as Section 5 notes, most of these subsidies have not efficiently supported low-income households and farmers, as they tend to benefit the wealthiest population groups, and could be replaced by direct social spending programmes.

A reform of these perverse support measures would help improve Mexico's environmental performance and the efficiency of public expenditure, with potentially high social and economic benefits. Subsidy reform raises intricate political economy concerns. The experience of countries that have undertaken such reform shows that the conditions for success include systematic analysis of the likely social impact (identification of winners

and losers); appropriate compensatory measures; transparent communication of the purpose, cost and beneficiaries of the subsidies and of their removal; and awareness-raising initiatives (OECD, 2012b; World Bank, 2012a). The Mexican government already conducts annual surveys of subsidies and tax expenditure and of their distribution among segments of the population. It could build on those surveys to assess its subsidy policy's broader environmental, social and economic impact. This would help identify the subsidies that could be removed, reduced or reshaped.

4.1. Energy subsidies

Support to energy consumption accounts for a large part of the environmentally harmful subsidies. The government estimates that subsidies for electricity, petrol, diesel and liquefied petroleum gas (LPG) for domestic use averaged more than MXN 200 billion or about 1.7% of GDP per year over 2005-09. Electricity use in the residential and agriculture sectors accounted for most of these subsidies (63%), followed by petrol and diesel (31%) and LPG (SENER, 2010).

Petrol and diesel use is indirectly subsidised by means of the price-smoothing mechanism described in Section 2. Despite increases in regulated fuel prices (Section 2; Figure 3.1), in 2011 this subsidy was estimated at MXN 169 billion or nearly 1.2% of GDP (SHCP, 2011). In addition, when fuel prices are such that the IEPS is a positive tax, fuel-tax credits are available in the agriculture and fisheries sectors and for commercial vessels, commercial road freight and passenger transport, manufacturing and certain non-transport uses of diesel (OECD, 2011c; OECD, 2012a).

Electricity consumption in the agriculture and residential sectors benefits from subsidies in the form of reduced tariffs.[11] Electricity subsidies in Mexico are among the largest in the world and are partly linked to the high cost of electricity provision (Komives et al., 2008; OECD, 2011a). The cost of the subsidy for household electricity was more than three times the amount of investment in the electricity sector for 2007-10. These subsidies are one reason why residential electricity consumption has grown more rapidly than that in other sectors and in the economy as a whole (Chapter 4). In agriculture, Mexico spends more on subsidies to partly cover the cost of electricity for water pumping than it does to improve irrigation infrastructure: in 2011, the subsidy cost MXN 8 074 million (USD 649 million), more than nine times the support to farmers' investment in more efficient water infrastructure (MXN 855 million) (OECD, 2012).[12] This subsidy, together with the exemption from the water abstraction charge, has encouraged wastage of water resources and runs counter to the objective of, and public spending on, efficient irrigation systems (Box 3.3).

Overall, by lowering end-use energy prices, energy subsidies encourage wasteful energy consumption, thereby impairing energy security and generating higher GHG emissions. As they reduce incentives to invest in energy-efficient technologies and appliances, the subsidies also weaken the effectiveness of various forms of budgetary support for renewables and energy efficiency (Section 3; Chapter 4). The LPG subsidy, furthermore, hampers the uptake of natural gas and renewables such as thermal solar for domestic use. This system is highly costly and inefficient, and it runs counter to Mexico's ambitious climate change mitigation goals. OECD simulations indicate that phasing out fossil fuel consumption subsidies could reduce Mexico's GHG emissions by 10% by 2050, compared with business as usual (Chapter 4).

Box 3.3. **Electricity subsidisation in the agricultural sector**

Water used in agriculture accounts for over three-quarters of Mexico's water abstraction. The agricultural electricity subsidy covers more than 60% of the cost of electricity for pumping irrigation water (Muñoz Piña et al., 2006). By artificially lowering prices for pumping irrigation water, the subsidy has contributed to keeping the efficiency of water use low and to the overexploiting of groundwater aquifers (Chapter 1). The subsidy also discourages investment in more efficient irrigation technology. In addition, it has a very unequal distribution, as it is mostly captured by owners of large irrigated farms. Farmers in the highest income decile receive an annual subsidy of more than USD 330 000, whereas farmers in the lowest decile receive from USD 28 to USD 72 per year (Table 3.1).

Table 3.1. **Distribution of agriculture electricity subsidy across farm income deciles**

	Average implicit electricity subsidy for water pumping (USD per year)	
Income decile	Aquifers suffering low to medium overexploitation	Highly overexploited aquifers
1	28	72
2	300	558
3	965	1 931
4	2 464	4 243
5	4 674	6 675
6	7 507	9 746
7	11 239	13 680
8	16 590	18 671
9	24 793	27 129
10	330 814	388 714

Source: INE.

StatLink http://dx.doi.org/10.1787/888932756079

Research shows that removing the subsidy would lead to water abstraction falling by 15% in the short term. It would also encourage a shift to more water-efficient technology such as drip irrigation and sprinklers, resulting in a 19% reduction in water abstraction in the long term (Muñoz Piña et al., 2006). In addition, INE estimated that this would result in GHG emission savings of about 980 000 tonnes of CO_2 eq per year (Muñoz Piña et al., 2010).

Because of these results, in July 2011, the government launched a pilot programme to partly decouple the amount of the subsidy from electricity use. The programme involves 13 aquifers with more than 8 000 potential beneficiaries. Participating farmers pay a higher electricity price, although still partially subsidised and below the average cost of electricity generation. In exchange, they receive a cash-transfer equivalent to the forgone electricity subsidy, calculated on the basis on their average consumption for the previous three years. The result is that farmers receive a less distorted price signal yet do not incur a net income loss.

Source: INE; Muñoz Piña *et al.* (2006).

The government, in national energy strategies, has reiterated its goal of reforming energy prices and subsidies. Some progress has been made, although much more could be done. As Section 2 indicates, the government has gradually increased regulated prices of petrol and diesel, but this does not prevent implicit subsidies when world oil prices are

high, as in 2011 (Figure 3.1). The government has launched a new cash-transfer programme to help poor households cover their energy needs, yet the household electricity subsidy remains fully in place. Mexico's pilot programme to replace electricity subsidies for pumping irrigation water with direct cash transfers in some states, thus removing the price distortion (Box 3.3), could provide experience to support broader energy subsidy reform.

These direct and indirect subsidies should be gradually removed. The government should address the potential negative impact on household budgets and well-being through targeted cash transfers; for example, it could expand the successful "Oportunidades" programme (Section 5). Such transfers should be designed so as to avoid a shift to cheaper, dirtier fuels such as traditional bioenergy (e.g. wood or animal manure). Improving the efficiency of the electricity sector and allowing for more competition, accompanied by sound regulation, would also help lower end-use prices and create a basis for removing electricity subsidies. In addition to halting environmentally harmful incentives, such a reform would be more effective in alleviating poverty and would help reduce public expenditure, as implicit subsidies to higher income households would be avoided (OECD, 2011a).

4.2. Agricultural support

Agriculture accounts for a larger share of GDP and employment in Mexico than in many other OECD countries (Chapter 1). As in many other OECD countries, agricultural producers receive various forms of support. Mexico has continued to reform its support policy to agriculture in the last decade. The level of support had declined since the early 2000s, in terms of what is provided to farmers and the cost to the economy as a whole: total agricultural support dropped from an average 1.25% of GDP in the early 2000s to 0.7% of GDP in 2009-11, slightly below the OECD average of 0.9%. In particular, support for farmers as measured by the share of producer support estimate (PSE)[13] declined from 23% of gross farm receipts in 2000-02 to 12% in 2009-11. This is well below the 20% OECD average.

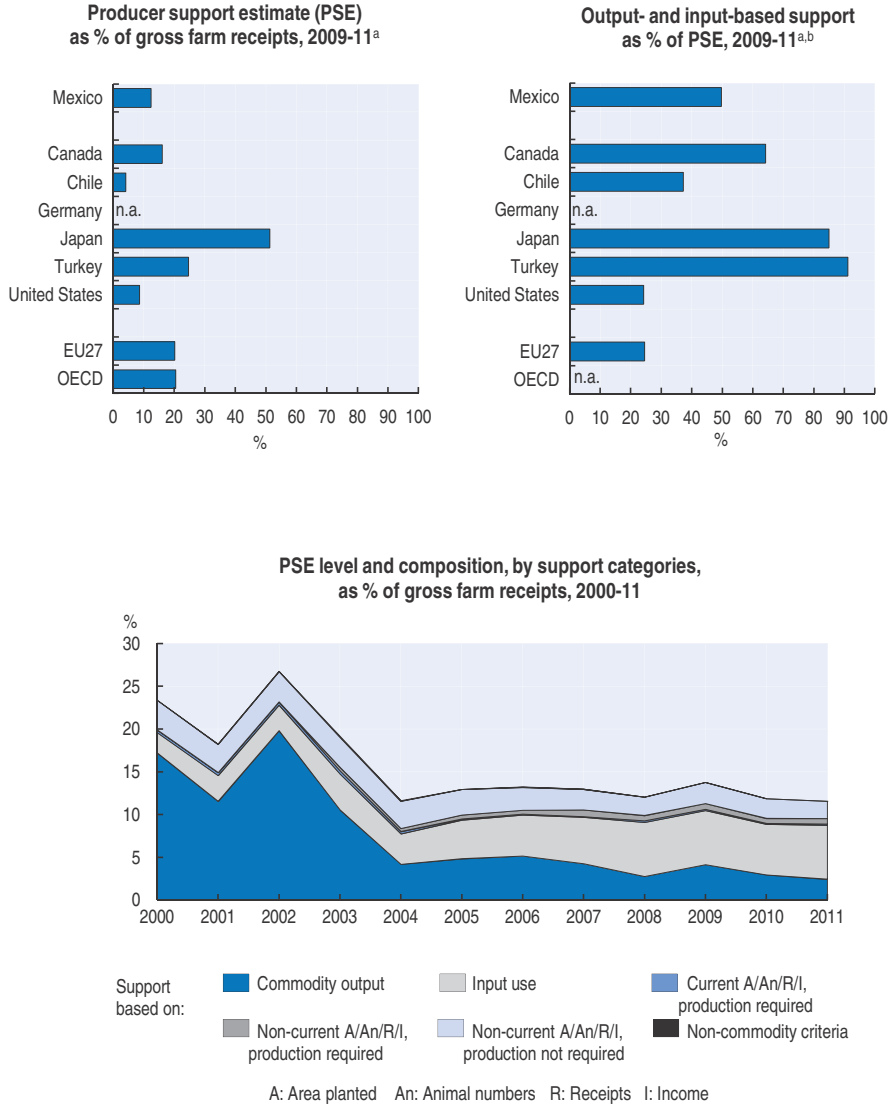
PSE from subsidies linked to output level and input use, the most distorting subsidies, also declined, from 20% of gross farm receipts in 2000-02 to 9% in 2009-11 (Figure 3.3). However, support based on input use has increased since 2000. This includes the electricity subsidy for water pumping (Box 3.3) and tax exemptions on fuel use. Despite their decline, subsidies linked to production still account for half of PSE, a level higher than in many other OECD countries (Figure 3.3). Such subsidies include a price support programme that targets ten basic crops (mainly grains), some of which are water-intensive (Ingreso Objetivo).[14] Overall, as they stimulate production and input use, these forms of support provide environmentally harmful incentives and encourage intensification and expansion of agriculture, with a potentially negative impact on the use of water, land, fertiliser and pesticides. The amount of these subsidies is estimated to be well above that of environment-oriented programmes such as the PES system. There is evidence that some subsidy programmes have accelerated land-use change and deforestation in some areas of the country, thereby working against Mexico's biodiversity policy (Chapter 5). In addition, as Section 5 will show, many agricultural subsidies are highly regressive, since they mainly target the largest producers with little positive impact on overall productivity (OECD, 2011a).

Water, a key factor in agricultural production, is still heavily subsidised. While farmers in irrigation districts pay fees for irrigation services (Garrido and Calatrava, 2010), farmers with consumption below a certain threshold are exempt from the water abstraction charge. Even when applied, the charge remains below those in other sectors and does not

vary with water availability (Box 3.2). This represents an implicit subsidy to agriculture, a sector that also benefits from an electricity subsidy for irrigation water (Box 3.3) and a VAT exemption on agrochemicals.

The government should consider ending potentially distorting subsidies such as Ingreso Objetivo and divert the resources to support general services to agriculture, including investment in rural infrastructure, training and education. During a transition period, beneficiaries could receive cash transfers decoupled from production and prices as a temporary compensation measure. The pilot programme to decouple subsidies from electricity use can provide useful experience in this regard (Box 3.3). Remaining agricultural support should be tied to meeting environmental requirements.

Figure 3.3. **Agricultural subsidies**



a) Unweighted averages.
b) Payments based on commodity output and variable input use.
Source: OECD (2012), *Producer and Consumer Support Estimates Database.*

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4.3. *Fishery support*

Mexico is one of the major fishing countries in the OECD (Chapter 1). Between 2000 and 2010, its fishery production, including aquaculture, grew by 20%. Mexico provides financial transfers to both marine capture fishing and aquaculture. Government financial transfers to the marine capture industry account for two-thirds of total transfers to the sector. They decreased from 19% of the value of production in 2003 to 8% in 2007, which is well below the OECD average of 22%. Most transfers in this sector have been direct payments and cost-reducing transfers, primarily fuel subsidies, direct grants and a decommissioning programme for the shrimp fleet. In 2007, such support amounted to 8% of the value of landings, well above the OECD average of 3% (OECD, 2006; OECD, 2010b; OECD, 2011d).

Some of these subsidies, particularly those for fuel, engine purchase and vessel modernisation, have potential for environmentally harmful effects as they encourage increases in fishing capacity and effort, despite most Mexican fish stocks being classified as fully exploited (OECD, 2010b). Moreover, while the decommissioning subsidy resulted in a decrease in fleet size, there remains a risk of fishing effort expanding, as major fisheries are regulated only by limits to entry; there are few constraints on expansion of input or effort. Most of the direct payment and cost-reducing transfer programmes should be reduced, as they mask price signals for inputs, distorting operating decisions and generating increased fishing pressure. In addition, financial transfers should be accompanied by management changes to ensure that effort does not expand (OECD, 2011d).

4.4. *Incentives to vehicle ownership and use*

In addition to implicit subsidies to fuel use, other distortionary incentives for road transport are in place and can have a potentially negative environmental impact. There is, for example, a 50% tax credit on road tolls paid on national motorways by transport businesses. Also, as in many countries, the tax treatment of company cars can provide incentives to car ownership and use. Mexico is one of the few countries in which company cars are fully exempt from employee income taxation, a fact that can encourage employers to provide income in the form of a car. About one-third of all newly registered cars in 2009-11 were company cars, a higher share than in many other OECD countries, including the US. The OECD (2012f) estimates that forgone revenue due to this tax exemption amounts to nearly 0.3% of GDP. The fixed cost of company cars is deductable from corporate income up to a certain threshold, which provides an incentive to buy cheaper, smaller cars.[15] They are not necessarily less polluting or more fuel efficient, however. Fuel expenses, moreover, are deductable from corporate income up to a generous cap of MXN 250 (USD 18.5) per-day per-car (SHCP, 2011). Hence, employers have nearly no incentive to limit the use of company cars by employees, who in turn face virtually no additional cost linked to actual car use and have no incentive to drive less or more efficiently. While it is difficult to distinguish between personal and work use of company cars, some form of taxation of their ownership and use should be considered.

Free parking for employees provided by employers is also a non-taxed benefit in kind. In contrast, commuting expenses paid by employers are part of employees' taxable income, though with some tax advantage when public transport is used (OECD, 2012f). Overall, this mix of incentives encourages driving to work (mainly at rush hours and to/from particularly congested locations), exacerbating congestion, accident risk and

environmental problems. The incentives should be removed by, for example, including parking spaces among taxable benefits. The environmental effects of removing these distortionary incentives for car ownership and use would be enhanced to the extent that efficient and reliable alternatives to private car transport are made available.

5. Reconciling environmental and poverty alleviation objectives

5.1. *Inequality, poverty and the environment*

Income inequality in the working age population in Mexico has declined since the mid-1990s. However, it remains the second highest in the OECD, after Chile, and well above the OECD average (Chapter 1). Also, the poverty rate is the highest in the OECD. Poverty is especially elevated among indigenous people, children and the elderly. The share of the population living in extreme poverty (on less than USD 1.25/day) dropped in the first half of the 2000s but grew from 3.9% to 5.3% between 2006 and 2010. Poverty in absolute terms, which takes account of access to food, health, education and housing, rose considerably as well. The high level of absolute poverty is also reflected in other indicators: infant mortality is three times the OECD average, and the illiteracy rate is above the OECD average.

Limited access to basic environment-related services is one of several dimensions of poverty in Mexico. In the last decade, the country has made considerable progress in this regard, although improvement has been uneven and wide variations persist among states. For instance, more people now have access to sanitation and drinking water services, which has resulted in health improvements such as a decrease in child mortality from waterborne diseases (Chapter 1). However, in the state of Guerrero nearly 20% of households lack basic sanitation facilities and nearly 30% have no tap water at home, whereas the corresponding figures in the state of Mexico City are 0.1% and 1.8%. Similarly, access to electricity has greatly improved: in 2010, 1.8% of households had no access to electricity, compared to 4.8% in 2000. However, in states such as Guerrero and Oaxaca more than 4% of households have no electricity at home. These two states and Chiapas are also those with the highest level of marginalisation, which the National Population Council (Consejo Nacional de Población) bases on education, housing, income and geographical isolation indicators. Overall, the level of marginalisation is higher in smaller, more isolated, poorer and rural settlements, and those with relatively large indigenous populations (Consejo Nacional de Población, 2011).

Such communities are also highly dependent on natural resources for their livelihoods and basic needs. Natural capital contributed some 5% to Mexico's total wealth in 2005, still more than the average of 2% for high-income OECD countries, although down from 10% in 1995 (World Bank, 2011a).[16] Yet the contribution of natural assets to wealth tends to be much higher in poorer areas of the country, especially in forest areas (Chapter 5). It is estimated that 13 million people live in forest areas; about 5 million of them are indigenous people, most of them living in extreme poverty (USAID, 2010). At the same time, a considerable proportion of the richest biodiversity areas and of water catchment basins are located in the poor, indigenous areas (SEMARNAT, 2009b).

5.2. *Effectiveness and environmental impact of poverty alleviation measures*

Direct social transfers

Tackling poverty and improving affordability of basic services have long been high on the political agenda in Mexico. New targeted cash transfer programmes have been

introduced in the last decade. An example is the federal human development programme "Oportunidades", a well-targeted conditional cash transfer programme covering about 5.8 million families. It has helped improve education and health outcomes. However, most of the poverty reduction programmes continue to exclude families living in only relative poverty, and unemployment programmes remain rudimentary. Also, coverage is still limited in urban areas.

Overall, the redistributive impact of the tax-benefit system is lower in Mexico than in many countries. This is because the share of progressive income taxes in overall tax revenue is low, as is spending in relation to GDP per capita (OECD, 2011a; OECD, 2011e). While public cash benefits as a share of disposable income have increased, they still constitute some 7% of disposable income, well below the OECD average of 12%. In addition, a large part of the social security programmes benefit higher-income households, with less than 10% of spending going to the poorest 20%.[17] Therefore, making the tax-benefit system more progressive and broadening its coverage are priorities.

Subsidised energy and water bills

Mexico spends more in indirect subsidies meant to help the poor than in direct social transfers. These indirect subsidies include those to energy use that have environmentally harmful effects (Section 4). In 2008, the energy subsidies cost more than twice the amount spent on anti-poverty programmes and 1.4 times the health budget (OECD, 2009b; OECD, 2011a); in 2011, the petrol and diesel subsidy was worth about 2.5 times the "Oportunidades" programme.

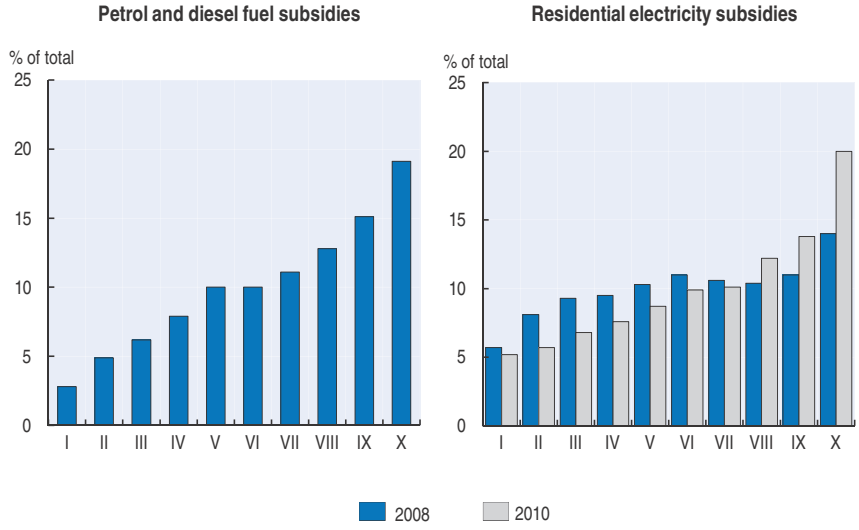
These energy subsidies are meant to ensure that low-income households can afford energy services. However, they are highly regressive and are inefficient as a poverty-alleviation mechanism, as they are largely captured by higher income groups. This is because the benefits depend on household expenditure on the subsidised products, which tends to increase with income. The richest 20% of the population captured about 33% of the residential electricity subsidies in 2010, substantially more than the 11% share attributed to the lowest 20%. Moreover, the distribution of electricity subsidies in 2010 was more unequal than in 2008. Similarly, nearly 35% of the petrol and diesel subsidy benefitted the two highest income deciles in 2008, compared to less than 8% going to the poorest 20% of the population (Figure 3.4).

Therefore, Mexico should consider phasing out energy subsidies and increasing targeted social transfers. One way to do this, as the OECD (2011a) has noted, would be to strengthen "Oportunidades" or complement it to compensate low-income households for subsidies' removal. Withdrawing energy subsidies and VAT exemptions could free between 2.5% and 3% of GDP, which should be sufficient resources to finance an extended social assistance system (OECD, 2011a).

In the water sector, Mexico applies increasing block tariffs in setting prices for water supply and sanitation services, so as to address affordability constraints (Box 3.2). Little or nothing is charged for the first block to give low-income households access to basic water services and provide a cross-subsidy from larger water users. This mechanism also provides incentives for larger consumers to save water. However, areas of "water poverty" remain: in 2008, water bills represented up to 4.2% of the income of the poorest 10% of households. This compared with the national average of 0.3% of household income, which was in line with many other OECD countries (OECD, 2011f).

Figure 3.4. **Distribution of energy subsidies across income deciles**

2008 and 2010



Source: Ministry of Finance and Public Credit (2012 and 2010), *Distribución del pago de impuestos y recepción del gasto público por deciles de hogares y personas.*

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This seems to confirm that increasing block tariffs are regressive in countries such as Mexico where networks are still incomplete. As the poorest segments of the population are not yet connected, they cannot benefit from the consumption subsidy. In addition, empirical research indicates that water demand is not very sensitive to income change, which implies that poor households do not necessarily consume much less water than better-off ones. Also, poorer households are often larger, so they may consume more than smaller, higher-income ones (OECD, 2010a; OECD, 2011f).

In an attempt to better design water tariffs, the government of Mexico City differentiates tariffs according to a development index. The index is based on a dynamic geo-statistical model that calculates the level of socio-economic development of each city block. Other ways to tackle affordability include providing direct income support (to compensate poor households for increases in water prices), facilitating payment and adjusting tariff structures to account for household size (OECD, 2010a; OECD, 2011f).

Poverty alleviation programmes in rural, forest and natural areas

The government uses several community-based incentives and advisory programmes to help rural communities manage their natural resources, while contributing to social development and poverty alleviation. This approach recognises that sustainable use of natural resources is key to improving socio-economic conditions in rural and forest areas. It also acknowledges that rural communities and indigenous people are instrumental in preserving Mexico's rich biodiversity.

A number of such programmes fall under the government's forestry policy and are managed by the National Forestry Commission (CONAFOR). In particular, in 2007 CONAFOR launched "ProÁrbol", which integrated most forestry support programmes (Chapter 5). "ProÁrbol" provides subsidies to landowners for a range of activities aimed at protecting,

restoring and using forests sustainably and creating job and income opportunities. The programme has been considerably scaled up since its inception. The National Commission of Natural Protected Areas runs similar subsidy programmes in protected areas and other conservation priority regions. These include the Programme of Conservation for Sustainable Development (PROCODES), which provides financial assistance to poor rural and indigenous communities living in protected areas. Similarly, the Ministry of Environment and Natural Resources (SEMARNAT) provides support to the management units for wildlife conservation, or UMAs, as tools for income and employment generation (Chapter 5). Vulnerable population groups have also received most of the payments in the framework of the PES programme, accounting for more than 80% in 2004 (OECD, 2012b; see also Chapter 5). In addition, SEMARNAT manages a programme providing temporary environment-related jobs and income in rural areas.[18] The Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) also manages a range of support programmes targeting low-income farmers.

In many cases these support programmes have succeeded in building social capital, raising living standards in rural areas and promoting sustainable natural resource management (World Bank, 2011b). However, there seems to be a proliferation of programmes, which are often based on modest financial resources and provide temporary income support. It is not possible from the available information to single out the long-term poverty alleviation effects of the programmes (SEMARNAT, 2011a), and there is little evidence that they have helped halt or reverse environmental degradation in targeted areas. Further use of indicator-based monitoring and evaluation mechanisms would help assess the social and environmental effectiveness of these support programmes. Conflicts associated with natural resource use continue to happen in certain areas under some form of nature protection. In some areas, the poor seem unable to reap the benefits of biodiversity conservation and sustainable use, and perceive conservation requirements as barriers to traditional economic activities, such as agriculture and animal husbandry (USAID, 2009). There is, therefore, a need to focus on capacity building and to assure broad participation of rural communities in decision making related to rural and forest areas. Such efforts would help ensure that benefits are shared equitably, thereby raising living standards (World Bank, 2011b). SEMARNAT's programme for indigenous people and the environment 2007-12 was a welcome step in this direction.

However, much of the support to rural areas is provided in the form of agricultural subsidies that worsen inequality and are environmentally harmful (Section 4). The richest 10% of farmers own about 75% of the land, by value, and receive the majority of subsidies, including 90% of market support such as Ingreso Objetivo (Scott, 2010) and 80% of electricity subsidies (Box 3.3). Large commercial farmers are likely to cumulate transfers and subsidies from different programmes, while the rural landless are left out. Overall, the Gini coefficient for agricultural subsidies is an estimated 0.9, very close to maximum inequality. Hence, better targeting of agricultural subsidies to small and medium-sized farms is necessary to improving income distribution (Scott, 2010). At the same time, as Section 4 mentioned, Mexico could build on the pilot programme on irrigation electricity subsidies to further untie support from input use and production levels so as to avoid environmentally perverse effects.

6. Investing in the environment to promote economic growth

6.1. Environment-related components of the stimulus packages

In response to the 2008-09 economic crisis, Mexico adopted a stimulus package accounting for 1.6% of GDP in 2009, less than the OECD average of 3.9% (OECD, 2009b; OECD, 2009c). Priority was given to spending measures (1.2% of GDP), mostly investment programmes, subsidies to employment and social transfers. Of particular interest from an environmental perspective were additional investment in sustainable urban transport, sewerage and water efficiency improvement, subsidies for replacement of inefficient light bulbs and electronic appliances, and a car scrapping programme. It is estimated that these measures[19] accounted for 10% of the total package (SEMARNAT, 2011b; ILO, 2010; GoM, 2010).

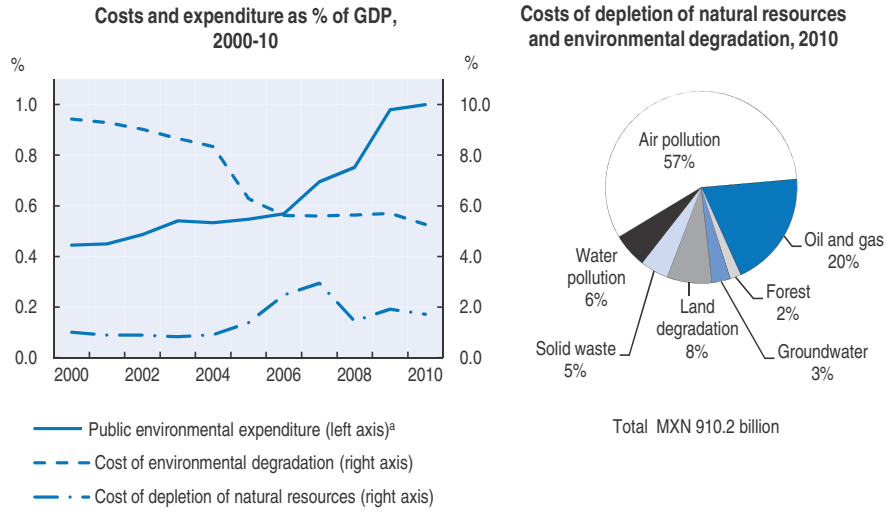
Investment in urban public transport has already recorded positive outcomes with growth in rail passenger traffic in metropolitan areas, but it has to be strengthened in the long term to influence the modal split (Chapter 4). Support to energy-efficient equipment in the residential sector has led to a broader project included in the Special Climate Change Programme. It is expected to have reduced GHG emissions by 2.7 Mt CO_2 eq by 2012, to have a low rebound effect and to assure appropriate disposal of scrapped items (including ozone-depleting substances) (World Bank, 2010); its environmental outcomes and cost effectiveness remain to be assessed. The car scrapping programme contributed to only a minor share of new vehicles sold and it was not linked to environmental performance of vehicles purchased. It is likely that the car industry in Mexico has benefitted more from the scrapping programme in the United States. In addition to these "green" measures, the stimulus package included increased energy price support, representing about 0.4% of GDP. The Mexican economy recovered swiftly from the global downturn, mainly on the strength of exports to the US.

6.2. Environment-related expenditure and financing

Public environmental expenditure[20] more than doubled in real terms between 2000 and 2010, growing from 0.4% to 1.0% of GDP. The growth was driven by increased investment related to wastewater, soil and groundwater and spending on biodiversity and forests, while investment on waste was reduced by one-third. By comparison, the cost of environmental degradation and depletion of natural resources was estimated at 7% of GDP in 2010, down from 10% in 2000 (Figure 3.5) (Box 3.4).

The federal budget continues to be the main source of funding for environmental expenditure. Only about 10% of subnational government revenue comes from subnational taxation and non-tax revenue. Charges on waste and wastewater cover a limited share of the cost of service provision. Between 2002 and 2011, the federal budget for environment and natural resources increased by about 9% annually, more than the average in other sectors (Chapter 2). This reflects the government's growing priority on addressing pressing environmental needs. Nevertheless, at 2% of the overall federal budget, the share for environment remains small. Financing for environment is also provided through loans secured by multilateral development banks (World Bank, Inter-American Development Bank). For example, in 2008-09, USD 2.7 billion in development policy lending was committed to environmental sustainability, climate change and green growth, equivalent to 16% of public environmental expenditure for the period (World Bank, 2011c). However, the exact amount of these flows and their conditions are difficult to assess.

Figure 3.5. **Environmental expenditure and costs of depletion of natural resources and environmental degradation**



a) Investment and current expenditure of federal (including public enterprises), state and local governments (municipalities since 2003). Includes expenditure on i) pollution abatement and control covering air protection, waste and wastewater management, protection and remediation of soil and groundwater, and other environmental protection activities (R&D, administration, education); and ii) biodiversity and landscape protection. Excludes expenditure on water supply.

Source: INEGI (2012), *Sistema de Cuentas Nacionales de México: Cuentas económicas y ecológicas de México, 2006-2010.*

StatLink http://dx.doi.org/10.1787/888932755737

Box 3.4. **Economic and environmental accounting**

Mexico was among the first countries to develop and implement a system of integrated economic and environmental accounting in the early 1990s. The Sistema de Cuentas Económicas y Ecológicas de México (SCEEM) makes it possible to estimate the impact on GDP of depletion of natural resources (oil and gas, forest, groundwater) and environmental degradation (air, soil and water pollution, land degradation). It is regularly updated under the National Statistics and Geography Institute (INEGI). SCEEM provides aggregated indicators such as net ecological domestic product, which is GDP adjusted for depreciation of capital and for imputed cost for environmental use (natural resource depletion and environmental degradation).

The costs of natural resource depletion increased until the middle of the past decade, driven by growing hydrocarbon production and declining reserves, but the trend has been reversed in recent years with new discoveries and reduced production levels. The costs of environmental degradation have declined due to air quality improvement.

Results of the SCEEM have provided useful insight for the drawing up of national development plans and environment programmes. However, they are not used to calculate budgetary requirements to offset environmental degradation, nor are they integrated in periodic reports of GDP.

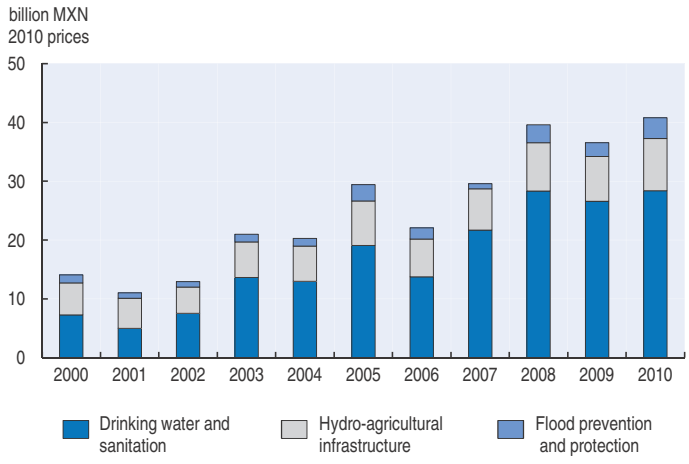
Source: INEGI (2012), *Sistema de Cuentas Nacionales de México. Cuentas económicas y ecológicas de México, 2006-2010.*

In the past decade, forests have become a national priority (Chapter 5). Since 2002, CONAFOR's budget has nearly tripled, in real terms, to MXN 6.5 billion (USD 520 million) in 2011, resulting in a significant increase in the forest area under conservation and sustainable management.

Water resource management has also been high on the Mexican policy agenda. Investment[21] in water infrastructure nearly tripled between 2000 and 2010 (Figure 3.6). Investment growth was particularly notable for drinking water and sanitation and, in the second part of the decade, flood prevention and protection. As a result, considerable progress was achieved in improving access to water services and decreasing mortality from water-related diseases. Between 2000 and 2011, the share of the population with access to drinking water increased from 87.9% to 91.6% and sanitation coverage rose from 76.2% to 90.2%. Mexico achieved and exceeded the related Millennium Development Goals and has set more stringent objectives for 2015.

Figure 3.6. **Investment in water infrastructure**

2000-10



Source: GoM (2011), *Quinto Informe de Ejecución del Plan Nacional de Desarrollo 2007-2012.*

StatLink http://dx.doi.org/10.1787/888932755756

However, the funding gap remains a major concern. Mexico has the lowest rate of connection to public wastewater treatment plants in the OECD. The rural population still has much less access to drinking water and sanitation than urban dwellers (Chapter 1). Within urban areas, there are significant backlogs in infrastructure and basic services. It has been estimated that MXN 51 billion (USD 4 billion) per year is necessary to achieve clean water bodies by 2030, along with balanced supply and demand for water, universal access to water services and settlements safe from catastrophic floods, as well as to maintain and operate the water infrastructure (CONAGUA, 2011b). There is therefore an annual funding gap of MXN 14 billion[22] (USD 1.1 billion). The National Water Commission (CONAGUA) estimates that the cost of the resulting restrictions on industrial activities would increase over time to MXN 1.5 billion (125 million USD) per year by 2030.

The lack of cost recovery through user fees is a major impediment to meeting investment needs in the water sector (OECD, 2010c). Funding relies almost entirely on government budgets and is disbursed through a variety of federal programmes, the largest

of which are managed by CONAGUA. Overall, private-sector participation and direct private financing of water investment has been rare (Box 3.5). There have been a few private sector participation contracts in the water and sanitation sector, which have been effective in raising funds for investments in facilities. However, with few exceptions (Aguascalientes, Cancun/Isla Mujeres, Saltillo), they have not improved the efficiency of water and sanitation providers and have increased the cost of service. The government is engaged in a water policy dialogue with the OECD to support implementation of Mexico's 2030 Water Agenda and identify institutional reforms needed to achieve its objectives (Chapter 2).

Box 3.5. **Private sector participation in water supply and sanitation services**

Private sector participation in water supply and sanitation services has been limited. Between 1992 and 2000, 26 contracts were signed, including service contracts (9 out of over 1 200 water operators in Mexico), concessions (5), management and leasing contracts (2) and build-operate-transfer/build-operate-own contracts (15). Between 2002 and 2008, only eight contracts were signed, all of them build-operate-transfer for wastewater treatment plants.

A successful example of private sector participation is the Aguascalientes full concession. The Aguascalientes service area has 693 000 inhabitants in the state capital and 46 rural communities. Under the concession contract, the private operator abstracts water, treats it, supplies it to customers, bills for it, collects payment and provides after-sales service. The process of private sector participation evolved gradually: it started in 1989 with a renewable 3-year partial service contract, and in 1993 a 20-year full concession contract was signed, which was later extended to 30 years. The partial service contract focussed on increased commercial performance; its achievements included a 42% increase in the number of registered customers, the installation of over 100 000 metres of pipe, productivity gains (the number of employees per 1 000 connections fell from 5 to 3) and a quadrupling of revenue. The concession contract was developed to meet a need for over MXN 660 million in investment to rehabilitate and expand infrastructure in order to increase coverage, service quality and efficiency.

Key indicators of success are improvements in technical efficiency (from 30% in 1993 to 50% in 2002, thanks to reduced water losses), commercial performance (the bill collection rate reached 97% in 2009) and coverage (it reached 98% in 2009, up from 61% in 1993). Between 1993 and 2002, tariffs increased from MXN 1.74 to MXN 8.05/m^3 in nominal terms; at the same time 7% of the revenue went into a social fund to provide support for households that couldn't pay the tariff. As a result of tariff increases and improvements in metering, billing and bill collection, water consumption was reduced from 370 litres per capita per day in 1993 to 240 in 2002.

Source: CONAGUA (2010b).

Mexico is vulnerable to natural disasters, including earthquakes, volcanic eruptions, floods and hurricanes. In 2010, economic losses due to severe hydrometeorological events were equivalent to 0.7% of GDP (Chapter 1). Mexico has moved from a corrective to a preventive approach to disaster risk management. It has developed an institutional framework for disaster preparedness involving risk assessment, risk reduction, prevention promotion and insurance. In particular, Mexico has developed a financial strategy for managing federal disaster costs, including: *i)* a natural disaster fund (FONDEN), drawing on

budgetary resources to cover the costs incurred in the most frequent types of disasters; *ii)* a reinsurance programme to cover unusually large losses without affecting public finances; and *iii)* a catastrophe bond that provides immediate emergency funds if a major disaster occurs. By issuing these catastrophe bonds, Mexico's federal government became one of the first governments to protect its public finance by transferring its exposure to hurricane and earthquake risks to specialised investors in the financial markets (Michel-Kerjan et al., 2011; World Bank, 2012b). In addition, SEDESOL launched in 2011 the Programme for Risk Prevention in Human Settlements (Programa de Prevención de Riesgos en Asentamientos Humanos), which extends financing of risk reduction to all municipalities.[23]

Shifting to a greener growth path requires Mexico to improve transport infrastructure and to better integrate transport and urban planning policies. Between 2000 and 2009, the transport sector was the fastest growing consumer of energy and the rate of motorisation doubled (Chapter 1). Investment in transport infrastructure increased significantly, from 0.3% of GDP in 2000 to 0.7% in 2010, just below the OECD average (Chapter 4). In 2008, Mexico created the Federal Support for Mass Transit Programme (PROTRAM) to improve the efficiency of urban transport systems. PROTRAM, complemented with loan programmes, has fostered the growth in rail passenger traffic in metropolitan areas in recent years. However, investment in rail accounted for 8% of total investment in transport infrastructure in 2010, a proportion well below that of other OECD countries. Support to public transport would need to be significantly scaled up to have an impact on car usage, and it will take many years to overcome the lock-in effect of the current organisation of cities.

In 2010, Mexico achieved the largest absolute increase in renewable energy investment in Latin America (UNEP, 2011). Investment in renewables, mainly in wind but also geothermal, more than quadrupled to reach USD 2.3 billion in 2010. This growth followed the adoption of the Law for Use of Renewables and Financing for Energy Transition and its implementing programme, which set a target of raising renewables-based power capacity (excluding large hydro) to 7.6% by 2012 (Chapter 4). Measures associated with high electricity prices for industry and technological developments have resulted in a significant expansion of wind power capacity for private self-generation. Despite a fall in investment in 2011 (to USD 0.2 billion), the renewables market is expected to strengthen from 2012 onwards (UNEP, 2012). However, much potential remains to be tapped, and the share of renewables in electricity production declined over the past decade. Fostering deployment of renewables will require better integration of environmental and social externalities in the cost of electricity, further grid development and steps to address land compensation issues.

7. Eco-innovation

7.1. Policy framework

Although the need to promote innovation as a driver for growth and competitiveness was recognised and reaffirmed in the 2001-06 and 2007-12 National Development Plans, until recent years, support for science, technology and innovation (STI) policy has been weak. Since 2000, several measures have been adopted, including a research and development (R&D) tax credit[24] in 2001, the 2002 science and technology (S&T) law and the 2001-06 Special Programme for Science and Technology. However, low budget allocations,

ineffective governance and a multiplicity of support programmes have continued to undermine performance in innovation (OECD, 2009d). Moreover, Mexico's structural conditions are not supportive to innovation, given the poor performance of the education system, lack of competition, barriers to business creation and to involvement of the private sector in key industries, problems with access to credit and poor policy co-ordination.

After an extensive consultation process, the government approved a 2008-12 programme to address these weaknesses. The main objectives of the Special Programme for Science, Technology and Innovation (PECITI) were to: *i)* establish short-, medium- and long-term policies to strengthen the links between education, basic and applied research, and technology and innovation; *ii)* promote decentralisation of STI activities; *iii)* increase STI funding, including from business; *iv)* increase investment in STI infrastructure; and *v)* evaluate the use of public resources to ensure that it targets national priority areas and to maximise impact on growth. Biotechnology, energy, environment and materials are among the nine PECITI priority areas.

Since 2002, the National Science and Technology Council (CONACYT) has been responsible for implementing STI policy and assuring inter-ministerial co-ordination. Along with sector ministries, it manages several funds to promote STI in various sectors. The energy and education ministries, with CONACYT, account for more than 80% of the federal S&T budget.

7.2. Innovation performance

Over the past decade, gross expenditure on R&D (GERD) grew in volume by more than 5% annually. Its share of GDP expanded from 0.34% in 2000 to 0.47% in 2010, then went down to 0.44% in 2011 (CONACYT, 2011, GoM, 2011). Mexico remains the least R&D-intensive economy in the OECD, where R&D spending accounted for 2.4% of GDP, on average, in 2009 (OECD, 2012g). Mexico fell short of its 2006 target of 1% of GDP and substantial efforts are needed to reach the 2012 objective set in the PECITI: 1.2% of GDP. While the share of business expenditure in GERD grew from 30% in 2000 to 45% in 2006, it has since been declining. In 2009, the R&D tax credit was replaced with direct support programmes, so more enterprises received public funding. However, this measure seems not to have delivered the expected increase in matching funding from the private sector. Mexican business expenditure on R&D, at 0.16% of GDP in 2010, is among the lowest levels in the OECD, where the average is 1.5%. Mexico appears off-track to achieve the objective of 0.65% of GDP in 2012. R&D funding from abroad is low by international standards, and its share in business expenditure has fallen sharply since the 1990s. In addition, Mexico still lags behind most other OECD countries in the production of highly skilled human resources. Although human resources for R&D more than doubled over 2000-10, they remain very low by international standards when compared to levels of total employment.

Innovation outcomes are also weak. Mexico continues to have one of the OECD's lowest levels of patents filed per capita under the Patent Co-operation Treaty (PCT) (OECD, 2010d). Even though the number of patent applications filed by Mexican nationals nearly doubled over the past decade, US and European Union nationals still account for the vast majority. A widespread preference for imported technology, furthermore, hinders technology diffusion and transfer in Mexican firms, particularly smaller enterprises. A significant level of patenting by Mexicans is in co-operation with foreign co-inventors: in 2000-09, such cases accounted for 23% of PCT applications, well above the OECD average of 8%.

7.3. Environment-related innovation policy

Over the past decade, the federal S&T budget for environmental purposes has remained stable in real terms, implying a decline in its share of the total S&T budget to 1% in 2010. This funding supports environment-related education as well as research carried out by INE, the Mexican Institute for Water Technology and the National Biodiversity Commission. However, very few of the research projects are applicable to industry (OECD, 2008). The share of energy in the total federal S&T budget had been steadily decreasing, reaching 13% in 2009, before growing to 18% in 2010 due to an increased PEMEX contribution to the sector fund of CONACYT and the Ministry of Energy. The Federal Law on Charges (Ley Federal de Derechos) provides for a proportion of the value of oil and gas extracted to be allocated to R&D on energy. The proportion, 0.05% in 2007, had grown to 0.65% by 2012. Two-thirds of the revenue is allocated to the Hydrocarbon Fund, which promotes innovation to increase the efficiency of PEMEX activities. In addition, about 20% is allocated to the Sustainable Energy Fund for projects on renewables, energy efficiency and cleaner technology.

Over 2003-08, water pollution abatement accounted for 1.9% of PCT patent applications and waste management for 1.4%, relatively high shares compared to other OECD countries where such technology is more mature. Patents on environmental management technology fell in the second half of the decade but applications concerning renewables (wind and solar thermal) increased, representing 2.5% of overall Mexican inventions for 2006-09; this reflects the development of national climate policy and the entry into force of the Kyoto Protocol (Chapter 4).

Innovation is a core element of Mexico's international co-operation on climate and environment. The country has signed numerous bilateral and multilateral agreements (with US, Canada, the EU, Japan) including provisions to spur innovation on climate-related technology. Under the Kyoto Protocol, clean development mechanism projects have enhanced technology transfers in wind power and biogas recovery. A study has shown that, compared with Brazil, China and India, Mexico has a bigger proportion of CDM projects that lead to technology transfer, mainly due to a sector-composition effect: many Mexican projects concern biogas recovery in breeding farms, a sector where transfer prevails (Dechezleprêtre, 2008). Weak enforcement of environmental regulations, energy subsidies and lack of involvement of the private sector have all contributed to weak performance in eco-innovation. Strengthening capacities to absorb and adapt technology developed abroad in sectors where it has potential (e.g. renewables) could help boost Mexico's competitiveness.

8. Environment, trade and development

8.1. Official development assistance

Mexico as a recipient

As an upper-middle-income economy, Mexico does not receive a significant amount of official development assistance (ODA): about 0.02%, on average, in the past decade. However, increased support for climate change activities has been reported since the Copenhagen pledge to scale up climate financing (Chapter 4). In 2010, DAC donors committed USD 340 million of bilateral ODA to Mexico for climate change mitigation, a contribution 16-times higher than in 2009 (DAC Statistics, June 2012). In addition, support to climate change adaptation amounted to USD 13 million. Bilateral aid in 2010 in support

of other Rio conventions also increased – twelve-fold for desertification, to USD 29 million, and two-fold for biodiversity to USD 20 million. Overall, bilateral environment-focussed aid to Mexico represented 0.04% of GDP.

Between 2000 and 2012, the Global Environment Facility granted USD 335 million to Mexico, of which about 41% was for co-financing activities related to climate change, 37% for biodiversity and the remainder for multifocal areas, international waters and persistent organic pollutants. In addition, Mexico receives support from the climate investment funds managed by the World Bank. In particular, the Clean Technology Fund (CTF) approved USD 414 million[25] in concessional loans over 2009-12 to support sustainable urban transport, energy-efficient equipment and renewables. In 2011, the Forest Investment Program (FIP) disbursed USD 42 million to help advance the REDD+ agenda on emission reduction from deforestation and forest degradation. While relatively small, these sums are expected to leverage significant co-financing from government, multilateral, public and private financial institutions (USD 3.6 billion for the CTF, USD 629 million for the FIP). As Mexico has been receiving an increasing amount of funds for climate-related initiatives there is a pressing need to measure and assess the environmental outcomes of this funding.

Mexico as a donor

Mexico's bilateral and regional development co-operation is directed mostly to Latin America and the Caribbean and primarily takes the form of technical and scientific co-operation for capacity development (OECD, 2011g). Mexico has implemented innovative support programmes, such as horizontal and triangular assistance co-operation with similar and less developed countries. It is among the most active countries in triangular co-operation in Latin America. It is engaged with Japan in environment and disaster prevention in Guatemala and El Salvador, with Germany and Japan on waste management in Guatemala and the Dominican Republic, with Spain on water and sanitation in Haiti and with Korea on climate and green growth in Latin America (OECD, 2009e). In 2011, environment accounted for 12% of the number of bilateral co-operation projects (Foreign Ministry, 2012).

In 2011, a law on development co-operation went into force and the Mexican Agency for Development Co-operation was created; it has an obligation to report on ODA flows both to and from Mexico. The Ministry of Foreign Affairs recently established a national system of information on international development co-operation, with support from INEGI, the OECD Development Assistance Committee (DAC), and the UN Development Programme. The system is intended to facilitate efficient, transparent reporting on Mexico's co-operation to the DAC.[26] In particular, this should help increase coherence, transparency and predictability in climate finance under the Busan Building Block on Climate Finance and Development Effectiveness,[27] which Mexico supports. A strategy on development co-operation will be developed to specify priorities of Mexico's development co-operation. The law specifies that sustainable development, environmental protection and climate change are to be among those priorities.

8.2. Trade and environment

International trade plays an important role in the Mexican economy. In 2010, exports of goods and services accounted for 30% of GDP and imports for 32%, above the respective OECD averages. Despite Mexico's efforts to engage in free trade agreements with other countries, the

United States remains its most important trading partner: around 80% of Mexican exports go to the United States, and 48% of Mexican imports are of US origin. Environmental co-operation provisions have been included in trade agreements signed with the US and Canada (the North American Free Trade Agreement, or NAFTA, 1994), the European Union (2000) and Japan (2005). In addition, Mexico unilaterally put a zero tariff on imported anti-pollution equipment that is not competitive with locally manufactured equipment.

The Commission for Environmental Co-operation (CEC) was created in 1994 following the entry into force of the North American Agreement on Environmental Co-operation (NAAEC), which accompanied NAFTA. The CEC addresses regional environmental concerns, helps avoid potential trade and environment conflicts, and promotes effective enforcement of environmental law (OECD, 2003). It has contributed to capacity building in Mexico in areas such as sound management of chemicals, pollution prevention and development of a pollutant release and transfer registry. It also set up a citizen submission process whereby residents and non-government organisations can raise issues related to failures to enforce environmental law. Overall, the establishment of the CEC was an innovative development. However, the Joint Public Advisory Committee (JPAC), which advises the CEC Council, recently recommended reviewing the citizen submission process with a view to increasing its impact on enforcement practices (JPAC, 2011). In response to these and other concerns, the CEC Council committed to and directed the implementation of a number of improvements to strengthen the governance of the CEC, including revisions to increase the timeliness, transparency, and accessibility of the citizen submission process, and reinvigorate public participation in the work of the CEC.

The CEC was also mandated to assess the environmental effects of NAFTA. It conducted symposia in 2000, 2003, 2005, and 2008 examining a broad range of environmental effects of trade in North America (CEC, 2008). A survey on eco-industries was part of this work (Box 3.6). Overall, only anecdotal evidence was found to support the "pollution haven" hypothesis that industry would relocate production facilities to benefit from lower environmental standards. On the contrary, a number of examples indicate that trade within NAFTA has helped improve environmental standards and regulations in Mexico (e.g. in the cement industry).

Increased trade has increased the scale of some activities, notably in the transport sector, where freight transport expanded massively, with associated effects on air quality. Increasing trade among NAFTA countries also spread alien invasive species, introduced through exchange with non-NAFTA countries (Perrault et al., 2003). JPAC recently expressed concern about transboundary movement of used lead acid batteries. Greater trade liberalisation was expected to facilitate diffusion of cleaner technologies and products, but only a few cases of technology diffusion were found, underlining the need to better link local firms with the global value chains of multi-national enterprises. Initiatives such as the Green Supply Chains Program[28] initiated by the CEC have delivered positive outcomes in this regard (Lyon and van Hoof, 2010). In sum, the analysis has shown that the objective of fostering collaboration among the three NAFTA countries on trade and environment issues has not been fully realised. The use of CEC studies for policy making has been limited, and efforts to integrate trade and environment issues have not been effective (Allen, 2012).

Under the NAAEC, the bilateral Border Environmental Co-operation Commission evaluates infrastructure projects for financing through the North American Development Bank (NADB). Since its establishment in 1994, the NADB has contracted a cumulative total

Box 3.6. **Trade and eco-industries in Mexico**

Improved environmental regulations and policies have been the main drivers of demand for and supply of environmental services and equipment in Mexico. The market value of the environmental goods and services (EGS) sector was estimated at USD 5.1 billion or 0.6% of GDP in 2006, up from 0.4% in 1995 (Table 3.2). Although it is difficult to clearly identify the effect of trade, increased influx of foreign manufacturers into Mexico, some of which brought higher environmental standards, contributed to the market growth. Mexican firms represented only 45% of the EGS market in 2006, and the trade deficit in EGS has widened over the years.

The water sector was the main source of employment in the EGS sector in 2009, with 132 484 jobs, followed by waste management (38 805 jobs), material recycling (37 752) and environmental consultancy and services (7 469) (SEMARNAT, 2011a).

Table 3.2. **Environment market and industry in Mexico**

	Mexican market[a] (% of total)		Mexican industry[b] (% of market)	Number of Mexican companies[c]	Imports (% of market)	
	1995	2006	2006	2006	2001	2006
Equipment						
Water equipment and chemicals	7	10	22	200	80	78
Air pollution control	6	4	29	100	75	75
Instruments and information systems	1	2	11	30	90	90
Waste-management equipment	4	5	71	300	40	40
Process and prevention technology	-	1	80	30	20	20
Services						
Solid waste management	16	15	73	1 200	20	28
Hazardous waste management	1	2	56	350	40	40
Consulting and engineering	4	4	50	900	50	50
Remediation/industrial services	8	7	43	120	60	60
Analytical services	-	1	67	70	40	40
Water treatment works	17	19	34	2 340	33	66
Resources						
Water utilities	25	20	57	1 360	33	44
Resource recovery	6	6	21	1 200	70	80
Clean energy systems and power	5	5	17	100	80	86
Total	**100**	**100**	**45**	**8 300**	**46**	**56**
Total (% GDP)	**0.4**	**0.6**	**0.3**			

a) Revenue from Mexican customers of all companies worldwide.
b) Revenue generated by Mexican companies worldwide.
c) Includes enterprises of the public sector, mostly in water, wastewater and waste management.
Source: Ferrier (2010).

StatLink http://dx.doi.org/10.1787/888932756098

of about USD 1.3 billion[29] in loans and grants to finance 154 certified projects for a total cost of USD 3.3 billion (NADB, 2012). About 60% of this funding went to projects in Mexico, and 40% to the US. Loan disbursements in real terms increased sixfold between 2006 and 2010. While historically the priority has been given to water and wastewater treatment, in 2010 air quality projects (road rehabilitation) constituted half of the NADB loan portfolio (NADB, 2010). As a result, progress has been achieved in addressing environmental and

public health problems in the border region. The ten-year Border 2012 Programme recorded: improved access to water and wastewater treatment services, establishment of an air monitoring system; retrofitting of diesel vehicles; remediation of contaminated sites; removal and sound disposal of used tyres; establishment of hazardous waste handling facilities; and development of binational emergency response plans in all 15 sister cities (SEMARNAT-EPA, 2011a). The new Border 2020 Programme includes strategies for: *i)* climate change; *ii)* underserved communities; *iii)* children's health; *iv)* environmental education; and *v)* strengthening of tribal, state, federal and international partnerships (SEMARNAT-EPA, 2011b).

Notes

1. For example, if mandatory energy standards for buildings were introduced, local property taxes could be linked to energy efficiency of houses (Chapter 4).
2. Mexico levies other taxes (or fees) of environmental significance on permits for road freight transport and for sport hunting and fishing licences. Revenue from all these is negligible.
3. The government refunds the price difference to the state-owned oil company, PEMEX, as a negative tax in a mechanism linked to the Fondo de Estabilización de los Ingresos Petroleros (Petroleum Revenue Stabilisation Fund).
4. The price increase was suspended in 2009 in response to the economic crisis.
5. By comparison, the maximum excise duty, reached in 2002, amounted to MXN 2.5. The duty was MXN 0.28 in 2009, the last year with a positive tax.
6. Subsidies for water use in sugar mills, the pulp and paper industry and mining were repealed in 2007.
7. From MXN 1.26 per cubic metre in Oaxaca to MXN 16.59 per cubic metre in Morelia, for consumption of 30 m^3 per month (CONAGUA, 2010a).
8. For example, rates vary from MXN 15 per month for poorer areas in Mérida and Tehuacán to MXN 80 per month in high-income residential areas. In some cities, volume-based charges are levied for collection of other municipal waste, such as that generated by hotels and shopping centres, with rates ranging from MXN 250 to MXN 350 per cubic metre.
9. Companies are allowed to deduct from their corporate income the full cost of the investment in one year. A zero tariff applies on the import of equipment for monitoring, prevention and control of pollution, provided that there is no equivalent domestically produced equipment.
10. As in other countries, the vehicle scrapping programme aimed at supporting the national car manufacturing industry. It provided (limited) subsidies to replace more than ten-year-old cars. All new vehicles below a certain price threshold were eligible, irrespective of their environmental or energy performance. The programme did not deliver the expected car sales.
11. The amount of the household electricity subsidy is decreasing in consumption volume, so that only the highest-volume consumers are not supported; warmer regions receive higher subsidies (OECD, 2011a).
12. Support programmes grouped under the Soil and Water Conservation Programme.
13. The PSE percentage expresses the monetary value of public transfers to producers as a percentage of gross farm receipts.
14. Ingreso Objetivo is a form of price support payment that provides subsidies equal to the difference between the market price and a reference that is meant to assure a fair income for farmers producing these goods. Payments have fallen to zero in recent years due to relatively high market prices.
15. In 2007, the threshold was reduced from MXN 300 000 to MXN 175 000.
16. The natural capital comprises agricultural land, protected areas, forests, minerals, and energy resources (World Bank, 2011a).
17. This is because many social security programmes cover only formal workers, who have higher incomes in general than Mexico's large share of informal workers (OECD, 2011a).

18. The eligible jobs include forest fire prevention, reforestation, forest management and soil conservation.
19. Not including additional investment in sewerage and water efficiency improvement.
20. Investment and current expenditure of federal (including public enterprises), state and local governments. Includes expenditure on: *i)* pollution abatement and control, covering air protection, waste and wastewater management, protection and remediation of soil and groundwater, and other environmental protection activities (R&D, administration, education); and *ii)* biodiversity and landscape protection. Excludes expenditure on water supply.
21. Investment of federal, state and local governments plus other investment of state commissions, housing developers, US Environmental Protection Agency and private initiatives.
22. Considering that MXN 37 billion was invested on average over 2007-10.
23. In doing so, SEDESOL met the related goal set under the Special Climate Change Programme.
24. Tax credit amounting to 30% of R&D expenditure to be deducted from corporate tax liability up to an annual ceiling on total credits, which is determined each year by law.
25. May partly overlap with bilateral assistance.
26. Mexico is an observer to the OECD Development Assistance Committee.
27. In the context of the Busan Partnership for Effective Development Co-operation, agreed at the fourth High-Level Forum on Aid Effectiveness, Busan, Korea, 2011.
28. A public-private partnership training programme to diffuse eco-efficient practices to small and medium-sized enterprises.
29. Including USD 569 million in grants of the Border Environment Infrastructure Fund for water and wastewater projects, which is fully funded by the US Environmental Protection Agency.

Selected sources

Allen (2012), "The North American Agreement on Environmental Co-operation: Has It Fulfilled Its Promises and Potential? An Empirical Study of Policy", *Colorado Journal of International Environmental Law and Policy,* Vol. 23:1, Winter, 2012.

Cámara de Diputados (2011), "Ley Federal de Derechos, Cámara de Diputados", Mexico, DF.

CEC (Commission for Environmental Co-operation) (2008), "Environmental Assessment of NAFTA: Lessons Learned from CEC's Trade and Environment Symposia", *Background Paper for the Experts Roundtable JPAC Public Session*, Phoenix, Arizona, April, 2008.

CONACYT (National Council for Science and Technology) (2011), *Informe General del Estado de la Ciencia y la Tecnología, México, 2010*, CONACYT, Mexico, DF.

CONAGUA (National Water Commission of Mexico) (2010a), *Statistics on Water in Mexico, 2010 edition*, CONAGUA, Mexico, DF.

CONAGUA (2010b), *Guía sobre la Participación Privada en la Prestación de los Servicios de Agua y Saneamiento*, CONAGUA, Mexico, DF.

CONAGUA (2011a), *Statistics on Water in Mexico, 2011 edition*, CONAGUA, Mexico, DF.

CONAGUA (2011b), *2030 Water agenda*, CONAGUA, Mexico, DF.

Consejo Nacional de Población (2011), *Índice de marginación por entitad federativa y municipio 2010*, *www.conapo.gob.mx/es/CONAPO/Indices_de_Marginacion_2010_por_entidad_federativa_y_municipio*, Consejo Nacional de Población, Mexico, DF.

Ferrier (2010), "The evolution of the environmental industry in the post-NAFTA era in Mexico", *International Environmental Agreements: Politics, Law and Economics,* Vol. 10, No. 2 (2010), 147-164, Doi: *10.1007/s10784-010-9114-x*.

Foreign Ministry (2012), *Informe Anual de Cooperación Internacional para el Desarrollo 2011*, Mexico, DF.

Garrido, A. and J. Calatrava (2010), "Agricultural Water Pricing: EU and Mexico", Background Report to OECD (2010), *Sustainable Management of Water Resources in Agriculture*, OECD, Paris.

GoM (Government of Mexico) (2010), "Cuarto Informe de Gobierno", Government of Mexico, Mexico, DF.

GoM (2011), "Quinto Informe de Gobierno", September, 2011, Mexico, DF.

ILO (2010), "G20 Country Briefs: Mexico's Response to the Crisis", G20 Meeting of Labour and Employment Ministers, 20-21 April 2010, Washington, DC.

INE (Instituto Nacional de Ecologia) (2011), "Estudio de emisiones y características vehiculares en ciudades mexicanas. Fase IV: medición de emisiones en cinco ciudades y análisis de resultados globales", *Informe final*, Centro de Transporte Sustentable de México, AC.

Islas Cortés, I., R. Fernández Ramírez and C. Inclán Acevedo (2012), "Nota técnica sobre la evolución de las emisiones de bióxido de carbono y rendimiento de combustible de los vehículos ligeros nuevos en México 2008-2011", Instituto Nacional de Ecología, Junio, 2012.

JPAC (Joint Public Advisory Committee of the Commission for Environmental Co-operation of North America) (2011), "Advice to Council", No. 11-04, 7 December, 2011.

Komives, K., et al. (2008), "Residential Electricity Subsidies in Mexico. Exploring Options for Reform and for Enhancing the Impact on the Poor", *World Bank Working Paper Series*, No. 160, World Bank.

Lyon, P. and B. van Hoof (2010), "Evaluating Mexico's Green Supply Chains Program", *Working Paper*, Ann Arbor, MI: University of Michigan, Ross School of Business.

Michel-Kerjan, E., et al. (2011), "Catastrophe Financing for Governments: Learning from the 2009-2012 MultiCat Program in Mexico", *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 9, OECD Publishing, doi: *10.1787/5kgcjf7wkvhb-en*.

Muñoz Piña, C., et al. (2006), "Agriculture Demand for Groundwater in Mexico: Impact of water right enforcement and electricity user-fee on Groundwater level and quality", *Working Paper,* INE-DGIPEA/0306.

Muñoz Piña, C., et al. (2010), "Institutional Failures and Aquifers Overexploitation", paper presented at the International Drought Symposium, University of California, Riverside, 24-26 March, 2010.

Muñoz Piña, C., M. Montes de Oca and M. Rivera Planter (2011), "Subsidios a las gasolinas y diesel en México: efectos ambientales y políticas públicas", *Working Paper,* INE-ENER-DT/02/2011.

NADB (North American Development Bank) (2010), *Annual Report 2010*, San Antonio.

NADB (2012), *Quarterly Status Report*, 31 March, 2012.

OECD (2003), *OECD Environmental Performance Reviews: Mexico*, OECD, Paris.

OECD (2006), *Agricultural and Fisheries Policies in Mexico – Recent Achievements, Continuing the Reform Agenda*, OECD, Paris.

OECD (2008), "Eco-Innovation Policies in Mexico", *internal working document*, OECD Environment Directorate, OECD, Paris.

OECD (2009a), "The Scope for CO_2-Based Differentiation in Motor Vehicle Taxes: In equilibrium and in the context of the current global recession", *OECD Working Party on National Environmental Policies, OECD Working Group on Transport* [ENV/EPOC/WPNEP/T(2009)1/FINAL], OECD, Paris.

OECD (2009b), *OECD Economic Surveys: Mexico*, OECD, Paris.

OECD, (2009c), *OECD Economic Outlook*, Vol. 2009/1, No. 85, June, OECD, Paris.

OECD, (2009d), *OECD Reviews of Innovation Policy: Mexico*, OECD, Paris.

OECD (2009e), "Triangular Co-operation and Aid Effectiveness, Policy Dialogue on Development Co-operation", *paper presented at the OECD DAC Policy Dialogue on Development Co-operation*, 28-29 September, 2009, Mexico City.

OECD (2010a), *Pricing Water Resources and Water and Sanitation Services*, OECD, Paris.

OECD (2010b), *OECD 2010 Review of Fisheries in OECD Countries: Policies and Summary Statistics*, OECD, Paris.

OECD (2010c), *Financing Water Resources Management in Mexico*, OECD, Paris.

OECD (2010d), *OECD Science, Technology and Industry Outlook*, OECD, Paris.

OECD (2011a), *OECD Economic Surveys: Mexico 2011*, OECD, Paris.

OECD (2011b), *OECD Environmental Performance Reviews: Israel*, OECD, Paris.

OECD (2011c), *Inventory of estimated budgetary support and tax expenditures for fossil fuels*, OECD, Paris.

OECD (2011d), *Fisheries Policy Reform, National Experiences*, OECD, Paris.

OECD (2011e), *Divided We Stand: Why Inequality Keeps Rising*, OECD, Paris.

OECD (2011f), *Meeting the Challenge of Financing Water and Sanitation: Tools and Approaches, 2011*, OECD, Paris.

OECD (2011g), *Development Co-operation Report 2011: 50th Anniversary Edition*, OECD, Paris, *http://dx.doi.org/10.1787/dcr-2011-en*.

OECD (2012a), "Mapping Energy Use and Taxation in OECD Countries", *OECD Joint Meetings of Tax and Environment Experts* [COM/ENV/EPOC/CTPA/CFA(2012)14], OECD, Paris.

OECD (2012b), "Green Growth and Developing Countries", *Consultation draft*, June 2012, OECD, Paris.

OECD (2012c), "Finance Mechanisms for Biodiversity: Examining Opportunities to Scale-Up Resources and Design and Implementation Considerations to Address Challenges", Working Party on Biodiversity, Water and Ecosystems [ENV/EPOC/WPBWE(2011)11/REV1], OECD, Paris.

OECD (2012d), "Tax Preferences for the Environment", Joint Meetings of Tax and Environment Experts [COM/ENV/EPOC/CTPA/CFA(2012)17], OECD, Paris.

OECD (2012e), *Agricultural Policy Monitoring and Evaluation 2012: OECD Countries*, OECD, Paris.

OECD (2012f), "The Tax Treatment of Company Cars and Commuting Expenses", Joint Meetings of Tax and Environment Experts [COM/ENV/EPOC/CTPA/CFA(2012)16], OECD, Paris.

OECD (2012g), *Main Science and Technology Indicators,* Vol. 2011/2, OECD, Paris.

Parry, I.W.H. and G.R. Timilsina (2009), "Pricing externalities from passenger transportation in Mexico city", *Policy Research Working Paper Series 5071*, World Bank, Washington, DC.

Perrault, B., *et al*. (2003), "Invasive Species, Agriculture, and Trade: Case Studies from the NAFTA Context", Presented at the *Second North American Symposium on Assessing the Environmental Effects of Trade*, 25-26 March 2003, Mexico City.

Scott, J. (2010), "Gasto Público para la Equidad: Del Estado Excluyente hacia un Estado de Bienestar Universal", Mexico Evalúa.

SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) (2009a), *Programa Nacional para la Prevención y Gestión Integral de los Residuos, 2009-2012*, SEMARNAT, Mexico, DF.

SEMARNAT (2009b), *Programa de los Pueblos Indígenas y Medio Ambiente 2007-2012*, SEMARNAT, Mexico, DF.

SEMARNAT (2011a), "Implicaciones Socioeconómicas de las Políticas Ambientales", *Draft Report*, SEMARNAT, Mexico, DF.

SEMARNAT (2011b), "OECD Environmental Performance Review of Mexico", Response to the Questionnaire.

SEMARNAT-EPA (2011a), "State of the Border Region 2010", *Border 2012: U.S.-Mexico Environmental Program Indicators Report*, May, 2011.

SEMARNAT-EPA (2011b), "Border 2020: U.S.-MEXICO Environmental Program", Draft Border 2020 Document – for public comment – September 5, 2011, *www.semarnat.gob.mx/temas/internacional/frontera2012/Documents/Programa%20Frontera%202020%20PCP%20Ingles.pdf*.

SENER (Secretaría de Energía) (2010), "Estrategia National de Energía", February 2010, SENER, Mexico, DF.

SHCP (Secretaría de Hacienda y Crédito Público de México) (2011), "Presupuesto de Gastos Fiscales 2011", SHCP, Mexico, DF.

Sheinbaum-Pardo, C. and C. Chávez-Baeza (2011), "Fuel economy of new passenger cars in Mexico: Trends from 1988 to 2008 and prospects", *Energy Policy*, Vol. 39, No. 12, Pages 8153-8162, doi: *10.1016/j.enpol.2011.10.014*.

UNEP Collaborating Centre, Frankfurt School of Finance and Management (2011), *Global trends in renewable energy investment 2011*, Analysis of trends and Issues in the financing of renewable energy, Frankfurt.

UNEP Collaborating Centre, Frankfurt School of Finance and Management (2012), *Global trends in renewable energy investment 2012*, Frankfurt.

USAID (2009), "Assessment of Tropical Forest and Biodiversity Conservation in Mexico", FAA Sections 118-119 Report, USAID.

USAID (2010), "Forests, Land Use, and Climate Change Assessment for USAID/Mexico", *Final Report*, 15 April 2010, USAID Mexico.

World Bank (2010), "Project Appraisal Document on a proposed loan the amount of USD 260.625 million and a proposed Global Environment Facility grant in the amount of USD 7.1186 million to the United Mexican States and a proposed Clean Technology Fund loan in the amount of USD 50 million to Nacional Financiera with a guarantee of the United Mexican States for the Efficient Lighting and Appliances project", 25 October 2010, World Bank, Washington, DC.

World Bank (2011a), *The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium,* World Bank, Washington, DC.

World Bank (2011b), "Forests and Climate Change Project", Project Appraisal Document on a Proposed Loan to the United Mexican States, *Report No: 65959-MX*, December, 2011, World Bank, Washington, DC.

World Bank (2011c), "Implementation Completion and Results Report on a loan in the amount of USD 501.25 million to the United Mexican States for a Climate Change Development Policy Loan", *Report*, 20 November 2011, World Bank, Washington, DC.

World Bank (2012a), *Inclusive Green Growth: The Pathway to Sustainable Development,* World Bank, Washington, DC.

World Bank (2012b), *Improving the Assessment of Disaster Risks to Strengthen Financial Resilience: A Special Joint G20 Publication by the Government of Mexico and the World Bank*, World Bank, Washington, DC.

PART II

Progress towards selected environmental objectives

PART II

Chapter 4

Climate change

Mexico has assigned a high political priority to tackling climate change. It has shown great leadership in, and a strong commitment to, supporting international efforts to address climate change. This chapter reviews its progress in strengthening its institutional, strategic and legal frameworks on climate change. It analyses the opportunities to improve the effectiveness and cost-efficiency of measures implemented in the energy and transport sectors, including those to promote renewables and energy efficiency. The potential to reduce non-energy-related emissions, including from deforestation and forest degradation, is also addressed.

Assessment and recommendations

In 2008, Mexico had the world's 13th highest GHG emissions, excluding land use, land-use change and forestry (LULUCF). Between 2000 and 2008, GHG emissions increased by 13% while energy-related (mainly CO_2) emissions increased by 17%. Urban population growth, economic growth and the associated increased demand for transport have been the main drivers. Some progress was made in improving the carbon intensity of the economy between 1990 and 2010, however, the carbon intensity increased between 2000 and 2010. In 2009, Mexico had the second lowest CO_2 emissions per capita in the OECD, reflecting its relatively low income level. As income increases, GHG emissions are expected to rise. The 2009 scenario prepared within the Special Climate Change Programme (PECC) suggested that, without additional policy measures, total emissions could increase by 70% by 2050, compared to the 2000 level.

In recent years, Mexico has assigned a high political priority to tackling climate change. Since 2005, it has substantially strengthened the institutional framework (including the scientific and economic base for decision making), increased the resource allocation and promoted greater public awareness of climate change. The Inter-Ministerial Commission on Climate Change has been a key driver. It developed the 2007 National Strategy on Climate Change and the PECC 2009-12. States and municipalities have been engaged, as have the private sector and civil society. Mexico's achievements were consolidated and reinforced by the adoption in June 2012 of the General Law on Climate Change. It confirmed Mexico's aspirational targets of reducing GHGs to 30% below a business-as-usual scenario by 2020, and 50% by 2050 from the 2000 level, conditional on international financial support. Mexico was one of the first developing countries to adopt an emission reduction target for 2050.

PECC set an objective of reducing GHG emissions (including LULUCF) by 51 Mt CO_2 eq, compared to business as usual, by 2012. By June 2012, nearly 95% of the target had been achieved. Measures in the oil and gas sector and in forestry were effective in achieving targets, but those for energy use and waste fell short.

Reducing the carbon intensity of the economy is a huge challenge. Fossil fuels account for 89% of Mexico's energy supply, compared to the OECD average of 81%. Oil is dominant in the energy mix at 55%, but the proportion of natural gas grew from 20% in 2000 to 30% in 2010. Mexico is one of the few OECD countries where total primary energy supply increased faster than GDP over 2000-08, in part due to low efficiency in extracting and distributing oil and gas, though some progress has recently been recorded. Total final consumption of energy grew in line with GDP. Nevertheless, energy intensity remains below the OECD average.

The price signals needed to provide adequate incentives to reduce GHG emissions should be significantly strengthened. This is an essential prerequisite for an efficient and effective climate mitigation policy. Although the government has reiterated its goal of reforming energy prices and subsidies, little progress has been made. While Mexico does not have a GHG emission trading system in place, the state-owned oil and gas company implemented a

voluntary, intra-company cap-and-trade system in the first half of the 2000s. This was the first of its kind in Latin America. Its re-establishment could provide the basis for developing a national system, with the possibility of eventually linking it to other systems.

Promoting renewable forms of energy was one of a package of measures adopted as part of the 2008 energy reform that seeks to address the decline in oil production. Considerable renewables potential exists. A variety of programmes have been implemented, resulting in an increase in wind power installed capacity from 2 MW in 2006 to 1 012 MW in 2012. However, the share of renewables in electricity production declined from 20% in 2000 to 18% in 2010, when the share of non-hydro renewables was 3.9%. It is not clear whether the 2012 target in the Special Programme for Use of Renewable Energies – 7.6% of total power capacity and 4.5% to 6.6% of total power generation from renewable sources except large hydropower – will be met. Mexico has adopted a new target of providing 35% of electricity from non-fossil sources (including nuclear power and carbon capture and storage) by 2024. However, the potential contribution of the various renewables technologies to this target remains to be clarified.

The organisation and regulation of the electricity sector is an impediment to the further development of renewables. The Federal Electricity Commission, the state-owned electricity company, has a monopoly on public supply of electricity. It is required by the Mexican constitution to purchase electricity at least cost, which, narrowly interpreted, does not include consideration of environmental externalities or other policy objectives. Because of this, renewables are not competitive. In addition, large subsidies for electricity consumption have increased demand, and contributed to the increased supply of electricity from fossil fuels. In a welcome move, the government amended the Public Electricity Service Law in 2011, to require the consideration of environmental externalities in the least cost criterion when purchasing electricity. Other obstacles to the further deployment of renewables include limits on access to finance, the need to further develop the grid and compensation for land use. Further efforts are needed to expand access to energy by developing decentralised renewables in remote areas. The 2012 target of supplying 2 500 rural communities with renewables-based electricity will not be met.

Various opportunities exist to improve energy efficiency at little or no cost. However, the continued subsidy of energy undermines the incentives and effectiveness of energy efficiency initiatives. On the production side, further fuel switching to natural gas and reduction of losses in transmission and distribution could reduce emissions in the electricity sector by 20% by 2030. Significant emission reductions could be achieved, with a net financial gain, by reducing gas flaring. In end-use sectors, Mexico's minimum energy performance standards have been regularly updated and are among the world's most stringent. However, more emphasis should be given to improving the energy efficiency of buildings, both new and old.

The transport sector is the largest energy consumer. Transport energy use rose by 43% over 2000-10, largely because of growth in road traffic. Motorisation rates have risen, driven by increasing income levels, a large supply of inexpensive vehicles (many of them imported, and not fuel efficient by international standards), the lack of fuel pricing incentives, urban sprawl and the lack of alternative transport modes. Programmes to promote sustainable urban transport have been successfully implemented in several big cities. However, they would need to be significantly scaled up to have an impact on car use, and it will take many years to overcome the lock-in effect of the current organisation of cities. Government control of energy prices has been a major obstacle to improving energy efficiency in the transport sector. The price-smoothing mechanism for transport fuels has given little or no incentive to reduce fuel

use. A package of measures should be adopted to reduce emissions from vehicle use, in conjunction with a gradual increase in fuel prices to reflect environmental costs. The government should address the social impact of rising fuel prices by introducing compensatory measures not linked to energy consumption.

In recent years, Mexico has shown great leadership in, and a strong commitment to, supporting international efforts to address climate change. For example, in 2010 it hosted the 16th Conference of the Parties to the UN climate change convention and was instrumental in brokering the adoption of the Cancun Agreements. Mexico is a non-Annex I country which does not have binding GHG reduction targets under the Kyoto Protocol. However, by adopting voluntary emission reduction targets for 2012, 2020 and 2050, it has provided an important example for both developed and developing countries. It also served as an example by submitting four National Communications under the convention, the only non-Annex I country to do so. Mexico has benefited from international co-operation as well; for example, it has the fourth largest number of registered projects under the clean development mechanism (CDM). Expanding the use of market mechanisms such as the CDM to reduce emissions from large energy-intensive industries and in the waste sector could help leverage the additional funding needed to achieve Mexico's objectives. Mexico is actively involved in the design of pilot projects under the REDD+ initiative to reduce emissions from deforestation and forest degradation.

Mexico is vulnerable to climate change: 15% of the country, 68% of the population and 71% of GDP are highly exposed to climate change risk. In addition to increased temperatures, potential impacts include reduced rainfall in the north, storms and heavy seasonal rainfall in the south, increased hurricane activity and intensity, and a sea level rise of 20 cm by 2050. PECC has identified eight areas for developing adaptation policies, including water, agriculture, ecosystems, health, energy and transport infrastructure. It has also identified 37 objectives and 142 targets, and proposed a three-phase programme to address them. By June 2012, three-quarters of the general adaptation goals had been achieved including emergency plans for extreme weather events in 70 vulnerable areas and modernisation of the national meteorological service. The national vulnerability atlas is near completion. Further development and implementation of this programme will require close co-operation among sectors and with subnational governments, business and civil society, as well as a robust, indicator-based monitoring framework.

Recommendations

- Take all necessary measures to implement the General Law on Climate Change; clarify the domestic emission reduction target and define an indicative allocation among sectors; identify least-cost ways to achieve the target within sectors and in general; ensure that targets and measures are adjusted on the basis of systematic, regular and independent assessments of progress; publish annual progress reports, and a GHG emission inventory at least every two years.
- Consider re-establishing the PEMEX intra-company emission trading system, and gradually extend it to other large emitters, in parallel with the reform of energy subsidies and the establishment of a robust system for monitoring, reporting and verifying emission reductions; consider how it could be linked to similar systems in other countries.

Recommendations *(cont.)*

- In conjunction with gradually removing energy subsidies, identify and implement more cost-effective approaches for further improving energy efficiency, such as reducing losses in electricity distribution and transmission, reducing gas flaring, promoting co-generation in large industries, establishing a mandatory energy efficiency standard for new buildings and providing targeted support to enhance the energy efficiency of existing buildings.
- Promote production and use of renewables, including by developing a sound methodology for valuing environmental and social costs of electricity production for use when purchasing electricity at least cost; developing a support system for renewables based on a careful assessment of potential, cost and benefits; establishing an independent mechanism to review and adjust objectives and the means of achieving them in light of market developments; and developing decentralised energy systems for renewables provision to rural communities.
- Further develop sustainable urban transport systems by scaling up and rolling out investment in low-carbon mass transit and strengthening regional and local capacity for development of integrated transport and urban planning policies.
- Take further steps to reduce GHG emissions and local air pollutants from motorised transport, including by adopting vehicle fuel efficiency or CO_2 emission standards, making vehicle inspection programmes mandatory in all states and examining the potential role of indigenous biofuels as a transport fuel on the basis of a full life-cycle assessment of their environmental impacts.
- Continue to show leadership, and to share experience, in international efforts to mitigate climate change, including by expanding the use of market mechanisms such as the CDM to reduce emissions from large energy-intensive industries and the waste and wastewater sectors, and developing a system for measuring, reporting and verification of GHG emissions and sinks.
- Further develop and implement the climate adaptation strategy by involving all relevant sectors, subnational levels of government, business and civil society, for example by developing technical guidelines for sectors such as forestry; establish a robust, indicator-based mechanism for monitoring and assessing progress in achieving objectives.

1. Introduction

Mexico ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol in 2000. However, as it is not a party to Annex I of the convention, it had no specific greenhouse gas (GHG) emission reduction commitments in the period to 2012.

Nevertheless, Mexico has shown great leadership and a strong commitment to addressing climate change, particularly since 2005. It was one of the first non-Annex I countries to set an aspirational target: halving its GHG emissions by 2050 compared to the 2000 level. It was the first developing country to deliver four National Communications under the UNFCCC, and is preparing its fifth. Under the Kyoto Protocol, Mexico has been active in the clean development mechanism (CDM) and has the fourth largest number of registered projects. It also signed the Copenhagen Accord and committed to reduce its GHG emissions by 30% compared to a business-as-usual (BAU) scenario in the period to 2020, contingent on the provision of adequate financial and technological support from

developed countries. This pledge was included as part of Mexico's commitments in the Cancun Agreements and in the 2012 General Law on Climate Change.

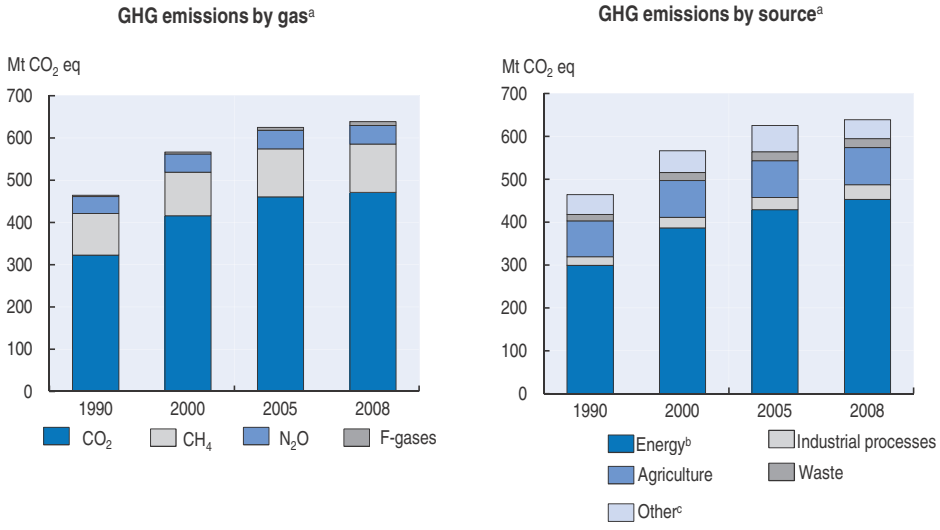
2. Greenhouse gas emission profile

2.1. Total GHG emission trends

As the latest National GHG Inventory (INEGEI, published in 2009) provides data to 2006, IEA estimates are used in the following analysis (OECD-IEA, 2011a). In 2008, Mexico contributed 1.3% of global GHG emissions (excluding LULUCF)[1] and had the world's 13th-highest level of emissions. Its GHG emissions increased by 13% between 2000 and 2008, reaching 639 million tonnes of CO_2 equivalents (Mt CO_2 eq) in 2008. Carbon dioxide (CO_2) was the main GHG, accounting for three-quarters of total emissions in 2008, followed by methane (CH_4) at 18% and nitrous oxide (N_2O) at 7%. Fluorinated GHGs (F-gases) accounted for 1% (Figure 4.1).

Energy-related emissions (from fuel combustion and fugitive emissions from fuel) accounted for 71% of total GHG emissions, and increased by 17% between 2000 and 2008. Population and economic growth, with the associated increased demand for transport, was the main driver of CO_2 emissions from energy use. Fugitive emissions from production and transport of oil and gas were primarily responsible for the upwards trend of CH_4 emissions.

Figure 4.1. **GHG emissions, by gas and source**
1990-2008



a) Excludes LULUCF other than forest and other vegetation fires.
b) Includes fugitive emissions.
c) Includes emissions from burning of forest, other vegetation, peat and waste.
Source: OECD-IEA (2011), *CO_2 Emissions from Fuel Combustion.*

StatLink http://dx.doi.org/10.1787/888932755775

Agriculture was the largest CH_4 emitter in 2008, mainly from enteric fermentation by animals. Since 2000, CH_4 and N_2O emissions from this sector have remained broadly stable whereas CO_2 emissions from agricultural energy use have increased rapidly. Non-energy-related GHG emissions from industrial processes (mostly CO_2 emissions) increased by 40% over 2000-08 because of construction growth and associated production and use of cement. CH_4 emissions from waste grew by 10%, driven by increased land filling and wastewater handling.[2]

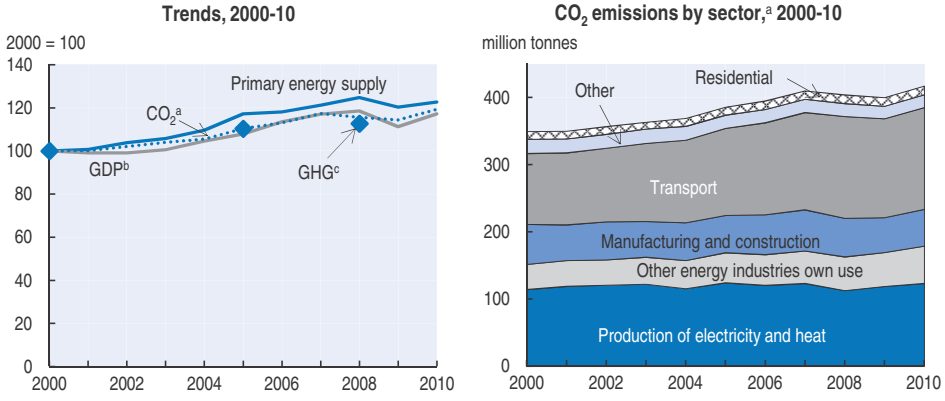
The 2009 INEGEI shows LULUCF emissions at 70 Mt CO_2 or 10% of total GHG emissions in 2006, down from 13% in 2002. Most of these emissions resulted from land-use changes from forest to agriculture and pasture.

In the 2009-12 Special Climate Change Programme (PECC) baseline scenario, Mexico's GHG emissions including LULUCF were expected to increase by 37% by 2020, 50% by 2030 and 70% by 2050, compared to the 2000 level. Transport and electricity were expected to be the biggest contributors to GHG emission growth, while emission reduction was expected from LULUCF due to recent decline in the net deforestation rate (SEMARNAT, 2009a).

2.2. CO_2 emission intensity

In 2009, Mexico had the second-lowest CO_2 emissions per capita in the OECD, reflecting the remaining difference in income levels (Reference I.C). However, increased energy consumption has resulted in a narrowing of the gap with the OECD average regarding CO_2 intensity per unit of GDP. After a period of reduction in the 1990s, the carbon intensity of the economy increased between 2000 and 2010 (Figure 4.2).

Figure 4.2. **CO_2 and GHG emissions**



a) CO_2 emissions from energy use only. Excludes international marine and aviation bunkers. Sectoral approach.
b) GDP at 2005 prices and purchasing power parities.
c) IEA estimates for 2000, 2005 and 2008. Excludes LULUCF other than forest and other vegetation fires.
Source: OECD (2011), OECD Economic Outlook No. 90; OECD-IEA (2012), *CO_2 Emissions from Fuel Combustion;* OECD-IEA (2012), *Energy Balances of OECD Countries.*

StatLink *To download the data corresponding to this graph, refer to Figure 1.1. CO_2 and GHG emissions*

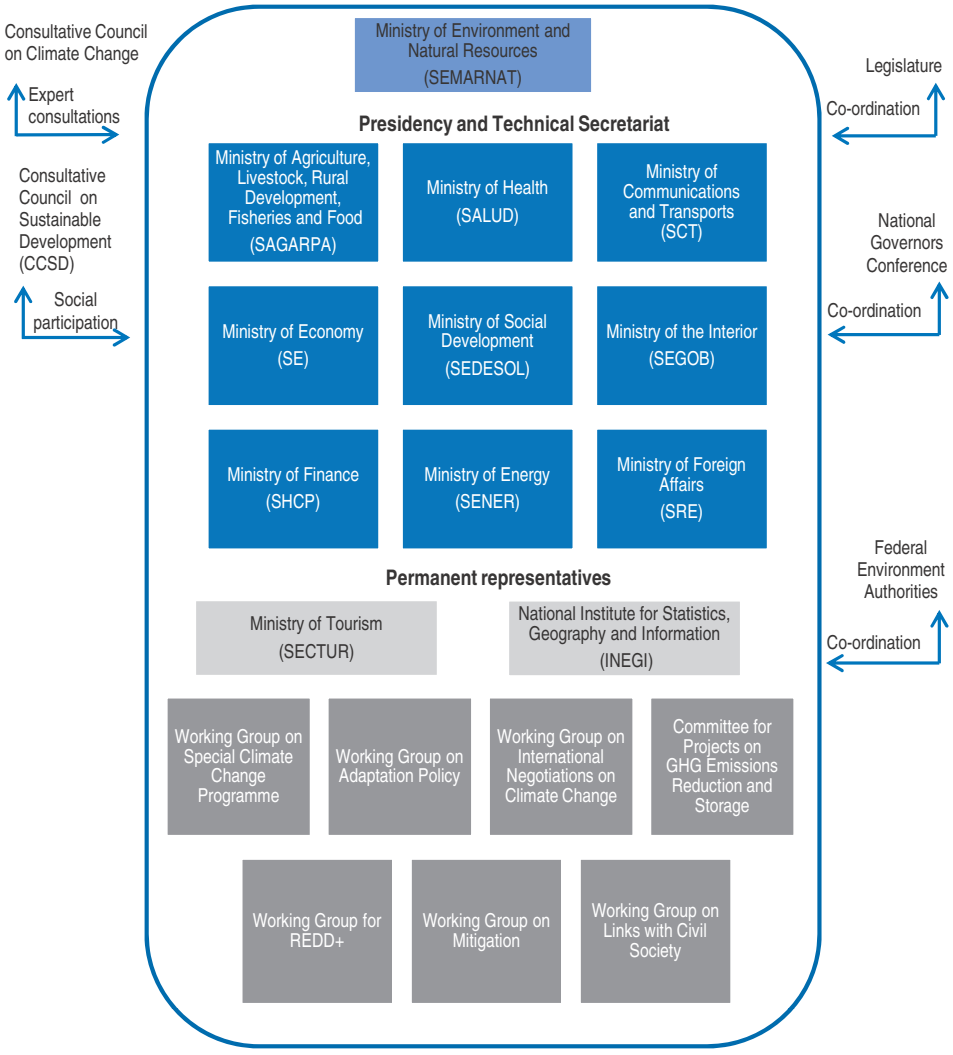
3. Policy and institutional framework

3.1. Institutional arrangement

Since the previous Environmental Performance Review in 2003, Mexico has strengthened its institutional frameworks to support climate change policy development and implementation (OECD, 2003). In 2005, the president established the Inter-Ministerial Commission on Climate Change (CICC) to elaborate national plans and strategies addressing climate change. Chaired by SEMARNAT, the CICC includes representatives from ten other ministries[3] (Figure 4.3).

The CICC is responsible for formulating national policies and strategies to address climate change and submitting them to the Mexican Presidency. It also works to ensure that ministries with key responsibilities in relation to GHG emissions lead the implementation phase. The CICC is supported by working groups to facilitate programme

Figure 4.3. **Inter-Ministerial Commission on Climate Change (CICC)**



Source: SEMARNAT, 2012.

implementation and an advisory group, the Consultative Council on Climate Change, to evaluate initiatives and make recommendations. This institutional framework has produced Mexico's main planning documents on climate change (Section 3.2).

In addition to strengthening its institutions, Mexico has increased the resources allocated to the organisations working on climate change. This includes the Ministry of Environment and Natural Resources (SEMARNAT), the National Ecology Institute (INE) and the Federal Attorney for Environmental Protection (PROFEPA), as well as other agencies supporting climate change programmes and initiatives, including the National Forestry Commission (CONAFOR) and the Ministry of Energy (SENER).

INE is responsible for co-ordinating production of the GHG inventory, INEGEI. In Mexico's four National Communications to the UNFCCC (in 1997, 2001, 2006 and 2009), it updated INEGEI each time (for 1990, 1998, 2002 and 2006), in line with the guidelines and methodologies of the Intergovernmental Panel on Climate Change. Mexico has thus

fulfilled its commitments under Articles 4 and 12 of the UNFCCC. Mexico also co-operates with international partners to further develop its database and monitoring systems. The federal government is working with state governments to share its expertise and develop GHG inventories in support of state programmes. Thus far 15 states have developed inventories, more than the eight targeted by PECC (Box 4.1).

Box 4.1. **State and municipal government**

Within Mexico's federal system of government, the states have an important role to play in applying climate change policies, particularly as regards setting up and managing information systems, developing policies for regulation and monitoring emissions. As part of the National Strategy on Climate Change, state governments have been encouraged to develop State Climate Change Action Programmes (PEACCs). Veracruz, Nuevo León, the Federal District, Tabasco, Chiapas, Hidalgo, Puebla and Guanajuato now have PEACCs, and other states are developing them. The states of Mexico, Puebla and Guanajuato have also developed climate strategies.The states have received training and support from INE since 2007 in developing these plans.

The institutional arrangements for PEACC development mirror the cross-sector approach at federal level: states are encouraged to set up inter-ministerial commissions involving all relevant government departments. Eleven states* have inter-ministerial commissions (INE, 2012a). State government responsibilities relevant to climate change policies and initiatives include air quality management through Air Quality Improvement Programmes (ProAires) (Chapter 2) and regulation of road transport, covering all vehicles except long-distance ones. Getting the states to establish climate change programmes generally involves a process of negotiation with the federal government and investment agreements. At local level, the federal government aims for each municipality to have its own climate change action plan, and has been working with the International Council for Local Environmental Initiatives to promote these plans.

* Baja California Sur, Campeche, Chiapas, Coahuila, Guanajuato, Guerrero, Jalisco, Morelos, Querétaro, Quintana Roo and Tabasco.

In 2004, a voluntary initiative was established to monitor, report and verify GHG emissions by private companies. Called "Programa GEI Mexico", the initiative was developed by SEMARNAT, the World Business Council for Sustainable Development, the World Resources Institute and the Business Council on Sustainable Development. It helps participating companies report their GHG emissions and develop mitigation projects. As of 2011, 155 companies were registered, representing about 18% of Mexico's GHG emissions; 100 of them delivered GHG emission reports in 2010 (Programa GEI Mexico, 2011).

3.2. Mexico's objectives and strategies

Following its establishment in 2005, the CICC and its advisory council developed a preliminary national climate change strategy, which was submitted to public consultation and published in 2006 (CICC, 2006). Building on these efforts, the CICC developed the National Strategy on Climate Change (ENACC) in 2007 (CICC, 2007). ENACC identifies specific measures for mitigation, with estimates of their potential for emission reduction. It also proposes studies for defining more precise mitigation targets and outlines national requirements for capacity building in adaptation to climate change. By developing a national strategy and assuming leadership in international negotiations on climate

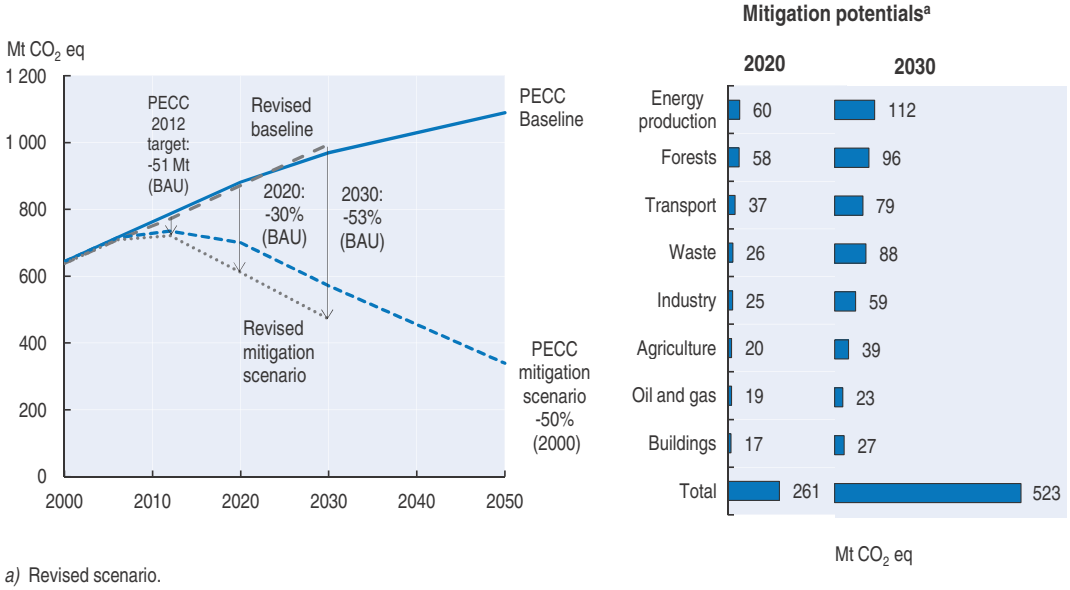
change, Mexico has delivered on the two relevant recommendations of the 2003 Environmental Performance Review (OECD, 2003) (Reference II).

Under ENACC, in 2009 the government approved the 2009-12 Special Climate Change Programme (PECC) setting out lines of action and specific measures for mitigation of and adaptation to climate change. PECC also contributes to the related objectives of the National Development Plan 2007-12. It has four main components:

- **Long-term vision:** specifying the baseline and mitigation scenario to achieve the 2050 aspirational target. In the PECC mitigation scenario, Mexico's GHG emissions including LULUCF were expected to peak in 2012 and then decrease by 20% by 2020 and 70% by 2050 compared to a BAU scenario (Figure 4.4). For adaptation, PECC defines three phases: *i)* evaluation of the country's vulnerabilities and cost assessment of priority measures (to 2012); *ii)* strengthening of strategic adaptation capacities (to 2030); and *iii)* consolidation of capacities (to 2050).
- **Mitigation:** identifying measures to be taken across all sectors to achieve a 51 Mt CO_2 eq reduction compared to a BAU scenario by 2012 (Table 4.1).
- **Adaptation:** presenting goals to develop adaptation capacity of people, goods, infrastructure and ecosystems, and aligning public policy on adaptation, with a focus on eight areas: integrated risk management; water resources; agriculture, forestry and fisheries ecosystems; energy, industry and services; transport and communication infrastructure; land-use planning and urban development; and public health.
- **Transversal policy:** integrating climate change policies across government departments.

Overall, PECC committed federal agencies to 105 objectives and 294 targets for mitigation, adaptation and mainstreaming. It defined Mexico's path to help stabilise global atmospheric GHG concentrations at 450 ppm of CO_2 eq. PECC includes Mexico's Nationally Appropriate Mitigation Actions, which are to be supported by developed countries as part of the Copenhagen Agreement (UNFCCC, 2011).

Figure 4.4. **National baseline and mitigation scenarios**



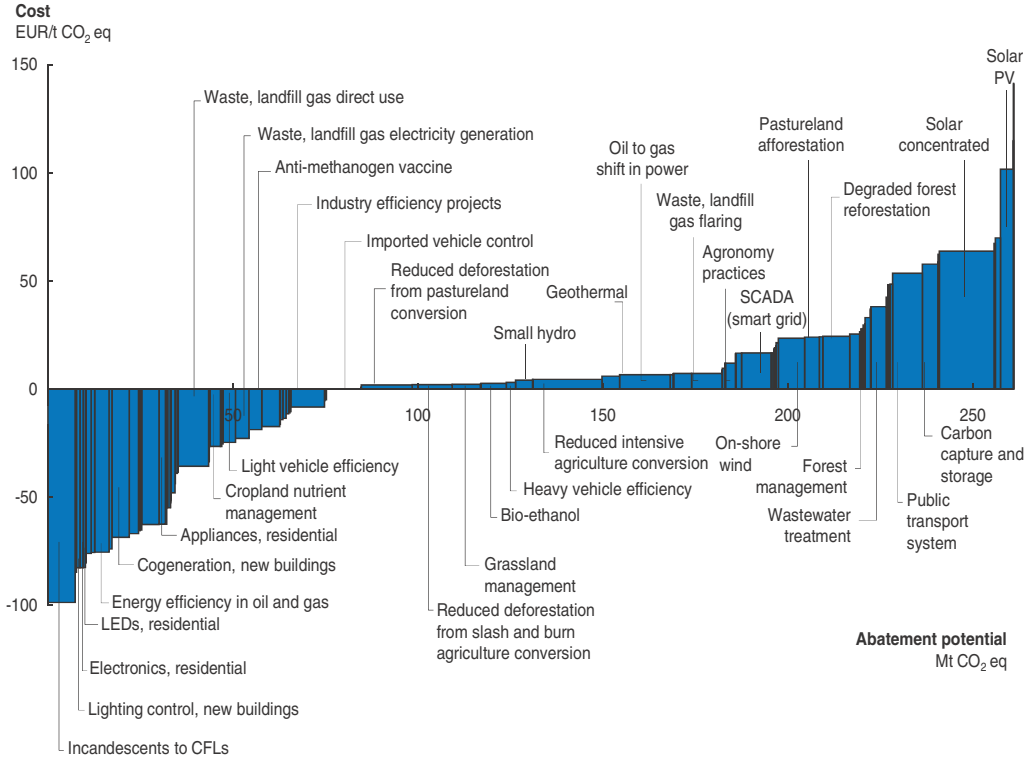
a) Revised scenario.
Source: INE (2010), *Potencial de mitigación de gases de efecto invernadero en México al 2020 en el contexto de la cooperación internacional*; SEMARNAT (2009), *Programa Especial de Cambio Climático 2009-2012.*

Mexico has relied on economic studies[4] to develop PECC's long-term vision and identify the least costly measures, as ENACC requires. After PECC was published, the INE reviewed mitigation potential in preparation for the 15th Conference of the Parties to the UNFCCC. This analysis showed that Mexico could reduce its GHG emissions by at least 10% compared to a BAU scenario by 2020 with its own financial and technological resources if it reformed its laws and key institutions, and that a further reduction of 20% would be possible if international support was available (INE, 2010). Mexico's commitment in the Copenhagen Accord took this new analysis into account (Figure 4.4).

The INE's review showed that Mexico's mitigation potential including LULUCF could reach 261 Mt CO_2 eq by 2020 and 523 Mt CO_2 eq by 2030, compared to a BAU scenario (Figure 4.4). Measures to realise this potential were identified using a marginal abatement cost curve analysis (Figure 4.5). In the mitigation scenario, Mexico would use its own financial resources to implement projects with positive net present value. Measures with zero or negative net economic benefit would deliver the remaining emission reduction potential, subject to provision of financial support from developed countries. Additional investment to realise the 2020 scenario was estimated at 1.1% of GDP a year, of which two-thirds would be financed with international support.

Figure 4.5. **GHG abatement cost curve for Mexico**

2020



Source: INE (2010).

In June 2012, President Calderon enacted the General Law on Climate Change. The new law consolidates Mexico's achievements in the field of climate change. It captures existing targets in law, and reinforces the supporting institutional and information framework at federal and local levels, to ensure that the targets are achieved. It lays a solid basis for future efforts for many years to come. Box 4.2 presents some of the law's main features.

Box 4.2. **The General Law on Climate Change (Ley General de Cambio Climático)**

Main features of the new law include:

- Confirmation of existing targets:
  - reduce GHG emissions to 30% below a BAU scenario by 2020 and by 50% by 2050 from 2000 levels, conditional on international financial support;
  - provide 35 % of electricity from non-fossil fuels by 2024.
- Creation of a climate fund to collect and channel resources for climate change mitigation and adaptation.
- Reformulation of the INE as the National Environment and Climate Change Institute (INECC), responsible for evaluating progress in implementing climate change legislation, providing research and policy recommendations, and supporting capacity building.
- Confirmation of the overall institutional structure for planning and implementation, including the CICC, the Climate Change Council and the INECC.
- Requirement of mandatory emission reporting, more frequent reporting and the creation of a public emission registry.
- Mandate to implement a national strategy for climate change, covering mitigation and adaptation, with horizons of 10, 20 and 40 years and regular revisions (every 10 years for mitigation, 6 years for adaptation).
- Mandate to develop programmes to define goals and activities in each sector, in line with the strategy.
- Authorisation of the CICC to set up an emission market, including the establishment of a regulating entity.
- Opening of the possibility for Mexico to make agreements related to emission trading with other countries.

Source: Ecofys (2012).

While the new law is a positive step, how it is implemented will determine its effectiveness. A first reading of the law suggests that several issues will need to be addressed. First, Mexico's domestic target for 2020 is defined relative to a BAU scenario rather than in absolute terms, and its achievement is conditional on international support. Thus it is not entirely clear what the target actually is and how responsibility for achieving it should be allocated among sectors. Although there is a risk that sector targets can increase compliance costs, and least-cost solutions should be prioritised, many governments have nevertheless set sector targets in order to clarify responsibilities. Second, given Mexico's overall socio-economic objectives, it will be crucial to use the most cost-effective means of achieving targets. However, as this and other chapters show, there are obstacles in this respect, particularly the fact that market-based approaches are not used. Third, it will also be crucial to have a mechanism in place to review and adapt

policies in light of experience, new information and market conditions. A balance needs to be struck between adapting policy to changing circumstances and providing a stable framework for public and private actors. While the law envisions a review of the strategy at least every ten years, more frequent reviews are probably needed. The approaches followed in other OECD countries, such as Germany and the UK, could be helpful in this regard (OECD, 2012a; Crown, 2008).

3.3. Performance evaluation of GHG emission reduction

PECC identified 86 measures to achieve the 2012 target of a 51 Mt CO_2 eq emission reduction compared with a BAU scenario (including LULUCF). Of those, 22 were expected to achieve more than 85% of the reduction (Table 4.1). Overall, the largest reductions were expected from energy production (36%) agriculture and forestry (30%), energy use (23%) and waste (11%).

Table 4.1. **Special Climate Change Programme (PECC): Main mitigation measures to 2012 and achievements**

Sector		Measures Represent 50% of the 2012 target	2012 target (Mt CO_2 eq)	Achievement June 2012 (Mt CO_2 eq)	Achievement June 2012 (%)	Expected achievement by end of 2012 (%)*
Forestry	M64	Incorporation of 2.95 million hectares to Sustainable Forest Management	4.37	5.98	137	110
	M78	Pilot project of incentives for reducing emissions from deforestation and forest degradation (REDD)	2.99	-	-	-
	M66	Additional 2.175 million hectares incorporated in programs of environmental services payment	1.43	3.51	245	248
	M65	Additional 2.5 million hectares of terrestrial ecosystems incorporated as Wildlife Conservation Management Units	1.39	5.09	366	183
	M67	Incorporation of 750 000 hectares of forest ecosystems as Natural Protected Areas	1.12	1.53	137	186
	M73	Establishment of 170 000 hectares of commercial forestry plantations	0.61	0.55	90	95
Oil and Gas	M1	Reinjection of sour gas in Cantarell	6.90	13.67	198	184
	M2 M3	Operational and thermal efficiency in Pemex	1.84	1.12	61	94
	M4	Cogeneration in Pemex	0.90	-	-	100
Power	M18	Promotion of self-supply projects for electrical energy generation with renewables	3.65	1.12	31	50
	M15	Wind power generation by CFE	1.20	0.80	67	75
	M11	Thermoelectric plant in Manzanillo, Colima	1.10	-	-	100
	M14	Hydro-electrical power project "La Yesca"	0.81	-	-	100
Buildings	M37	Energy savings through new household appliances and incandescent bulb replacement programmes. "Para Vivir Mejor"	2.68	1.79	67	101
	M43	Installation of 600 000 efficient wood burning stoves	1.62	1.33	82	96
	M39	Green buildings and green mortgages	1.20	1.19	99	105
Transport	M31	Increased use of rail for freight transport	1.60	-	-	-
	M27	Construction of 38 new highways	1.20	0.56	47	45
	M29	Scrappage of old motor vehicles	1.10	1.50	136	139
	M26	Clean Transportation Programme	0.90	0.39	43	44
Waste	M82	Landfill sites with controlled methane combustion or energy generation	4.44	1.81	41	100
Agriculture	M63	Sustainable planned grazing strategy in 5 million hectares	0.84	2.62	312	301
		Subtotal 22 measures	**43.89**	**44.56**	**102**	**111**
		Other measures	**6.77**	**3.51**	**52**	**63**
		Total	**50.66**	**48.07**	**95**	**104**

* These expected values were calculated in January 2012, thus some of them might be less than the real values achieved up to June 2012.
Source: SEMARNAT (2012).

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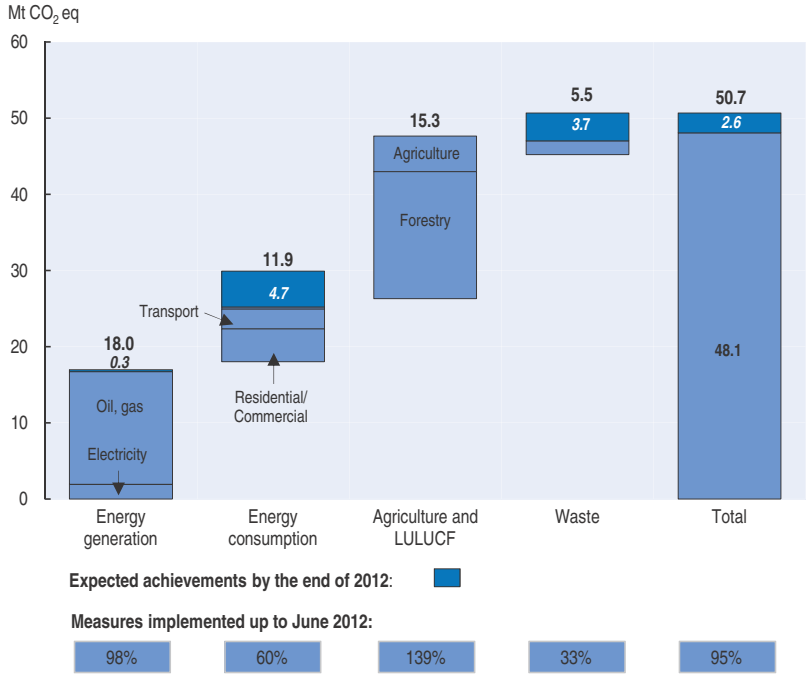
By June 2012, nearly 95% of the 2012 target had been achieved. Measures in the oil and gas industry and in forestry had good performance against objectives (targets were exceeded in forestry), whereas emission reductions in energy use and waste were far from reaching their goals (Figure 4.6). Nevertheless, SEMARNAT projections suggested that Mexico was on track to reduce its GHG emissions by 51 Mt CO_2 eq compared to a BAU scenario by 2012 (SEMARNAT, 2012).

Figure 4.6. **Progress in meeting 2012 mitigation targets**



Source: SEMARNAT, 2012.

4. Climate change and energy policy

Mexico has significant but decreasing domestic non-renewable energy resources. Fossil fuels make up the bulk of its energy mix (Box 4.3). The main objectives of its energy policy were set out in the National Development Plan and the Energy Sector Programme, both for 2007-12. The objectives include energy security, economic and productive efficiency and environmental sustainability. Of particular relevance for climate policy, the Energy Sector Programme has three quantitative objectives to be achieved by 2012: *i*) increase energy savings from 21 686 GWh in 2006 to 43 416 GWh; *ii*) raise the share of renewables in total power capacity from 23% to 26%: 17% large hydro, 3% small hydro and 6% other renewables; and *iii*) reduce GHG emissions from electricity generation by 28 Mt CO_2 eq.

In 2008, the government adopted a set of laws to reform the energy sector and address the decline in oil production. As part of this reform, Mexico started to promote renewables and energy efficiency with the adoption of the Law for Sustainable Energy Use, the Law for Use of Renewables and Financing for Energy Transition, and the Law for Bioenergy Promotion and Development. These laws were followed by the adoption in 2009 of

Box 4.3. **Energy structure and trends**

Energy mix

Between 2000 and 2008, Mexico's GDP grew by 19%. In 2009, it declined by 6% as a consequence of the economic crisis, but it quickly recovered (growing by 5%) in 2010. Total primary energy supply (TPES) increased by 25% over 2000-08, decreased by 4% in 2009 and grew by 2% in 2010. Thus no decoupling between GDP and energy supply occurred until 2009. Mexico's energy supply heavily relies on fossil fuels. In 2010, they represented 89% of TPES, above the OECD average (Reference I.A). Oil remains the main component of TPES (55%), but the share of natural gas increased from 20% in 2000 to 30% in 2010, while coal was 5% (Figure 4.7, left). In 2010, Mexico was the world's seventh largest oil producer and twelfth largest natural gas producer (PEMEX, 2011a). However, it is a net importer of gas and refined petroleum products. Moreover, it is forecast that Mexico will become a net oil importer by 2020 as demand increases and production decreases (US-EIA, 2010). Renewable energy sources accounted for about 10% of TPES in 2010, above the OECD average but down from 12% in 2000. The decrease was due to a decline in the rural population and the associated decrease in wood consumption for energy. Nuclear power accounted for the remaining 1% of TPES.

Electricity generation increased by 33% between 2000 and 2010. Natural gas became the major source of electricity in 2010 at 52% while the share of oil was cut by more than half to 16%. Renewables contributed 18%, which is comparable to the OECD average, but the share has dropped since 2000, offset by increased coal use (Figure 4.7, right). One nuclear power plant, Laguna Verde, with two reactors, generated around 4% of total electricity on average during the review period.

The use of renewables increased only marginally during the period. Biomass is the most used primary renewable fuel (48%), but hydro is the largest source of renewable electricity at 78%, followed by geothermal energy with 14%. Mexico is among world leaders in geothermal power generation. Electricity generation from wind has risen sharply in recent years, although it accounted for only 2.6% of generation from renewables in 2010 (Figure 4.8). Installed wind capacity rose from 2 MW to 1 012 MW between 2006 and 2012 (SENER, 2012b).

Energy use and energy efficiency

Mexico is among the few OECD countries not to have decoupled TPES from economic growth over the past decade. TPES grew even faster than GDP over 2000-08. Total final consumption (TFC) changed in line with GDP. The difference in supply and consumption trends is explained by the growing use of energy for oil and gas extraction, along with oil refinery and gas leakage. Nevertheless, Mexico's energy intensity remains below the OECD average (Reference I.A). Electricity consumption has increased by 28% since 2000, with rises especially in the residential sector (37%) and service sector (19%). However, electricity use per capita is around one-fourth of the OECD average.

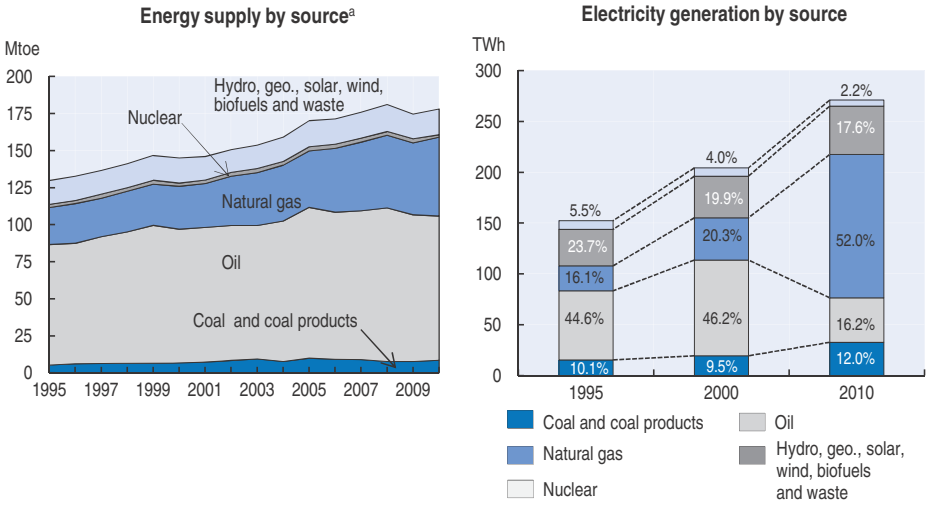
Over 2000-10, the transport sector was the fastest growing consumer of energy, with a rise of 43%, followed by agriculture at 24%. Energy use remained fairly stable in the residential, commercial and industrial sectors, although it declined in industry in 2009 with the economic slowdown (Figure 4.9).

Transport is the largest energy consuming sector, accounting for 46% of TFC in 2010, well above the OECD average and up from 37% in 2000. The growth was largely driven by increased road transport, which accounts for more than 95% of energy consumption in the sector. The total number of vehicles in Mexico doubled between 2000 and 2010, as the motorisation rate grew from 10 vehicles per hundred inhabitants to 19 in 2010 (Reference I.A).

Industry is the second largest energy user, contributing 24% to TFC in 2010, a share equivalent to the OECD average. The highest-consuming industries were iron and steel, accounting for 16% of industrial energy consumption, non-metallic minerals with 15% and chemical and petrochemical at 12%. Between 2000 and 2010, energy consumption per unit of industrial production decreased by 11%. The largest improvements were achieved in the chemical industry. Energy intensity in the steel industry also improved, but at a slower pace than in the 1990s, while intensity increased in the cement industry.

Figure 4.7. **Trends within the energy sector**

1995-2010



a) Total primary energy supply. Breakdown excludes electricity trade.
Source: OECD-IEA (2012), *Energy Balances of OECD Countries.*

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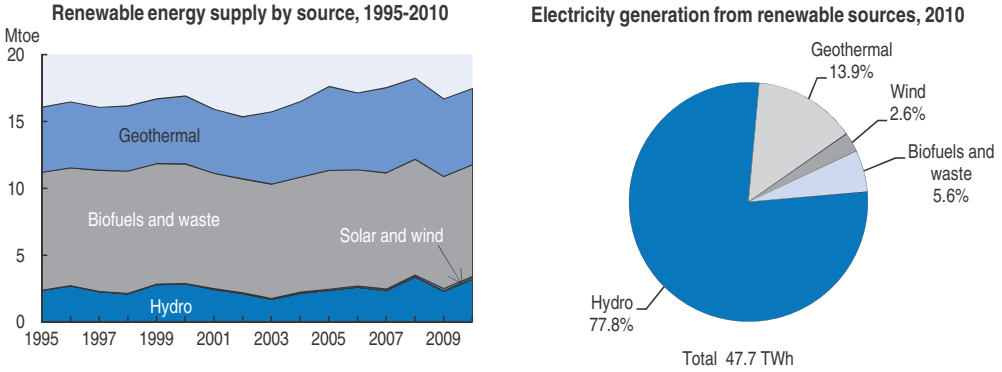
Figure 4.8. **Renewable energy supply by source and as a proportion of total electricity generation**



Source: OECD-IEA (2012), *Energy Balances of OECD Countries.*

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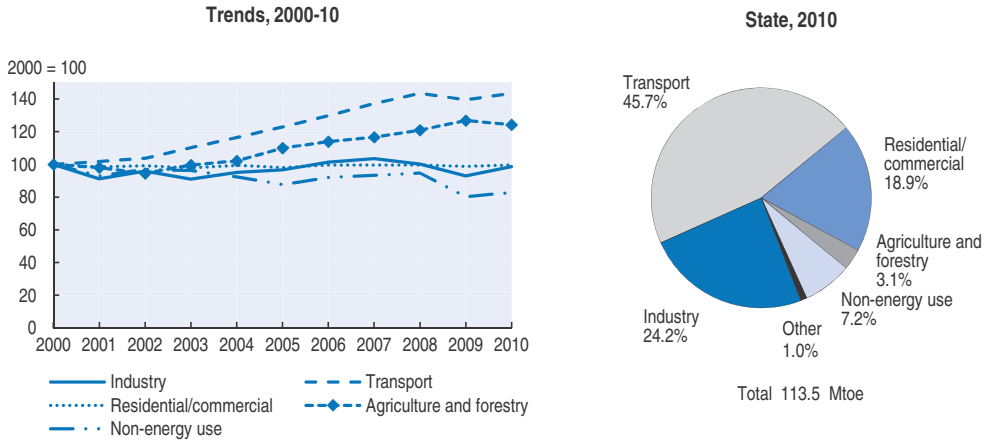
implementing programmes such as the National Programme for Sustainable Energy Use, the Special Programme for Use of Renewables and the Programme for Bioenergy Introduction. In 2011, SENER, the Ministry of Energy, released a Strategy for Energy Transition and Sustainable Use of Energy, reporting on progress achieved.

SENER is in charge of designing and implementing energy policy. Since the 2008 reform, it has had to submit an annual energy strategy to the Mexican Congress for approval. The 2012 strategy, setting the policy orientation to 2026, aims at increasing oil production by 32% and gas production by 94% through enhanced oil recovery, deep-water methods and shale gas exploitation; increasing electricity generation from non-fossil fuels

Figure 4.9. **Total final energy consumption by sector**



Source: OECD-IEA (2012), *Energy Balances of OECD Countries.*

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to 35%, with wind and nuclear development as possible scenarios; and saving 15% of final energy consumption compared to a baseline scenario (SENER, 2012a).

4.1. *Promoting renewable energy sources*

Mexico's physical and climatic conditions provide it with significant renewable energy potential. It is estimated that wind potential could reach 20 GW, small hydropower 3 GW, geothermal 10.6 GW, and biofuels and waste between 2 635 and 3 771 PJ per year. Solar thermal has a maximum potential of 37 GW (SENER, 2009a, 2012; INE, 2010). However, further efforts are needed to tap this potential. The 2009-12 Special Programme for Use of Renewable Energies (Box 4.4) set objectives to: i) increase the share of renewables (excluding large hydro) to 7.6% of total power capacity and to between 4.5% and 6.6% of total power generation; and ii) raise to 2 500 the number of rural communities supplied with renewable electricity. The first target mainly relies on wind expansion. As of early 2012, although permits granted for wind installations covered the target on capacity, it was unclear whether the actual capacity target would be met on time (SENER, 2012a). No progress was recorded on the second target (World Bank, 2012).

Mexico's progress on renewables development should be assessed in the broader institutional context of electricity generation. The Federal Electricity Commission (CFE), the state-owned electricity company, has a monopoly on public supply of electricity. It is responsible for generation, transmission and distribution of electricity. Since 1992, private sector participation in power generation has been allowed for self-supply, co-generation, independent power producers (IPPs), small producers and exports. As a result, between 1996 and 2011, nearly 80% of new power capacity came from the private sector. Although the CFE remains the major electricity producer, the share of the private sector (mostly IPPs) in total power capacity increased from 3% to 35% while its participation in power generation rose from 2% to 40%. However, most of the new capacity is based on gas combined-cycle power plants. Development of renewable projects has proved more difficult (Garrison, 2010). A major impediment is that electricity produced (other than that used for own consumption, sold to rural communities or exported) must be sold to the CFE.

Box 4.4. **Main features of the Special Programme for Use of Renewable Energies**

1. Promote information
2. Develop mechanisms to take advantage of renewable energy sources
   - Prepare a National Renewable Energy Inventory.
   - Adopt administrative norms, directives and methodologies governing the generation of electricity from renewables.
   - Develop a methodology for valuing the externalities of electricity generation based on renewables.
3. Electrification using renewables
   - Create mechanisms to facilitate access to energy for remote, rural and indigenous communities.
   - Create a catalogue of pilot and demonstration alternative energy projects for rural communities.
   - Promote the technical capacity of communities that benefit from renewable energy programmes.
   - Promote a process for community management to assure the sustainability of projects.
4. Development and promotion
   - Support the establishment and strengthening of organisations for promotion of energy efficiency and renewables.
   - Create a Renewable Energy Advisory Council.
   - Develop national and regional catalogues of producers and suppliers of different clean energy technologies.
   - Develop financing schemes for different levels of energy generation, including small scale energy producers.
   - Provide microfinancing and support mechanisms to increase the participation of small renewable energy producers.
   - Propose guarantees, shared-risk systems and risk management to drive investment in new technologies.
   - Review with SENER the support mechanisms for the manufacturers of renewable energy technologies.
5. Infrastructure and regulation
   - Promote the use of renewables in public sector installations.
   - Incorporate the transmission and interconnection infrastructure to utilise national renewable energy sources.
   - Analyse and evaluate transmission fees and simplify the methodologies applied.
   - Explore regulatory instruments to promote efficient co-generation.
   - Promote the installation of renewables in federal housing programmes.
   - Support the development of technical and legal instruments to promote the use of renewables.
   - Establish mechanisms for the use of net-metering in the grid so that users can make use of renewables.
6. Research and technical development

Source: Garrison (2010).

As the CFE is mandated by the Mexican Constitution to purchase power at the least-cost price, which, narrowly interpreted, does not include consideration of environmental externalities, renewable-based power cannot be competitive. In addition, large subsidies for electricity consumption have increased demand, and contributed to the increased supply of electricity from fossil fuels. In a welcome move, the government amended the

Public Electricity Service Law in 2011, to require the consideration of environmental externalities in the least cost criterion when purchasing electricity. Other obstacles to the further deployment of renewables include lack of experience in renewables, a lack of incentives, the need to adjust procurement procedures to the type of renewable (e.g. intermittent), limited access to finance, to grid infrastructure and compensation for land use.

Over the past decade, Mexico has undertaken several projects to overcome these barriers. Since the mid-2000s, large wind demonstration projects co-financed by grants from the Global Environment Facility and World Bank loans have proved successful for building capacity in grid-connected renewables applications. New regulatory instruments have been put in place, including an energy bank (2001) allowing self-suppliers to carry over excess capacity from one year to the next; predictable wheeling fees[5] (2004) and lower capacity back-up fees (2006) levied on self-supply generators;[6] net metering for small scale self-supply generation;[7] capacity payments for CFE contracts with IPPs (2005); and new bidding mechanisms for the private sector to cover the costs of new CFE grid capacity (CCAP, 2012). In addition, since 2005, the Federal Income Tax Law has allowed 100% depreciation of capital expenses for renewables in a single year.

These measures, together with high electricity prices for industry, have resulted in rapid growth of installed wind power capacity (Box 4.3). Nevertheless, in 2010 the share of non-hydro renewables in total electricity generation was only 3.9%, below the 2012 target. The Law for Use of Renewables and Financing for Energy Transition was amended in 2011 to include targets on the share of generation from non-fossil resources (including nuclear plants and carbon capture and storage): 35% in 2024, 40% in 2035 and 50% in 2050. However, clear, specific post-2012 targets on renewables, as well as means of achieving them, are needed for consistency with the mitigation scenario, which sees renewables contributing 70% of emission reduction in the electricity sector. The law on renewables expanded the Energy Regulatory Commission responsibilities to issue standards and methodologies related to the administration of renewables and to work with SENER on setting the fees and other costs to be paid by the CFE to private electricity producers. The law also requires SENER, SEMARNAT, the Finance Ministry and the Health Ministry to develop a methodology for valuing externalities associated with electricity generation. Until such externalities are considered in the CFE's least cost requirement, new incentives such as feed-in-tariffs could be provided to support investment in renewables while removing electricity subsidies (CCAP, 2012).

4.2. Promoting energy efficiency

Energy sector

Despite progress in reducing the overall carbon intensity of electricity production through increased use of natural gas, there is potential for additional energy efficiency improvements. For example, losses in electricity transmission and distribution are about twice international standards. In the INE mitigation scenario, further fuel switching to natural gas and reduction in losses would provide one-fifth of emission reduction in the electricity sector by 2030. Although the CFE infrastructure investment plan to 2025 includes renovations (including at the Manzanillo thermoelectric plant selected in PECC), there are no incentives such as energy performance standards, energy/CO_2 taxes or emission trading to increase the energy efficiency of fossil fuel plants (Ecofys and Climate Analytics, 2012).

Moreover, as a state-owned monopoly, the CFE has soft budget constraints, which are disincentives to improving energy efficiency.

There is significant potential for abatement measures with net financial benefit in the oil and gas sector, including reducing gas flaring, increasing efficiency of PEMEX installations and installing co-generation. Fugitive methane emissions, mostly from the depleting Cantarell field, have jumped since 2005 to reach about 36 Mt CO_2 eq in 2008 (C. Ortiz, 2011). Since the mid-2000s, PEMEX has been working with the Methane to Markets Partnership[8] and the World Bank's Global Gas Flaring Reduction partnership to measure and mitigate methane emissions from several installations. In addition, in the framework of the 2008 energy reform, new regulations impose annual limits on flaring and venting. These measures have had good results and PEMEX surpassed its 2012 PECC goal (Table 4.1). Venting and flaring potential is expected to be fully exploited by the middle of the decade. Low-cost measures such as co-generation at refineries and petrochemical plants and energy efficiency could achieve half of the oil and gas emission reduction potential by 2030.

Operational and energy efficiency objectives of the energy sector are set in the National Energy Strategy (ENE). In particular, the 2012 ENE seeks to raise methane recovery in the oil and gas sector to 99.2% and to reduce electricity losses to 8% by 2026. However, these objectives are conditional on the provision of sufficient funding for additional investment. Most importantly, the ENE includes a target to reduce CO_2 emission from energy production and use by 51 Mt CO_2 eq compared to a BAU scenario, which is not in line with the mitigation scenario for achieving Mexico's climate objectives. Notably, the strategy forecasts an increase in emissions related to enhanced oil and gas production. The document is also pessimistic regarding opportunities to achieve the 35% target on generation from non-fossil fuels, underlining the need to improve assessment of the renewable energy potential in Mexico.

End-use sectors

The 2009 National Programme for Sustainable Energy Use (PRONASE) identifies opportunity areas for energy savings in end-use sectors. Acknowledging the growth in transport energy use and in residential electricity consumption, the programme aims to promote efficiency standards for vehicles, lighting and appliances. The cumulative impact of PRONASE is expected to save 43 TWh by 2012, up to 4 017 TWh by 2030 and 16 417 TWh by 2050 (Table 4.2). Measures on vehicles are covered later in this chapter.

Mexico's Minimum Energy Performance Standards have been the country's most effective instrument for energy saving. They have been updated regularly and are in line with the world's most stringent standards (World Bank, 2010a). In 2011, 22 Official Mexican Norms were in force on energy-efficient products such as air conditioners, refrigerators, motors, pumps and lighting systems. A standard adopted in 2010 will gradually phase out incandescent light bulbs by 2014. In addition, a voluntary label system certifies and identifies energy-efficient products for the Mexican market. The government has adopted a range of programmes to improve energy efficiency in the residential sector, including the Sustainable Light Programme to replace around 47 million incandescent bulbs with compact fluorescent bulbs; the Home Appliance Substitution Programme to replace refrigerators and air conditioners with new, more energy-efficient models; the promotion of solar water heaters and efficient stoves; and the Green Mortgage Programme, which provides financial assistance to low-income buyers for energy-efficient homes. Between

Table 4.2. **Estimated potential energy savings for the priority areas of the National Programme for the Sustainable Use of Energy**

Areas of Intervention	Savings by 2012 (TWh)	Accumulated savings by 2030 (TWh)	Reduction in demand 2030 (%)
1. Transportation	9.0	[1 739-2 736]	[18-26]
2. Lighting	19.2	520	52
3. Household and buildings	6.6	134	10
4. Cogeneration	2.1	[40-483]	..
5. Buildings	1.4	[85-93]	[15-16]
6. Industrial motors	3.5	[26-29]	2
7. Water pumps	0.2	22	12
Total	**43.4**	**[2 566-4 017]**	**[12-18]**

Source: SENER (2009b).

StatLink http://dx.doi.org/10.1787/888932756136

2007 and 2011, the accumulated savings from these programmes was estimated at 117 TWh, 80% of it from energy performance standards (Federal Government, 2011). However, electricity subsidies reduce incentives to adopt efficient appliances. There is room to improve enforcement of building standards and to introduce a mandatory national energy-efficient building code (Ecofys and Climate Analytics, 2012).

Despite industry's share in energy consumption, efforts to support energy efficiency in the sector are relatively weak, although some energy efficiency standards apply to motors used in industry and efficiency is indirectly supported by relatively high electricity prices for industry. Mexico has large industries such as iron/steel and cement, which are highly energy efficient by international standards. However, small and medium-sized enterprises (SMEs) have lower performance (World Bank, 2009). Voluntary programmes such as the National Environmental Audit Programme have provided positive outcomes but there is room to develop energy and resource management systems in industry and SMEs.

4.3. *Financing energy transition*

As part of the 2008 energy reform, two funds were established to support research and development on energy: the Hydrocarbon Fund to improve efficiency of PEMEX activities and the Sustainable Energy Fund for projects on renewables, energy efficiency and cleaner technology. These funds have been allocated a growing share[9] of revenue from oil and gas sales, amounting to MXN 10 billion[10] (about USD 800 million) between 2007 and 2011 (SENER, 2011a). Two-thirds of that has gone to the Hydrocarbon Fund, whose results have yet to be assessed.

In addition, the law on renewables established the Fund for Energy Transition and Sustainable Use of Energy, which allocated MXN 3 billion (USD 220 million) per year to promote renewables and energy efficiency projects from 2009 to 2011. The bulk of this funding – MXN 5.8 billion up to June 2011 – was allocated to the Home Appliance Substitution Programme, followed by the Bioeconomia 2010 programme (MXN 1 billion up to October 2010), which promotes biofuel production (SENER, 2011a, 2011b).

Achieving Mexico's GHG targets is contingent on international financial support. Mexico has been proactive in using the clean development mechanism as a financing source for climate change activities since 2005. As of June 2012, it had registered 141 CDM projects, representing a reduction of 12.4 Mt CO_2 eq per year. Mexico has the fourth largest

number of projects registered and the fifth largest volume of certified emission reductions (CERs) issued. The largest number of projects concerns biogas recovery from manure, while one large HFC decomposition project delivers the highest volume of emission reductions. However, compared to the other major CDM host countries, Mexican projects tend to be relatively small. In addition, heavy reliance on methane-related projects could be an obstacle to achieving expected emission reductions, as this type of project can be difficult to verify: the performance rating of methane projects[11] is usually lower than that of other types of CDM projects (Burtraw et al., 2010). Very few projects are related to the CFE and PEMEX, which have high emission-reduction potential. Diversifying the CDM portfolio and better involving these two state-owned companies would provide additional funding for climate projects.

Mexico does not receive much official development assistance (ODA). Flows of ODA averaged only 0.02% of GDP over the past decade. However, increased ODA for Mexican climate change activities was reported following the Copenhagen pledge to increase climate financing by USD 30 billion in 2010-12. In 2010, members of the OECD Development Assistance Committee committed USD 340 million in bilateral ODA to Mexico for climate change mitigation, a contribution 16-times higher than in 2009 (DAC Statistics, June 2012). Between 2000 and 2012, the Global Environment Facility granted USD 137 million to Mexico for 12 national projects, with particular support for renewables development. In addition, Mexico is the second largest recipient of aid from the Clean Technology Fund, which aims at scaling up financing for deployment of low-carbon technology with potential for long-term GHG emission savings. Between 2009 and 2012, the fund approved concessional loans for six projects totalling USD 414 million,[12] including urban transport transformation, efficient lighting and appliances, and renewables (CTF, 2012). These projects leveraged USD 3.6 billion in co-financing from government, multilateral, public and private institutions. Such funding has helped broaden private sector participation in wind development.

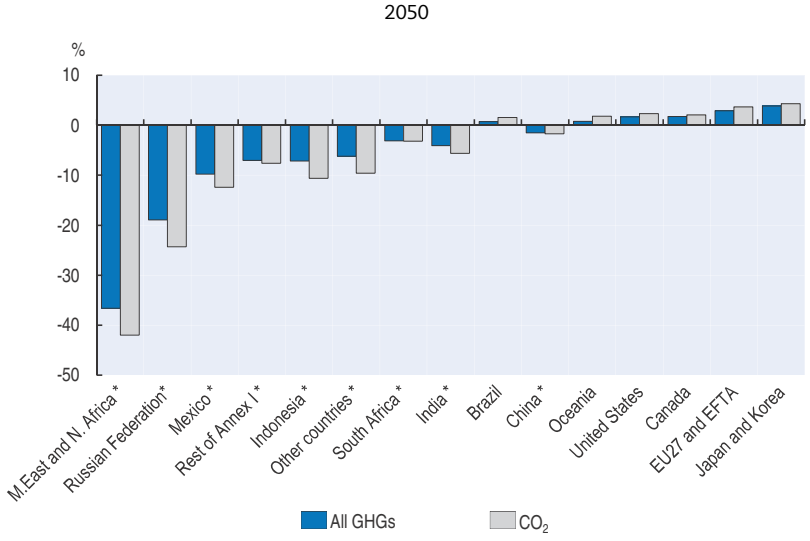
Mexico's proposal to establish a Green Climate Fund to scale up provision of long-term financing for developing countries was an important part of the Cancun Agreements. The 2012 Climate Law establishes a national fund to manage international and domestic climate change funding in support of the national climate strategy.[13] The law includes provisions for control and transparency procedures that will help in tracking and assessing the effectiveness of climate funding.

While Mexico does not have a GHG emission trading system in place, the state-owned oil and gas company Petróleos Mexicanos (PEMEX) implemented a voluntary intra-company GHG cap-and-trade programme, the first of this kind in Latin America (OECD, 2003). The programme operated from 2001 to 2005 and involved 25 business units. While the contribution of the system to reducing PEMEX emissions is unclear, Mexico could build on this experience to revive the system and extending it to its electricity company, as well as gradually to other large industries. The 2012 Climate Law opens the possibility of establishing a voluntary trading system which could facilitate the financing of investments in emission reductions by other countries. This would allow Mexico to obtain funds by selling emission allowances to its more technologically advanced partner countries, where GHG abatement would be more expensive. Given the state-owned and monopolistic nature of Mexican energy companies, complementary policies and strong government leadership would be needed to provide sufficient emission reduction incentives (Burtraw et al., 2010; OECD, 2011). However, as the experience of other countries

shows, implementing an effective cap-and-trade system needs, among the other things, accurate emission data at facility level, sound monitoring and enforcement procedures, and a relatively long learning phase before it delivers the desired results (Hood, 2010).

Financing needs should be assessed against the cost of subsidies for electricity and transport fuels. Over 2007-10, the cost of subsidies for household electricity was more than three times the amount of investment in the electricity sector (Chapter 3). Removing fossil fuel subsidies would lower investment costs and could reduce GHG emissions (excluding LULUCF) by 10% by 2050, compared with a BAU scenario (Figure 4.10). It would also help encourage energy efficiency, promote the development and diffusion of low-carbon technology and renewable energy sources and generally support the transition to a lower-carbon economy.

Figure 4.10. **Impact on GHG emissions[a] of phasing out fossil fuels subsidies**



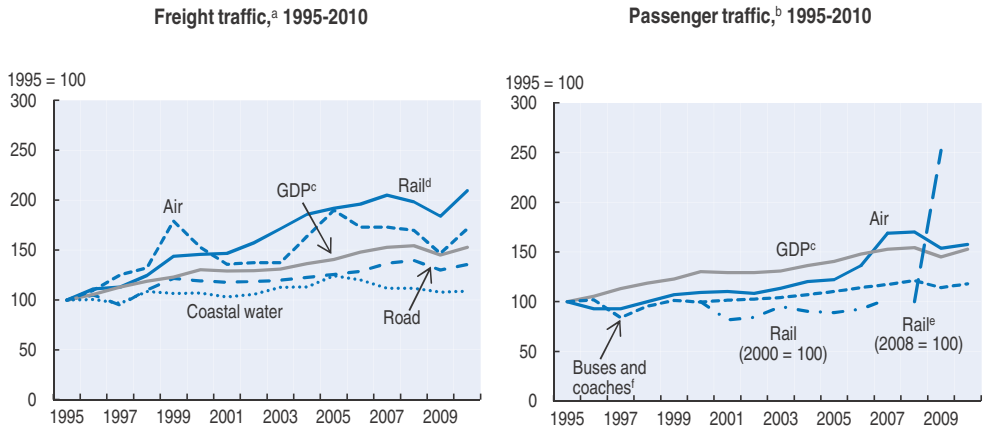
a) Excluding LULUCF.
* Regions for which fossil fuel subsidies reform is simulated.
Source: OECD (2012), *OECD Environmental Outlook to 2050.*

StatLink http://dx.doi.org/10.1787/888932755851

4.4. *Policy and measures in the transport sector*

Transport activity has been increasing, driven by economic growth. Rail freight traffic in particular has shown a marked increase, boosted by the growing volume of trade (Figure 4.11). After the transport sector was restructured in the late 1990s, the share of rail in total freight traffic increased from 22% to 26%. On the other hand, the restructuring resulted in a shift of passenger transport to the road sector. In 2010, road transport accounted for three-quarters of freight and a majority of passenger transport. Although Mexico's private car ownership is far below the OECD average, the rate of motorisation nearly doubled between 2000 and 2010, driven by increases in income, a large supply of inexpensive used vehicles, urban sprawl and the low cost of transport fuels. In a BAU scenario, GHG emissions from transport will increase by 65% by 2020 compared to the 2006 level, and more than double by 2030 (INE-SEMARNAT, 2010).

Figure 4.11. **Trends in freight and passenger traffic**



a) Index of relative change since 1995 based on values expressed in tonne-kilometre.
b) Index of relative change since 1995 based on values expressed in passenger-kilometre.
c) GDP at 2005 prices and purchasing power parities.
d) Includes international transport.
e) As from 2008, data include transport on the suburban railway of the Mexico City Metropolitan Area and are therefore not comparable with those of previous years.
f) Intercity buses on Mexico's federal highway system.
Source: OECD, Environmental Data; OECD (2011), *OECD Economic Outlook No. 90.*

StatLink http://dx.doi.org/10.1787/888932755870

The 2007-12 NDP and the transport sector programme have identified efficient public transport systems, expansion of rail transport and upgrading of road infrastructure as important means of reducing GHG and other air pollutant emissions. In line with these programmes, PECC specified 8 related mitigation objectives and 12 policy measures.

Investment in transport infrastructure has significantly increased, from 0.3% of GDP in 2000 to 0.7% in 2010, just below the OECD average (ITF, 2012). Investment in road infrastructure drove this growth, more than tripling over the decade. However, investment in rail infrastructure, which more than doubled between 2004 and 2007, later decreased. In 2010 it was only 16% higher than in 2000 and accounted for 8% of total investment in transport infrastructure, a proportion well below that of other OECD countries. This suggests that Mexico could strengthen its efforts towards rail expansion. It has set up several programmes promoting sustainable urban transport (Box 4.5). They have fostered the growth in rail passenger traffic in metropolitan areas in recent years but would need to be scaled up substantially to tap the 27% of GHG emission reduction potential in the transport sector by 2030, as expected in the INE mitigation scenario.

The control of fuel prices by the government has been a major obstacle to improved energy efficiency in transport. Mexico applies a price-smoothing mechanism to diesel and petrol which turns into an implicit subsidy in times of rising oil prices (Chapter 3). This price setting method resulted in net expenditure for fuel subsidies equivalent to 1.2% of GDP in 2011. The mechanism removes the potential incentive to reduce fuel use provided by rising fuel prices and contradicts Mexico's objectives on climate mitigation. Recently, the government has gradually increased end-use prices but they remain lower, in nominal terms, than in any other OECD country. Mexico should ensure that diesel and petrol prices do not deviate from their international reference levels and introduce an excise tax on transport fuels with a component reflecting the carbon content and other environmental externalities. In doing so, the government would need to address the social impact of rising

Box 4.5. **Sustainable urban transport policies in Mexico**

Under the 2007-12 NDP, the federal government has implemented two main programmes for improving the efficiency of public transport and reducing GHG emissions: the Federal Support for Mass Transit Programme (PROTRAM) and the Urban Transport Transformation Programme (PTTU). PROTRAM provides financial support for planning studies and investments in projects like bus rapid transit (BRT) systems, trams, light rail and subways in cities of more than 500 000. The National Infrastructure Fund, created as a trust in the state-owned development bank, Banobras, manages the programme. Since 2008, 40 mass transit projects in 30 cities have been registered (ITF, 2011).

The PTTU is a loan programme to complement and strengthen PROTRAM. It enables urban transport projects to have access to loans from the Clean Technology Fund and the International Bank for Reconstruction and Development. Eligible projects need to include *i)* capacity building for developing local urban transport planning; *ii)* development of integrated mass transit corridors and ancillary investment to reduce CO_2 emissions; and *iii)* promotion of low-carbon bus technology and scrapping of old buses. To receive financial support, projects must follow procedures to minimise potential environmental and social impacts.

Even before these federal programmes were established, local governments promoted urban transport projects, partly with federal and international financial support. In particular, three major cities – León, Guadalajara and Mexico City – have reformed their mass transport systems in the last decade.

León was the first to introduce a BRT system in Mexico in 2003. When the third stage of the system is completed, the Integrated Transport System (SIT-Optibus) will serve about 80% of the city's transport users, or more than 500 000 people.

In Mexico City, Metrobus, also a BRT system, was introduced in 2005 with support from the Global Environment Facility and World Bank. Four Metrobus lines have been built, covering 95 km in both directions. Nine additional corridors with 200 km of tracks and 800 buses are proposed. This is expected to replace some 3 000 old and inefficient microbuses and reduce CO_2 emissions by about 0.24 Mt CO_2 eq per year.

In Guadalajara, the city's urban transport operator introduced a new BRT system called Macrobus in 2009, in addition to two metro lines. The route covers 80 km and serves 130 000 passengers per day. Ten additional Macrobus corridors have been proposed.

fuel prices by introducing compensatory measures not linked to energy consumption and by promoting reliable alternative transport modes.

The political sensitivity of the issue would make it necessary to introduce fuel taxes gradually. At the same time, Mexico would need to apply other instruments to curb transport emissions. Improving vehicle efficiency standards would provide a significant opportunity. In the INE scenario, such standards are expected to deliver 60% of the GHG emission reduction potential of the transport sector by 2030. As part of PECC and PRONASE, the government has been developing a fuel efficiency standard for cars harmonised with the US and Canada, a measure justified by the high degree of integration of the US and Mexican car markets. The proposal would bring fleet average fuel economy to 14.9 km/litre by 2016, in line with the US standard. The average fuel economy of new cars sold in Mexico is higher than in the US because vehicles sold in Mexico tend to be smaller. In addition, the efficiency of new cars sold in Mexico has improved from 11.8 km/litre in 2008 to 13.1 km/litre

in 2011, probably because the global economic downturn has been associated with reduced demand for heavier vehicles (INE, 2012b). The proposal from the government would therefore require a lesser effort from Mexican manufacturers. However, strong opposition from stakeholders has kept the standard from being issued thus far (El Financiero, 2012).

Improving vehicle fleet efficiency also requires strengthening controls on vehicles in use. Good practices have been developed in the framework of Air Quality Improvement Programmes (ProAires) (Chapter 2). For example, the Valley of Mexico metropolitan area requires regular vehicle inspections and exempts the least polluting vehicles from "No Driving Day" (Hoy No Circula). This programme has contributed to a significant reduction in air pollution. However, it is an exception; vehicle inspection programmes have been implemented in metropolitan areas and some municipalities of only 15 states. Lack of adequate enforcement of vehicle emission standards has contributed to the import of old vehicles, particularly from the US. SEMARNAT and the Ministry of Transport have implemented a voluntary Clean Transportation Programme to reduce fuel consumption, emissions, and operational costs of long-haul freight carriers. However, it has not delivered the GHG reduction expected in PECC (Table 4.1).

Mexico levies a one-off tax on every purchase of a new passenger vehicle and an annual tax on old and new vehicles, but these taxes do not provide sufficient incentive to shift to more efficient vehicles with lower emissions (Chapter 3). The annual tax is collected in only half the states, the one-off tax applies only to new vehicles, and both taxes are proportional to the purchase price, thus encouraging the purchase of cheaper and older used vehicles. New electric and hybrid cars have been made exempt, but as such vehicles represent a minor share of the market, the exemption is likely to have limited impact. Mexico should broaden application of the annual tax to all states and restructure vehicle taxes to take account of environmental performance.

Measures to support the car industry and modernise the vehicle fleet have included a vehicle-scrapping programme in 2009, an exemption to the annual tax on new vehicles in 2010 and the provision of loan guarantees for the purchase of new vehicles in 2011. Results have been mixed. For example, the resources allocated to the scrapping programme were not all spent, and only 2% of new vehicles sold that year benefited from the programme (UNAM, 2010). However, the measures seem to have delivered the GHG reduction expected in PECC (Table 4.1). From a long-term perspective, the economic and environmental benefits of such initiatives are likely to be limited (OECD, 2009). They are not cost-effective ways to reduce GHG emissions, especially in a country where transport fuels are heavily subsidised.

5. Reducing non-energy-related emissions

5.1. *Land-use change and forestry*

Mexico has 64.8 million ha of forest, representing 33% of the total land area. As of 2010, Mexico was ranked 12th in the world in terms of forest coverage. Although it still has an annual net loss of forest, the rate of deforestation fell from 354 000 ha per year over 1990-2000 to 155 000 ha over 2005-10 (Chapter 5). Reflecting this relative improvement, the share of land use, land-use change and forestry in total GHG emissions declined from 13% in 2002 to 10% in 2006. Emission reduction from LULUCF is expected to account for nearly 30% of the 2012 PECC target. The INE mitigation scenario suggests that LULUCF emissions could become negative (i.e. represent a net sink) between 2020 and 2025.

This ambitious scenario is consistent with the proactive forest policy that Mexico has been implementing over the past decade (Chapter 5). Since 2002, the budget of the National Forestry Commission (CONAFOR) has nearly tripled in real terms, reaching MXN 6.5 billion (USD 520 million) in 2011. This significant financial effort has allowed CONAFOR to assist communities and small private owners in developing management plans, restoring degraded forest areas, planting trees and protecting environmental services.

In international negotiations on climate change, Mexico has played a leading role in promoting the REDD+ initiative (Reducing Emissions from Deforestation and Forest Degradation). In 2010, at the Cancún meeting, Mexico presented its Vision on REDD+, an important step towards a national REDD+ strategy that is expected to be finalised in 2012. The vision was developed by a working group of the CICC and a technical consultative committee with representatives of indigenous communities, landowners, foresters and researchers. In line with the objectives of the NDP, PECC and the Strategic Forestry Programme, its goals for 2020 include: *i)* zero net emissions from land-use change and increased carbon reservoirs; *ii)* a significant reduction in the forest degradation rate; and *iii)* the maintaining of biodiversity and strengthening of the social capital of rural communities by promoting rural sustainable development (CONAFOR, 2010). The vision emphasises the need to effectively capitalise on the opportunities REDD+ provides in terms of co-benefits for biodiversity conservation, sustainable forest management and sustainable rural development. Mexico is actively involved in the design of REDD+ pilot projects in several key regions (e.g. the state of Jalisco and the Yucatán peninsula), supported by multilateral and bilateral financial assistance. To achieve its ambitious goal, Mexico will need to scale up funding, assure effective participation of all stakeholders to develop equitable benefit-sharing mechanisms, improve co-ordination with agriculture policy and enforce regulations to halt deforestation and forest degradation.

5.2. Agriculture

In the INE's BAU scenario, emissions from agriculture further increase by 37% in 2020 and by 52% in 2030 compared to the 2006 level. The 2007-12 Agriculture and Fisheries Sector Programme identifies climate change as a strategic national and international problem demanding immediate action. The programme contains provisions for adaptation, mitigation, and promotion of carbon sequestration. For example, it includes eliminating the use of fire, promoting zero tillage and reforestation, retrofitting livestock facilities to capture and use methane and improving energy efficiency in fishing (SAGARPA, 2007). In PECC, the measure expected to have the largest emission reduction impact to 2012 is the introduction of planned sustainable grazing practices on 5 million hectares.

The sector programme also includes agriculture's role as supplier of biofuels, with the goal of reducing GHG emissions from liquid fuels, though PECC does not quantify the effect of this on emission reduction to 2012. The Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) announced in December 2007 that by 2012 Mexico would be dedicating some 300 000 ha to biofuel crops. SAGARPA noted that the use of biofuels should reduce negative environmental impacts, achieve energy security and improve the living standards of families depending on the agribusiness sector (Morgera et al., 2009). In addition, the Law for Bioenergy Promotion and Development, which went into force in 2008, is meant to promote production of biofuel inputs from farming, forestry and other sources, without jeopardising food security and the country's sovereignty in terms of food production. While SENER and SAGARPA are in charge of

production and distribution of biofuels, SEMARNAT has oversight regarding the environmental aspects.

There is no large-scale ethanol or biodiesel production in Mexico. Sugarcane could be a potential feedstock for first-generation ethanol production, but it is not considered commercially viable, as production costs in Mexico are comparatively high (World Bank, 2009). Second-generation production might be more feasible. Development of biofuels in Mexico is at a relatively early stage. The current policy framework does not provide safeguards against deforestation or land competition for food production (Romero-Hernandez et al., 2011).

5.3. Waste sector

The waste sector has been a fast growing contributor to GHG emissions. The INE review shows that, in a BAU scenario, GHG emissions will continue increasing from the 2006 level, by 31% in 2020 and 45% in 2030. Over the past decade little progress has been made in recycling. Mexico has one of the highest landfilling rates in the OECD (Chapter 1). As more than half the waste collected is organic material, there is considerable potential for low-cost reduction of emissions. PECC waste-related measures are consistent with the 2009 National Programme for Waste Prevention and Integrated Waste Management. They include closing or rehabilitating unsanitary landfills and avoiding GHG emissions through methane capture and recovery. Progress has been achieved in improving landfill management, and an increasing number of projects for methane recovery are being developed under the CDM. For example, Monterrey has constructed a 7 MW plant that captures and converts enough landfill gas into electricity to power the city's light-rail transit system and its streetlights (OECD, 2010). In late 2011, the Bordo Poniente landfill in Mexico City, one of the world's largest dumps, was closed. Biogas recovery from the site is expected to avoid 1.2 Mt CO_2 eq annually (SEMARNAT, 2009b). However, the 2012 PECC target for waste is unlikely to be met. To achieve the emission reductions required by the mitigation scenario (20% under a BAU scenario by 2020 and 61% by 2030), Mexico will need to strengthen municipal institutional capacity for waste management and expand the use of CDM waste-to-energy projects.

6. Adaptation

Mexico is vulnerable to the impact of climate change: 15% of the country, 68% of the population and 71% of GDP are highly exposed to climate change risk (SEMARNAT, 2009a). Potential effects include increased temperatures, with estimates ranging from 1 °C to 4 °C by the end of the century; reduced rainfall in the north and storms and heavy seasonal rainfall in the south; increased hurricane activity and intensity; and a sea level rise of 20 cm by 2050 (SEMARNAT, 2009a). The cost of resulting loss of agricultural production, reduced water availability, deforestation, effects on health and loss of biodiversity could range from 3.7% to 7% of GDP[14] by 2050 (Table 4.3) (SEMARNAT, 2010). By contrast, the estimated cost of meeting the 2050 aspirational target is 0.6% to 2.4% of GDP.[15]

PECC covers adaptation policies in eight areas: integrated risk management; water resources; agriculture, forestry and fisheries; ecosystems; energy, industry and services; transport and communication infrastructure; land-use planning and urban development;

Table 4.3. **Significant impacts of climate change in Mexico**

Sector	Impacts
Agriculture	• Lower productivity, particularly in a context of reduced water availability, though increases in CO_2 and temperatures can raise productivity of some crops in certain locations and types of soil.
Biodiversity	• Shift in location of ecosystems and species, with potential loss of species and habitats. • Increased wildfires, with negative impact on vegetation and animals.
Health	• Spread of contagious diseases and pests, along with the impact of heatwaves, particularly in cities.
Vulnerable communities	• Economic impact on communities that are particularly vulnerable to climate variability – including small farmers and coastal communities – due to adaptation costs.
Water resources	• Increased demand for water for irrigation, livestock, industrial process cooling and human consumption. • Increased hurricane activity and intensity, affecting people's lives, economic activities and the natural environment around the Gulf of Mexico and on the Pacific coast.

Source: SEMARNAT (2009a).

and public health. It contains 37 adaptation objectives and 142 adaptation targets. PECC outlined a three-phase approach to adaptation:

- **Phase 1 (2008-12):** carrying out studies on the economic implications of climate change and Mexico's climate vulnerability, and publicising proposals for modification of civil protection against natural disasters and of the national planning system. In 2010, Mexico launched a programme to modernise the national meteorological services as part of the measures supporting adaptation in the water sector. Mexico has played a leading role in identifying approaches to water-related adaptation on the international agenda (for instance, by organising the Dialogs for Water and Climate Change in the framework of COP-16 in Cancún).
- **Phase 2 (2013-30):** developing and extending adaptive capacity of sectors and regions and enhancing the climate-resilience of ecosystems. This includes adopting sustainable production methods on agriculture, cattle, forestry and fisheries; and establishing programmes to relocate human settlements or infrastructure exposed to high climate change risks.
- **Phase 3 (2030-50):** strengthening the national planning system to minimise vulnerability to climate change.

By June 2012, three-quarters of the general adaptation goals had been completed, including emergency plans for extreme weather events in 70 vulnerable areas and modernisation of the national meteorological service. The national vulnerability atlas is near completion.

However, like many other OECD countries, Mexico is still primarily in the early stage of developing and implementing its climate adaptation strategy. Given the country's vulnerability, Mexico will need to enhance its capacity, promote public awareness and allocate sufficient resources to meet this challenge. It will also need to identify low-cost measures to integrate climate adaptation into sector policies, actively involve state and local governments, and work with the private sector. The effectiveness of mainstreaming adaptation into sector and subnational policies should be monitored through an agreed set of indicators.

Notes

1. Emissions and removals from land use, land-use change and forestry.
2. In the national inventory, the waste sector accounts for a larger share of GHG emissions, and its emissions have increased much faster than in IEA estimates.
3. SEMARNAT, the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), the Ministry of Communications and Transportation (SCT), the Ministry of Economy (SE), the Ministry of Social Development (SEDESOL), the Ministry of Energy (SENER), the Ministry of Interior (SEGOB), the Ministry of Foreign Affairs (SRE), the Ministry of Finance and Public Credit (SHCP) and the Ministry of Health (SALUD). The Ministry of Tourism and the National Statistics and Geography Institute (INEGI) also participate in the CICC as "permanent guests".
4. World Bank (2008), Mexico: Low-Carbon Study; CMM & McKinsey (2008), Low Carbon Growth: a Potential Path for Mexico; Facultad de Economía de la Universidad Nacional Autónoma de México (UNAM) (2008), La Economía del Cambio Climático en México; Center for Clean Air Policy: Mitigation Options in Pemex and Cemex; G. Quadri (2008): "El Cambio Climático en México y el Potencial de Reducción de Emisiones por Sectores."
5. For grid access when the location of power generation is different from the site of consumption.
6. To ensure that their electricity demand is met even when their self-supply is insufficient.
7. To benefit from all renewable power generated through sales of excess generation.
8. International co-operative framework for methane mitigation. In 2010, it was replaced by the Global Methane Initiative.
9. From 0.05% in 2007 to 0.65% in 2012, according to the Federal Law on Charges (Ley Federal de Derechos).
10. Of which 65% is allocated to the Hydrocarbon Fund, 20% to the Sustainable Energy Fund and 15% to the Fund for Scientific Research and Technological Development of the Mexican Petroleum Institute.
11. Measured as the ratio of the average number of CERs issued to the average number of CERs expected.
12. May partly overlap with bilateral assistance.
13. It replaces FOMECAR, a non-profit trust fund created in 2006 to provide technical assistance and financial support for CDM projects in Mexico.
14. Based on discount rates of 4% and 2%, respectively.
15. Ditto. Assuming respective costs of USD 10 and USD 30 per tonne of CO_2.

Selected sources

AMDEE (Asociación Mexicana de Energía Eólica) (2011), "Panorama General de la Energía Eólica en México, 2011", *http://amdee.org/Proyectos/AMDEE%20Presentacin%20en%20Espaol%202011.pdf*, accessed 9 May, 2012.

Amin A.L. and C. Tully (2009), *IDF Public-Private Sector CTF Proposal: Mexico Public-Private Sector Renewable Energy Program*, IDB (Inter-American Development Bank), New York.

Barnes-Regueiro, F. (2011), "Mexico's transition towards Green Growth", Power Point presentation in November, 2011, INE-SEMARNAT, Mexico, DF.

Burtraw, D. et al. (2010), "Feasibility Assessment of a Carbon Cap-and-Trade System for Mexico", *RFF Report*, Resources for the Future.

de Serres A., J. Llewellyn and P. Llewellyn (2011), "The Political Economy of Climate Change Mitigation Policies: How to Build a Constituency to Address Global Warming?", *OECD Economics Department Working Paper,* No. 887, OECD, Paris.

Cesar Rafael Chavez Ortiz (2011), "Experience with Methane Emission Reductions", presentation at the Global Methane Initiative Oil & Gas Subcommittee Meeting in Krakow, Poland, October, 2011, *www.globalmethane.org/documents/events_oilgas_101411_tech_ortiz.pdf*.

CCAP (Center for Clean Air Policy) (2012), *Case study: Mexico's Renewable Energy Program*, *www.ccap.org/docs/resources/1031/Mexico%20renewables%20case%20study%20FINAL%20cover.pdf*.

CICC (Intersecretarial Commission on Climate Change) (2006), *Towards a National Climate Change*, SEMARNAT, Mexico, DF.

CICC (2007), *Estrategia Nacional de Cambio Climático*, SEMARNAT, Mexico, DF.

CMM McKinsey (2008), *Low-Carbon Growth, A Potential Path for Mexico*, McKinsey & Co., Mexico City.

CONAFOR (Comisión Nacional Forestal) (2001), "Programa Estratégico Forestal para México 2025", *Informe Final*, CONAFOR, Zapopan.

CONAFOR (2010), *Visión de Mexico sobre REDD+: Hacia una estrategia nacional*, CONAFOR, Zapopan.

Crown (2008), Climate Change Act 2008, UK: The Stationery Office Limited.

CTF (Clean Technology Funds) (2012), "Semi Annual Report", April, 2012.

Ecofys and Climate Analytics (2012), "Assessment of Mexico's policies impacting its greenhouse gas emissions profile, Climate Action Tracker Mexico", 3 May, 2012.

EIA (U.S. Energy Information Administration) (2010),*International Energy Outlook 2010, EIA*, Washington, DC.

FAO (Food and Agricultural Organisation) (2010), *Global Forest Resources Assessment*, FAO, Rome.

Garrison J.L. (2010), *Clean Energy and Climate Change Opportunities Assessment for USAID/Mexico*, USAID/ Mexico, Mexico City.

Federal Government (2011), "Quinto Informe de Gobierno", September, 2011, Mexico, DF.

Hood, C. (2010), "Reviewing Existing and Proposed Emissions Trading Systems", *Information Paper*, November, 2010, International Energy Agency, Paris.

INE (Instituto Nacional de Ecología) (2008), *Inventario Nacional de Gases de Efecto Invernadero 2006*, *Informe final*, Parte 1; Energía INE, Mexico City.

INE (2010), "Potencial de mitigación de gases de efecto invernadero en México al 2020 en el contexto de la cooperación internacional", *www2.ine.gob.mx/descargas/cclimatico/ Potencial_mitigacion_GEI_Mexico_2020_COP.pdf*, accessed 3 April, 2012.

INE (2012a), Plan Estatal de Acción ante el Cambio Climático, *www2.ine.gob.mx/sistemas/peacc/ags/ index.html*, accessed 3 April, 2012.

INE (2012b), "Nota técnica sobre la evolución de las emisiones de bióxido de carbono y rendimiento de combustible de los vehículos ligeros nuevos en México 2008-2011", June, 2012.

IMP (Instituto Mexicano del Petróleo)-INE (2009), "Escenarios de Emisiones de Gases de Efecto Invernadero en el Mediano y Largo Plazos: 2020, 2050 y 2070", INE, Mexico City.

ITF (International Transport Forum) (2011), "Implementing Sustainable Urban Travel Policies in Mexico", *Discussion Paper,* No. 2011-14.

ITF (2012), "Infrastructure Investment", *Statistics Brief*, June, 2012.

Morgera E., K. Kulovesi and A. Gobena (2009), "Case studies on bioenergy policy and law: options for sustainability", *FAO Legislative Study*, No. 102, FAO, Rome.

OECD (2003), *OECD Environmental Performance Reviews Mexico*, OECD, Paris.

OECD (2009), *OECD Economic Outlook,* No. 86, November OECD, Paris.

OECD (2010), *Cities and Climate Change,* OECD, Paris.

OECD (2011), *OECD Economic Surveys: Mexico 2011*, OECD, Paris.

OECD (2012a), *OECD Environmental Performance Reviews: Germany 2012*, OECD, Paris.

OECD (2012b), *OECD Environmental Outlook to 2050*, OECD, Paris.

OECD-IEA (2011a), *CO_2 Emissions from Fuel Combustion, 2011 edition*, OECD-IEA, Paris.

OECD-IEA (2011b), *Energy Balances in OECD Countries, 2011 edition*, OECD-IEA, Paris.

OECD, IEA, World Bank and OPEC (Organisation of Petroleum Exporting Countries) (2010), "Analysis and scope of energy subsidies and suggestions for the G-20 initiative", OECD-IEA, Paris.

PEMEX (Petróleos Mexicanos) (2011a), *Statistical Yearbook 2011*.

PEMEX (2011b), *Annual Report Pursuant to Section 13 or 15 (d) of the Securities Exchange Act of 1934*, US Security and Exchange Commission, Washington, DC.

Programa GEI Mexico (2011), Resultados del Programa para el año 2011 (correspondientes al periodo 2010), *www.geimexico.org/index.html*, accessed 3 April, 2012.

Romero-Hernández, O., Masera, O., Romero, S. and Grunstein, M. (2011), "Legal and institutional frameworks at national and subnational levels for biofuel promotion in Mexico", *Working Paper,* No. 63, CIFOR, Bogor.

SCT (Secretaría de Comunicaciones y Transportes) (2007), *Programa Sectorial de Comunicaciones y Transportes 2007-2012*, SCT, Mexico, DF.

SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación) (2007), *Programa Sectorial de Desarrollo Agropecuario y Pesquero 2007-2012,* SAGARPA, Mexico, DF.

SEMARNAT (Secretaría de Medio Ambiente Y Recursos Naturales) (2009a), "Programa Especial de Cambio Climático 2009-2012", SEMARNAT, Mexico, DF.

SEMARNAT (2009b), "Programa Nacional para la Prevención y Gestión Integral de los Residuos 2009-2012", SEMARNAT, Mexico, DF.

SEMARNAT (2010), *La Economía del Cambio Climático en México*, SEMARNAT, Mexico, DF.

SEMARNAT – INE (2009), *México Cuarta Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático*, SEMARNAT, Mexico, DF.

SEMARNAT (2012), comments on the draft of the OECD Environmental Performance Review: Mexico 2013.

SEMARNAT – PROFEPA (Procuraduría Federal de Protección al Ambiente) (2011), "Economía verde empresarial: Mecanismos voluntarios del sector ambiental", Fact sheet provided in 2011, SEMARNAT, Mexico, DF.

SENER (Secretaria de Energia) (2009a), "Programa Especial para el Aprovechamiento de Energías Renovable", SENER, Mexico, DF.

SENER (2009b), "Programa Nacional para el Approvechamiento sustentable de la Energía, 2009-12", SENER, Mexico, DF.

SENER (2011a), *Quinto Informe de Labores*, SENER, Mexico, DF.

SENER (2011b), *Estrategia Nacional para la Transición Energética y el Aprovechamiento Sustentable de la Energía*, SENER, Mexico, DF.

SENER (2012a), "Estrategia Nacional de Energía 2012-2026", SENER, Mexico, DF.

SENER (2012b), *Sexto Informe de Labores*, SENER, Mexico, DF.

Tudela, F. (2011), "OECD Environmental Performance Reviews, Mexico", Power Point presentation on 22 November, 2011, SEMARNAT, Mexico, DF.

US-EIA (US Energy Information Administration) (2010), "*International Energy Outlook 2010, EIA*", July 2010, Washington, DC.

UNAM (Universidad Nacional Autónoma de México) (2010), "El Programa de renovacion vehicular como apoyo a la industria automotriz en Mexico y sus resultados".

UNFCCC (United Nations Framework Convention on Climate Change) (2011), "Compilation of information on nationally appropriate mitigation actions to be implemented by Parties not included in Annex I to the Convention", FCCC/AWGLCA/2011/INF.1, *http://unfccc.int/resource/docs/2011/awglca14/eng/inf01.pdf*, accessed 3 April, 2012.

UNFCCC (2012), Greenhouse Gas Inventory Data – Detailed data by Party, *http://unfccc.int/di/DetailedByParty/Event.do?event=go*, accessed 3 April, 2012.

World Bank (2009), *Low-carbon development for Mexico*, International Bank for Reconstruction and Development, World Bank, Washington, DC.

World Bank (2010a), "Project Appraisal Document on a proposed loan the amount of USD 260.625 million and a proposed Global Environment Facility grant in the amount of USD 7.1186 million to the United Mexican States and a proposed Clean Technology Fund loan in the amount of USD 50 million to Nacional Financiera with a guarantee of the United Mexican States for the Efficient Lighting and Appliances project", 25 October, 2010, Washington, DC.

World Bank (2010b), "Modernization of Mexico's Urban Transportation System", 26 March, 2010, Washington, DC, *http://go.worldbank.org/8COMRSLHD0*, accessed 3 April, 2012.

World Bank (2011), "Project Appraisal Document on a proposed loan from the IBRD in the amount of USD 350 million, Strategic Climate Fund-Forest Investment Program (SCF-SIP) in the amount of USD 16.34 million and a proposed grant from the Strategic Climate Fund-Forest Investment Program (SCF-SIP) in the amount of USD 25.66 million to the United Mexican States for the Forests and Climate Change project", 21 December, 2011, Washington, DC.

World Bank (2012), "Implementation Status and Results Report, Mexico (CRL) Integrated Energy Services (P088996)", 13 May, 2012, World Bank, Washington, DC.

PART II

Chapter 5

Biodiversity and forests

Because Mexico is a mega-diverse country, its progress in protecting biodiversity and forest resources is of global significance. This chapter examines Mexico's institutional and policy framework for the conservation and sustainable use of these resources. It analyses the instruments adopted, the progress achieved and the further efforts needed to reduce the main pressures on the natural resource base. It also examines how biodiversity and forestry objectives have been mainstreamed into other key policy areas, such as agriculture and tourism, and provides recommendations for a more co-ordinated, coherent and strategic policy framework.

Assessment and recommendations

Mexico is one of the most important countries globally in terms of biological diversity. It is home to 10-12% of the world's biodiversity, and is one of 17 "mega-diverse" countries. Mexico has been ranked in the top five on a number of biodiversity indicators, including reptiles, mammals, amphibians and flora. Forests cover one-third of the land area and provide a home for 11 million people living in extreme poverty. Between 1976 and 2007, the area covered by tropical forests declined by 10%, though the rate of deforestation has been significantly reduced over the last decade, particularly for primary forest. Around two-thirds of forests are fragmented, which results in reduced quality and quantity of wildlife habitat. More than 2 600 species are listed under different categories of threat, and the share of known mammal and bird species threatened is high compared to levels in other OECD countries.

The conversion of natural ecosystems to crop and livestock production, either directly or indirectly, continues to be the main driver of deforestation and land-use change. Secondary drivers include urban expansion and construction of infrastructure for roads, telecommunications, ports, tourism, energy supply lines, and pipes and ducts. The main driver of forest degradation is forest fires, with illegal logging, fuel wood collection and natural disasters exerting further pressure. Key pressures on marine ecosystems include overexploitation of fisheries, pollution including nitrogen deposition and eutrophication from agricultural run-off and domestic and industrial sewage waters, habitat modification such as wetland loss, and climate change.

Over the last decade, Mexico has developed a number of strategies and programmes to promote conservation and sustainable use of biodiversity and forests, and the budget of the National Forestry Commission has nearly tripled, in real terms since 2002. The environmental axis of the 2007-12 National Development Plan includes several objectives related to biodiversity and forests. The 2000 National Strategy on Biodiversity sets out a 50 year vision to avert large-scale conversion of natural ecosystems. The Strategic Forest Programme presents a strategy for sustainable forest management to 2025. These and other laws, strategies and programmes, together with a strong set of institutions, provide a good basis for conservation and sustainable use of forests and biodiversity. Consideration should be given to how the agreements reached under the Convention on Biological Diversity at the tenth Conference of the Parties in 2010 should be integrated into the policy framework.

Significant progress has been made in developing more comprehensive monitoring and reporting frameworks to support policy development and implementation. Better scientific information is crucial to policy development, and further progress in this area will help in reinforcing and assessing policy performance over time. However, the information base for policy development could be further strengthened through a better understanding of the main drivers of biodiversity and forest loss (at national and state level) and how they are likely to change in a business-as-usual scenario. While a few

economic valuation studies have been undertaken, economic analysis of biodiversity should be strengthened with a view to adopting more efficient policy approaches.

Mexico has a wide set of policy instruments to promote the conservation and sustainable use of biodiversity and forests. It is largely dominated by subsidies, many of which also aim to improve the conditions of local and indigenous communities living in forests. Federal protected areas and their associated resources have increased significantly over the last decade. In 2010, there were 174 protected areas covering 25.4 million ha, equivalent to 12.9% of national territory. However, further expansion of protected areas is needed to achieve the goal of 16% by 2020. Additional resources, including from access fees, will be needed to continue this expansion and to assure effective management. The ecosystems covered should be more representative, and take into account the conservation gaps identified in 2010. Further support should be provided for the establishment and effective management of biological corridors, and management programmes should be developed and implemented in all protected areas.

The National Ecological Land Use Plan (ELUP), adopted in 2012 is an important step for the conservation and sustainable use of ecosystems. This instrument establishes land-use planning and zoning principles to promote development that simultaneously protects and conserves the environment. By July 2012, SEMARNAT had supported the development of 85 ELUPs at different geographic scales, of which 43 were decreed in the last six years. Further efforts are needed to ensure that the regions with the highest development potential for tourism, industry, agriculture, aquaculture and fisheries are covered by ELUPs.

Mexico has pioneered several economic instruments for the conservation and sustainable use of biodiversity. The national programme on payment for ecosystem services (PES) under ProArbol (the federal umbrella programme that promotes sustainable forestry), covers 3.25 million ha of forests and represents one of the largest PES programmes in the world. Other examples of economic instruments include a form of biodiversity offsets for projects involving deforestation – the Forest Land Use Change mechanism; reforestation programmes; controls on illegal hunting of wildlife; and fishery buybacks for more sustainable fisheries management. Some of these have produced positive results (e.g. reforestation), but there is insufficient evidence to fully evaluate the effectiveness of others (e.g. controls on illegal hunting of wildlife). Some can be refined to more cost-effectively attain their environmental goals (e.g. PES and the Forest Land Use Change mechanism). The proposed national study on the economics of biodiversity should examine opportunities to apply further economic instruments based on the polluter-pays principle. The various programmes that have been established to support indigenous people and the environment would also benefit from review. There seems to be a proliferation of small programmes providing temporary income, as opposed to building capacity.

A few voluntary approaches have been put in place, such as green certification of coffee production; about 10% of all coffee producers in Mexico participate in this agreement. However, there is considerable scope to develop such approaches further; for example, while progress has been made in timber certification which can also help combat illegal logging, procedures should be strengthened to consolidate the national market for certified products; efforts to promote sustainable tourism, including eco-tourism certification should be strengthened as to help reduce the environmental footprint of this large and growing sector. More generally, opportunities exist to further engage the private

sector in conservation and sustainable use of forests and biodiversity through regulatory, economic-based and voluntary approaches.

Conservation and sustainable use of biodiversity will not be achieved only by applying policy instruments in the environment sector. It will also be necessary to reform policies in other sectors, such as agriculture, tourism, fisheries and energy, that exert significant pressures on ecosystems and biological resources. For example, a variety of support programmes for farmers contribute to deforestation and the intensification of agricultural production. While agricultural subsidies have been reduced, a large share of agricultural support programmes is still made up of production-related measures, which are the most environmentally damaging. There has been only limited uptake of agri-environment payments that could support more environment-friendly farming practices. Given the environmental and economic significance of biodiversity, establishing an inter-ministerial commission for biodiversity along the lines of the one for climate change could support a more focussed and coherent approach for promoting its conservation and sustainable use.

Recommendations

- Update the 2000 National Biodiversity Strategy and Action Plan to reflect the 2011-20 Aichi biodiversity targets and other measures agreed under the Convention on Biological Diversity in 2010; develop an action plan to achieve the target for protected areas that optimises the conservation of biodiversity and ecosystems, and provides adequate management and financial resources.
- Establish a high-level inter-ministerial task force (similar to the one for climate change) to promote economically and environmentally sustainable use of ecosystems and biodiversity.
- Strengthen economic analysis of biodiversity to support implementation of more efficient and effective policies; complete the planned study of the economics of biodiversity; develop business-as-usual projections to identify future pressures on biodiversity.
- Review the efficiency and effectiveness of economic instruments for the conservation and sustainable use of biodiversity and forests; assess the feasibility of new instruments based on the polluter-pays principle.
- Review programmes to support indigenous people and the environment with a view to streamlining them, increasing the focus on capacity building, and achieving social and environmental objectives more efficiently.
- Identify opportunities to further engage the private sector in the conservation and sustainable use of biodiversity through, for example, the strengthening of timber and eco-tourism certification.
- Ensure that conservation and sustainable use of biodiversity form part of more general efforts to integrate environment into sector policies, e.g. in application of strategic environmental assessment.

1. Introduction

With over 200 000 different species, Mexico is home to 10-12% of the world's biodiversity. It ranks first in biodiversity in reptiles with 804 known species, second in mammals with 535 species, fourth in amphibians with 361 species and fourth in flora with 26 000 species. Many species, especially crops, have their origins and/or diversification in Mexico. Mexico is also considered the second ranked country in terms of variety of ecosystems and fourth in overall species. Mexico is 12th in the world in terms of forest area (FAO, 2010). As one of the world's 17 so-called "mega-diverse" countries, Mexico has a role in global biodiversity and ecosystems that cannot be overemphasised.

Many socio-economic challenges generate pressure on Mexico's biodiversity and ecosystems such as rapid urbanisation, population growth and rising income (Chapter 1). While the energy and material intensities of the economy are relatively low compared to other OECD countries, this gap has narrowed over the last decade. At the same time, Mexico is the second most unequal country, in terms of income, among OECD members. And it has the highest poverty rate in the OECD. Poverty is elevated among indigenous peoples.

Natural resource exploitation (forests, soil, water and fisheries) has played an important role in Mexico's development. While deforestation rates decreased by half (to -0.29% per year) from 2000 to 2010, Mexico recorded, on average, annual net loss of 155 000 ha of forest over 2005-10 (FAO, 2010). Land-use practices, it is estimated, have reduced soil fertility on 17% of the territory; slash and burn agriculture persists and salinisation affects up to 8 000 km^2 of land. Contamination of water resources poses a problem in many parts of the country and stocks of some fish species show signs of overexploitation. While agriculture, livestock, forestry, fisheries and hunting have contributed only around 3.6% of Mexico's GDP over the last few years (Chapter 1), these sectors remain very important for employment and livelihoods.

About 13 million people live in Mexico's forests, which cover some 65 million hectares; 10.9 million of these people live in what is considered extreme poverty. Although ownership falls on rural communities, lack of technical and organisational capacity has hampered their sustainable management of forests. Capacity building efforts for forest conservation and sustainable management have been enhanced in the last six years through strategic forest programmes such as "ProÁrbol". The poor remain the most heavily affected by the loss of forest and soil fertility. Thus it is relevant that the situation of indigenous and local communities has been taken into account when formulating policies for the conservation and sustainable use of forests and biodiversity.

Mexico's 2000 National Biodiversity Strategy sets out a 50 year vision to avert large-scale conversion of natural ecosystems. It has four main strategic thrusts: knowledge management, valuation of biodiversity; conservation; and diversification of use. Some of the more specific and tangible biodiversity and forestry goals and targets include: expanding protected areas to 16% by 2020 from 12.9% today; significantly reducing (also by 2020) the national forest degradation rate and maintaining forest biodiversity under the REDD+ programme on greenhouse gas emissions from deforestation and degradation; and, by 2020, having efficient prevention, detection and early response systems and instruments in place so as to prevent, mitigate, control and eradicate invasive species. A major effort currently under way is to decentralise implementation through the development of state biodiversity strategies.

The Strategic Forest Programme (2001-25) aims to promote and strengthen sustainable development of natural resources in forest ecosystems through conservation measures to assure their protection, restoration, development and production for the overall welfare of society. It is carried out through six-year forestry programmes. Targets include establishing plantations over a total area of 875 000 ha by 2025. A short-term target is ensuring that one-third of Mexico's territory is subject to some form of conservation and sustainable use regime by 2012.

2. Institutional framework

Responsibility for the environment, including biodiversity and forests, is primarily under the Ministry of Environment and Natural Resources (SEMARNAT). While SEMARNAT covers three main areas (see Chapter 2), it is also the parent body of several decentralised agencies, each of which is assigned specific duties. The agencies include the Federal Attorney for Environmental Protection (PROFEPA), the National Forestry Commission (CONAFOR), the National Commission of Natural Protected Areas (CONANP), the National Water Commission (CONAGUA), and the National Ecology Institute (INE).[1] Fishery management, which was originally under the auspices of SEMARNAP, as the environment ministry was called when it was first established in 1994, was transferred to the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) in 2000.[2] The National Commission for Knowledge and Use of Biodiversity (CONABIO) is an inter-ministerial commission with representation from ten ministries[3] where SEMARNAT serves as the technical support to the commission. The National Institute for Geographical and Statistical Information (INEGI) (see Box 5.1), and the National Council of Evaluation of Social Development Policy (CONEVAL) are other agencies relevant to biodiversity and forest management.

These environmental government entities have different architectural frameworks, with some more integrated than others. CONAFOR's governing body, for example, is made up of representatives of seven agencies.[4] There is also the Inter-Ministerial Commission for the Sustainable Management of Coastlines and Oceans (CIMARES), created in 2008 by presidential agreement to help ensure that all government sectors include these concerns in their management decisions. A more cohesive approach to integrating biodiversity into other sector policies could be facilitated by creation of an inter-ministerial task force for biodiversity, similar to the Inter-Ministerial Commission on Climate Change (CICC) and the 2009-12 Special Climate Change Programme (see Chapter 4), which would encompass CONABIO, CONAFOR, CONANP and CONAPESCA, as well as other ministries such as those involved in CONABIO. The CICC has been an important driver of policy development on climate and has engaged the main ministries in this area.

3. Key trends in biodiversity and forests and other relevant information

3.1. Current and projected trends in state and pressures

Mexico has taken initiatives to collect, monitor and report on indicators relevant to assessing the state and pressures on biodiversity and forests. In 2005, for example, SEMARNAT's General Directorate of Environmental Information and Statistics established a National System of Environmental Indicators (SNIA) covering terrestrial, marine and freshwater ecosystems, among others. It comprises a set of 49 indicators of environmental performance plus three key headline indicators. SNIA was later restructured and today is a

component of the National System of Environmental and Natural Resource Information (SNIARN), whose main components are:

- statistical databases;
- geographical databases;
- SNIA;
- documentary information, chiefly reports and evaluations.

Other decentralised agencies have their own statistical and geographical information systems relevant to the specialist areas for which they are responsible (Box 5.1).

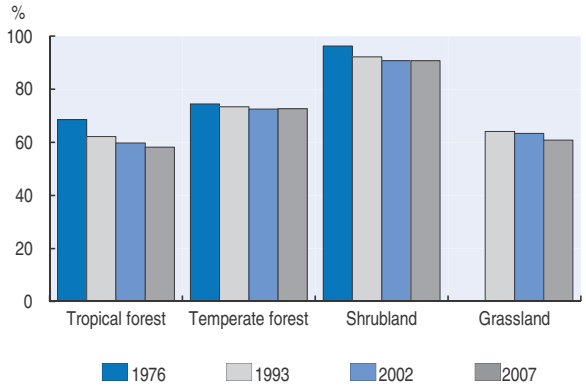
Box 5.1. **Selected data collection and monitoring initiatives relevant to biodiversity**

- CONABIO's National Biodiversity Information System includes satellite imaging data, electronic cartography and data on species. Key areas of ecosystem monitoring include mangroves and cloud forests. There is also an early warning fire detection system.
- CONAFOR is responsible for forest monitoring, for the national forestry and soil inventory, as well as the National Forest Information System.
- SAGARPA is responsible for the collection of fishery data.
- CONANP's System of Information, Monitoring and Evaluation of Conservation (SIMEC), established in 2003, incorporates biological, geographical, social and economic indicators designed to analyse the effectiveness and impact of public policy implementation in priority regions for conservation.
- INEGI integrates the National System of Statistical and Geographical Information (SNIEG). The main objective is to provide information of national interest, through co-ordination and widespread adoption of national and international standards, in compliance with the SNIEG Law. For example, every five years SNIEG produces an updated map, based on satellite imagery and field data, of Mexico's land-use and vegetation at a scale of 1:250 000.

In 2007, 71% of the Mexican territory was under natural vegetation in varying states of conservation, with the remaining area having been converted to agricultural, urban and other uses. As Figure 5.1 shows, tropical forests declined by about 10% between 1976 and 2007. The area of shrubland also declined, as did temperate forests and grassland, albeit at a lower rate.

A closer look at forest area shows that the net annual deforestation rates fell from 354 000 ha over 1990-2000 to 235 000 ha between 2000 and 2005 and 155 000 ha from 2005 to 2010 (FAO, 2010).[5] Of the current net annual loss of 155 000 ha, 9 000 ha is temperate (mostly pine and oak) forests and 146 000 ha tropical forests. The annual rate of primary forest loss declined from 187 279 ha over 2000-05 to 43 909 ha between 2005 and 2010, indicating a shift towards cutting of secondary forest (Figure 5.2). This would be an important change in itself: in the decade to 2000, the rate of loss of primary forest was closer to 405 000 ha a year (SEMARNAT, 2006). Estimates vary, however, so further studies and analysis of all available data are needed to validate these findings and identify the main factors underlying the trend.

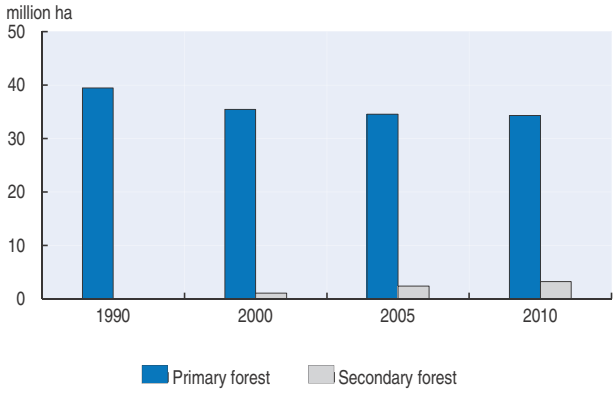
Figure 5.1. **Remaining natural vegetation**
1976-2007



a) As percentage of original natural vegetation area for each vegetation type.
Source: SEMARNAT (2012), *Sistema Nacional de Indicadores Ambientales.*

StatLink http://dx.doi.org/10.1787/888932755889

Figure 5.2. **Trends in primary and planted forests**
1990-2010



Source: FAO (2010), *Global Forest Resources Assessment 2010.*

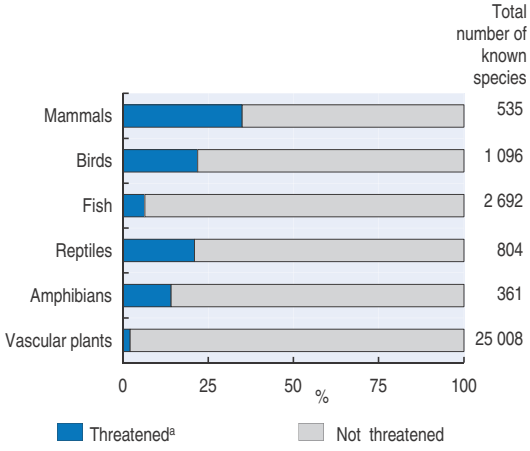
StatLink http://dx.doi.org/10.1787/888932755908

Compared to levels in other OECD countries, the shares of threatened amphibians and vascular plants are relatively low, that for reptiles is average, and that for mammals and birds is high (Figure 5.3).

In terms of pressures on biodiversity and forest loss and degradation, the conversion of natural ecosystems to crop and livestock production, either directly or indirectly, continues to be the main driver of deforestation and land-use change. Secondary drivers include urban expansion and construction of infrastructure for roads, telecommunications, ports, tourism, energy supply lines, and pipes and ducts (Challenger and Dirzo, 2008; FAO, 2010; SEMARNAT, 2011).

Pressures on forest degradation and other terrestrial ecosystems appear to be increasing. The main driver of forest degradation is extensive livestock grazing in natural ecosystems, followed by forest fires (mainly from uncontrolled slash and burn agricultural

Figure 5.3. **Threatened species**
late 2000s



a) IUCN categories "critically endangered", "endangered" and "vulnerable" in % of known species.
Source: OECD, Environmental Data.

StatLink http://dx.doi.org/10.1787/888932755927

practices and abandoned or untended bonfires), illegal logging and fuel wood collection. Natural disasters, soil extraction and open cast mining exert further pressures. Key pressures on marine ecosystems include overexploitation of fisheries, pollution including nitrogen deposition and eutrophication from agricultural run-off and domestic and industrial sewage waters, habitat modification such as wetland loss, and climate change.

Studies showing projected trends in biodiversity and forests, and the underlying causes of change, are generally not available in Mexico. One exception is a study on the likely effects of climate change on priority areas for species conservation. The study, jointly undertaken by CONABIO, INE and the National Autonomous University of Mexico (UNAM), finds that 69 species of terrestrial vertebrates are likely to lose their areas of distribution as a result of climate change in projected scenarios to 2030 and 2050 (Martínez-Meyer et al., 2011). Broader, more comprehensive studies of this kind would help identify how key pressures on biodiversity and forests may evolve, and would thus help in prioritising possible policy interventions for the future.

3.2. Information on the economic valuation of biodiversity and forests

Another important type of information useful for prioritising policy interventions concerns the economic value of biodiversity and forests. As many of the benefits associated with biodiversity and forests are not reflected in market prices, economic valuation techniques – a component of cost-benefit analysis – serve to inform efficient resource allocation and use.

While several economic valuation studies have been undertaken in the context of biodiversity and forests in Mexico, only a handful have been used in policy decision making and design. Examples are valuation studies informing the design of the national PES programme, the level of access fees for protected areas and assessments of the impact of bat colonies on agriculture (Box 5.2). There are plans to assess the economic benefits of biodiversity in the context of national climate change adaptation plans under the REDD+ initiative to reduce greenhouse gas emissions from deforestation and forest degradation

Box 5.2. **Results of selected studies on economic valuation of biodiversity and forests in Mexico**

Terrestrial

Protected areas provide economic benefits and cost savings equivalent to almost MXN 49 billion (USD 3.4 billion) a year by storing carbon, protecting water supplies and supporting tourism. It is estimated that every Mexican peso invested (USD 0.07) in protected areas generates 52 pesos to the economy (USD 4) (Bezaury-Creel and Pabon-Zamora, 2009).

Pest control by bats reduces the need for pesticides by an estimated 25-50%; where pesticides are not used, bats reduce production losses by 55%. This natural pest control service is valued at between USD 6.5 million and USD 61.6 million a year (Gandara et al., 2006).

Adger et al. (1994) estimated the total economic value of forests in Mexico. The study placed the annual lower-bound value of the services of the total forest area at about USD 4 billion. This aggregate value stems from the non-marketed services provided by non-consumptive use (e.g. recreation and tourism), from future potential use of the genetic resources and from pure existence values, combined with the functional values of hydrological and carbon cycling, which accounted for the largest proportion of economic value.

Marine and coastal

Sanjuro and Welsh (2005) estimated that in the Pacific mangrove areas, the value of the environmental service was as low as USD 1 per hectare in the current situation of disorganised and overexploited fishery, but could be as high as USD 77 per hectare if optimal fishing effort and catch were present (cited in Guevara-Sanginés, 2009).

In 2002, Mexico introduced entrance fees of USD 1.80 for access to coral reef natural protected areas. To gauge the reaction of visitors to various fee levels, Rivera-Planter and Munoz-Pina (2005) carried out a contingent valuation survey and constructed aggregate demand for several parks. They explored the benefits and costs of differentiating fees, looking at both revenue maximising and welfare maximising fees. In Cancún, for example, during the high season, revenue maximising fees would be as high as USD 36 for a foreign visitor and USD 20 for a Mexican visitor (see also Section 4.3).

Guevara-Sanginés (2009) drew on a number of studies on economic valuation of biodiversity and ecosystems in Mexico and suggests that in many cases a consumer surplus existed – i.e. full economic potential was not being met.

INE is currently conducting a study on the economic valuation of damage from the 2010 oil spill.

(see climate change chapter). But more comprehensive assessments of the costs and benefits associated with biodiversity would enable more efficient policy design. Notably, INE planned to prepare a national study in 2012 on the economics of ecosystems and biodiversity, in collaboration with CONANP, CONABIO, CONAFOR and the United Nations Environment Programme study on the topic.

More broadly, efforts are under way to integrate biodiversity into national accounts. As discussed in Chapter 3, INEGI calculates the Net Internal Ecological Product (PINE)[6] as part of its National System of Economic and Ecological Accounting. While this exercise is useful on a general level for expressing environmental deterioration as a component of the national accounting system, it cannot yet put an economic value on biodiversity *per se*.

4. Policy instruments for biodiversity and forestry conservation and sustainable use

Mexico has introduced many policy instruments concerning biodiversity and forest conservation and sustainable use. They can be divided into regulatory (command-and-control) approaches, economic instruments, and voluntary and information approaches. Table 5.1 gives an overview of the three types while Figure 5.4 shows the total area under conservation and sustainable use in several of these programmes. Overall, the policy instrument mix in Mexico is largely dominated by the use of subsidy programmes, many of which also serve poverty alleviation goals. The mix tends to focus more heavily on conservation and sustainable use of forestry resources.

Table 5.1. **Overview of policy instruments for biodiversity and forest conservation and sustainable use in Mexico**

Regulatory approaches	Economic instruments	Voluntary and information
Protected areas (terrestrial and marine)	Access fees for protected areas	Eco-labelling and certification: • Forestry certification (Mexican Standard for the Certification of Sustainable Forest Management* and FSC wood) • Green certification for coffee (Bird-friendly coffee and Rainforest Alliance coffee) • Eco-certification of tourism-related businesses
Ecological land-use plans (ELUPs)	Payments for ecosystem services (PES) (ProÁrbol)	
Fishing permits, logging permits Hunting licenses (e.g. for bighorn sheep)	Reforestation subsidy (ProÁrbol)	
• Ban on harvest, use and trade of all sea turtles and turtle products • Gill net and trawl fishing ban in the vaquita refuge (part of the vaquita PACE) • Ban on shark and stingray fishing (May-August) starting in 2012	Forest Land Use Change Compensation mechanism	
Environmental impact assessment (EIA)	Promotion of Conservation and Sustainable Use of Wildlife, through Management Units for Wildlife Conservation (UMAs) and Facilities for Wildlife Handling (PIMVS) in rural areas	
PACE (Action Programmes for Species Conservation)	Fishery buybacks (part of the vaquita PACE)	
	Wastewater regulation – charges and fees Tradable development rights Sian Ka'an biosphere reserve	

* This allows sustainably managed forests to obtain national certification for their products to be eligible for purchase by the federal government under its green procurement criteria (CONAFOR, 2011).

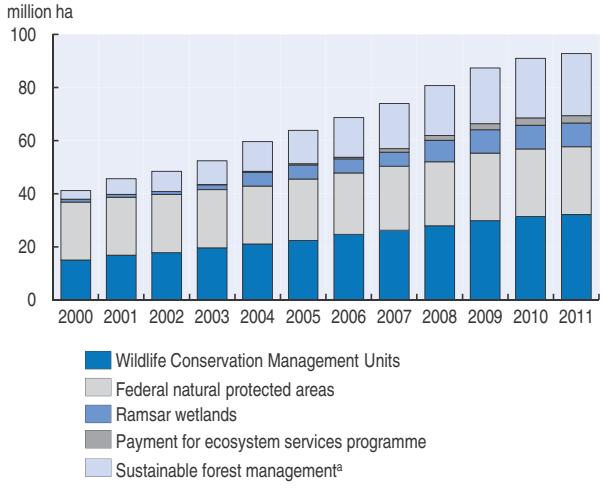
4.1. *Regulatory approaches*

A number of Official Mexican Norms (NOMs) relevant to biodiversity and forest conservation have been created since 2000. Examples include specifications for the preservation, conservation, sustainable use and restoration of coastal wetlands in mangrove areas; guidelines and specifications for Mexican wildlife fauna and flora species; and restrictions on whale watching activities.[7] The establishment of protected areas is a

traditionally used regulatory approach for biodiversity conservation in most countries. Mexico has 174 federal protected areas covering, in all, 25.4 million ha, or 12.9% of the national territory, in 2010. This figure includes both terrestrial and marine areas. It represents a 50% increase from 2000 (Figure 5.5; CONANP, 2010).[8]

Figure 5.4. **Overview of total area under conservation and sustainable use**

2000-11



a) Including PROCYMAF, to improve forest ecosystem productivity and PRODEFOR, the forest development programme.
Source: SEMARNAT (2012), *Sistema Nacional de Indicadores Ambientales*.

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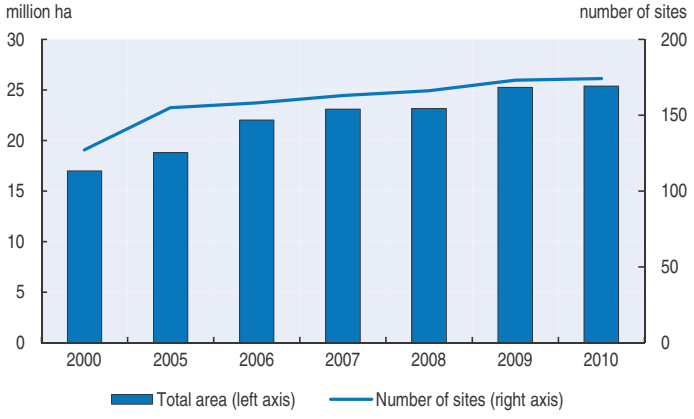
Monitoring of the status of conservation in protected areas is conducted at federal level through SIMEC (Box 5.1). CONABIO and CONANP analysed gaps and omissions in conservation following the work programme on protected areas agreed at CBD COP-7 in 2004.

Figure 5.5. **Marine and terrestrial federal protected areas**[a]

2000-10



a) Protected areas identified according to national legislation.
Source: CONANP, 2010.

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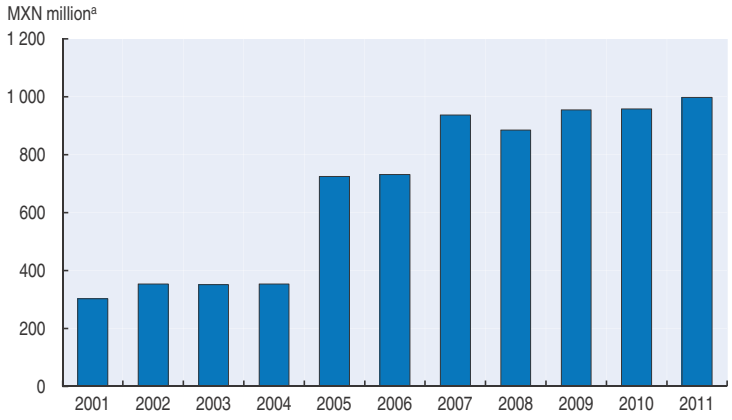
The study examined the representativeness of eco-regions in the network of federal, state and municipal protected areas. Of the 96 eco-regions evaluated, 11 were found not to be represented, 50 were under-represented and 34 were represented in higher proportions than the percentage protected at national level. In 2006, just over 50% of federal protected areas had personnel for basic operation. Financial resources for protected areas increased from 3.4 pesos (0.3 USD) per hectare in 2001 to 12.7 pesos in 2006 (roughly 1 270 pesos or USD 98 per km^2). Figure 5.6 shows total federal budget spending on protected areas from 2001 to 2011.

Figure 5.6. **Federal budget for natural protected areas**

2001-11



a) At constant 2011 prices.
Source: OECD (2011), *OECD Economic Outlook No. 90;* SEMARNAT, 2011.

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In terms of management effectiveness, studies suggest a high degree of heterogeneity between protected areas (see CONABIO-UNDP, 2009). An analysis by Figueroa and Sanchez-Cordero (2008) found that 37 protected areas (54%) were effective, 16 (23%) barely effective and 16 (23%) ineffective. Biosphere reserves showed the largest percentage of effective areas (65%) and national parks the least (31%). While it is a legal requirement to publish management reports, less than 40% of protected areas at the federal level have done so (CONANP, 2008). CONANP created the National Programme of Natural Protected Areas 2007-12 to govern all such areas, so even those with no published management programme are bound by the document outlining the general rules of management. There has been a recent push to develop management programmes at state level. At least four states have such programmes for all their protected areas, but there remain states which do not have management programmes for any of theirs (CONABIO-UNDP, 2009).

The Mexican component of the Mesoamerican Biological Corridor has been operating since 2001. It originally consisted of five corridors, linking some of the larger federal protected areas on the Yucatán peninsula and the state of Chiapas.[9] A further three corridors were added from 2011, all of them in the state of Tabasco, which adjoins both Campeche on the Yucatan peninsula and Chiapas to the south.[10] Overall, the biological corridors are located mainly in the south and need to be improved elsewhere.

Outside protected areas, the Ecological Land Use Plans are essential in aiding efforts for the conservation and sustainable use of ecosystems. Mexico's main instrument for environmental planning, the ELUP is legally defined as an "environmental policy instrument aimed at regulating or inducing land use and productive activities to attain environmental protection, the conservation and sustainable use of natural resources from the trend analysis of deterioration and their potential use".[11] It is used to reconcile land-use suitability, priorities and needs. At the end of 2000, the decreed ELUPs increased from 12 in 2000 to 85 by July 2012, with an additional 10 underway. From this total, since 2007, SEMARNAT has co-ordinated or provided technical assistance on a further 22 ELUPs: ten regional, two state coastal, nine municipal coastal and one marine.

The government has adopted a National Ecological Land Use Plan in 2012. It has committed to encouraging the formulation of ELUPs in priority regions, including coastal and marine areas within national jurisdiction, working particularly to implement ELUPs in coastal states and municipalities with a high development potential for tourism, industry, agriculture, aquaculture and fisheries. Also in preparation is a Strategy for Coastal and Marine Biodiversity.

Progress has been made in preparing Action Programmes for Species Conservation (PACEs) as part of the 2007 Programme to Conserve Species at Risk (PROCER). These programmes aim to foster the recovery and long-term conservation of priority species; that is, those endemic to Mexico, rare, threatened,[12] with high ecological value or of strategic importance as keystone species, or with a high level of social, cultural, scientific or economic interest. Between 2007 and 2012, 27 PACEs were published and implemented. The species covered include jaguar, several eagle species, vaquita, scarlet macaw, Mexican grey wolf, grey whale, manatee and Baird's tapir. All these programmes included measures for habitat conservation as well.

Other regulatory restrictions or prohibitions related to biodiversity conservation include bans on sea turtle, shark and stingray fishing, and on the use of gill nets. Sea turtles are nationally listed as in danger of extinction and legally protected via the national Wildlife Law (Ley General de Vida Silvestre). There is a complete and permanent ban on the harvest, use and trade of all sea turtles and turtle products (DOF, 2002; SEPESCA, 1991). In September 2011, Mexico announced to the United Nations a plan to ban shark and stingray fishing from 2012. The temporary ban covers Mexico's territorial seas and expansive exclusive economic zone in the Pacific Ocean, Caribbean Sea and Gulf of Mexico. It will be in force during the period of greatest reproductive intensity, May to August. The gill net ban dates from 1992; it covers the use of a specific type of gill net (12 inch mesh) in order to protect the vaquita.[13] More recently, a vaquita refuge was designated in 2005, and there are complete bans on both gill nets and shrimp trawling in this area (Sanjurjo et al., 2008).

Environmental impact assessment is the procedure by which SEMARNAT establishes conditions to prevent or minimise negative effects on the environment from construction projects and other activities that could cause ecological disturbance or exceed limits or conditions established in applicable provisions intended to protect the environment and to preserve and restore ecosystems.[14] While the EIA process is well run, there is a lack of strategic environmental assessment for policies, plans and programmes concerning biodiversity and forests, as in other policy areas (see Chapter 2).

In addition to these instruments, a programme to detect and fight forest fires is run by CONAFOR in co-ordination with CONABIO's satellite heat detection system and data from

the National Meteorological Service and co–operation with firefighters from the military and state and local governments. The area affected by fires varies yearly due to weather variations and other factors (USAID, 2009).

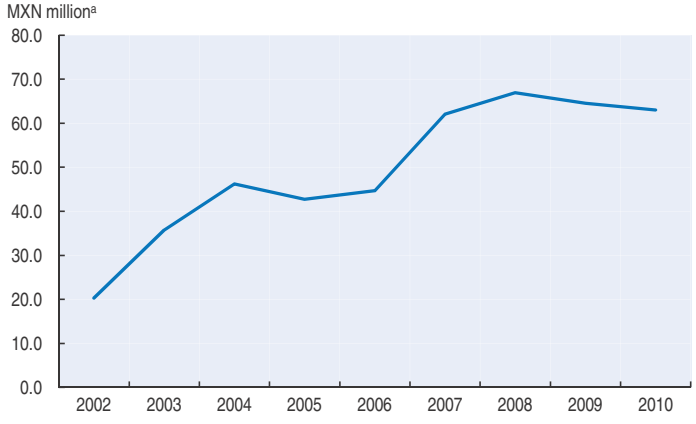
4.2. Economic instruments

As was noted earlier, many economic instruments applied in Mexico concerning biodiversity and forests are subsidy based. There may be a good rationale for such approaches when natural resource users are especially poor, though the objectives and means of achieving them require careful consideration. In Mexico, over 53%% of the forests are owned by local communities – either *ejidos* or indigenous communities (Reyes et al., 2012). Although ownership of forests was legally transferred to rural communities long ago, establishing rights-based land tenure policies, including agrarian reform laws and recognition of indigenous peoples' territories, would provide a sounder basis for conservation and sustainable use of forests and biodiversity. At the same time, opportunities should be sought to reflect the value of ecosystem services and environmental externalities in the pricing system, particularly for those sections of the population that can afford to pay.

Mexico has implemented several economic instruments affecting biodiversity and forest conservation (Table 5.1). Access fees to protected areas, for example, were introduced in 1998; initially the revenue went to the federal government budget, however, so incentives to apply them effectively were weak. This changed in 2001 when, after a request from SEMARNAT, Congress earmarked the revenue for activities in parks (Guevara, 2009). From 2002 to 2010, the number of protected areas participating rose from 13 to 68 (out of 174), and the total revenue collected increased from about MXN 20 million to MXN 63 million (Figure 5.7), equivalent to 7% of the federal budget allocated for protected areas in 2010.

Figure 5.7. **Revenue from charging for access to protected areas**

2002-10



a) At constant 2010 prices.
Source: OECD-EEA (2012), *OECD/EEA Database on Instruments Used for Environmental Policy and Natural Resources Management;* OECD (2011), *OECD Economic Outlook No. 90.*

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The revenue raised from these charges is invested in conservation projects for protected areas, and in the *ejidos* (common property land) and communities which live in and around them, to maintain landscapes and biodiversity for the public and visitors alike.

The scope and level of these access fees could be further increased and new ways explored to raise additional finance for protected areas. This will be particularly important as Mexico has a goal of further expanding the coverage of protected areas in accordance with the Aichi biodiversity targets for 2020, as well as Mexico's Vision 2030 and sustainability goals, which state that protected areas are to increase to 16% of the total territory. Management effectiveness can also be further improved.

A widely-known programme in Mexico and abroad is the national system of payment for ecosystem services (PES). The federal government, through CONAFOR, launched two PES initiatives involving forest management: the Hydrological Ecosystem Services Programme (PSAH) in 2003 and the Programme to Develop Ecosystem Service Markets for Carbon Sequestration and Biodiversity and to Establish and Improve Agro-forestry Systems (CABSA) in 2004. These PES programmes involve 3.25 million ha, making Mexico's one of the world's largest PES programmes (Box 5.3). Since 2011, both programmes have been integrated into one with two modalities (hydrological ecosystem services and biodiversity conservation), along with an environmental endowment fund and the promotion of local PES mechanisms through matching funds.

Box 5.3. **The National Programme of Payment for Ecosystem Services**

The federal government has established two PES programmes involving forest management: PSAH is aimed at protecting hydrological ecosystems and CABSA concerns carbon sequestration, biodiversity and agro-forestry systems. Payments are made annually. Verification of forest cover through satellite image analysis or ground visits is conducted annually on about half of all enrolled properties (McAfee & Shapiro, 2010). Areas where deforestation is detected are removed from the programme and payments are reduced proportionally. PSAH is funded mainly by a national fee on water use. In contrast, the CABSA budget is negotiated every year in Congress and hence does not have stable, long-term funding. Ecosystem service providers in Mexico are predominantly *ejidos*.

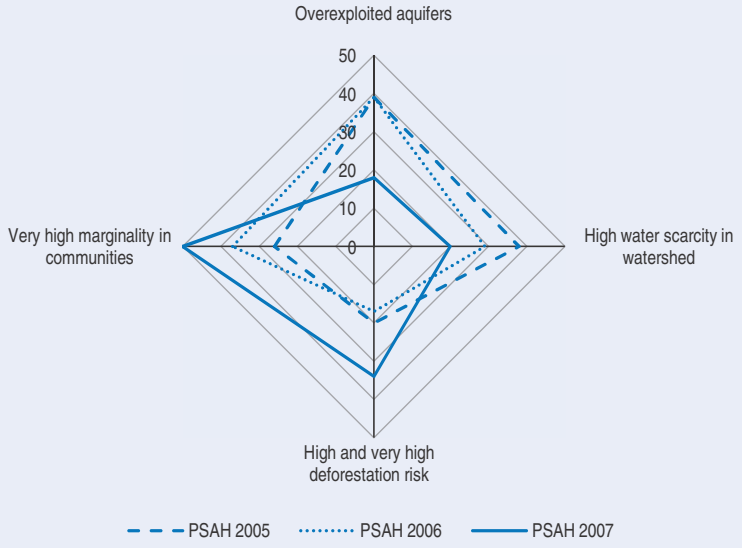
A key feature of cost-effective PES programmes is to target areas with high biodiversity benefits, high risk of loss (to ensure additionality) and low opportunity costs (OECD, 2010a). Mexico has adjusted and revised its PES programme several times to address the first two of these elements. As Figure 5.8 shows, there are trade-offs involved in terms of the priorities of the PES programmes.

Table 5.2 summarises the payment levels that landowners/users are eligible for, depending on the type of ecosystem and the deforestation risk index.

Between 2003 and 2007, PSAH prevented an estimated 18 000 ha from being deforested. However, 1.8 million ha was enrolled in the programme (Muñoz-Piña, Rivera, Cisneros and García, 2011). The conservation impact of PSAH has therefore been fairly low. This can be partly explained by the design of the programme with respect to the weight given to environmental, social and other objectives. In 2006, there were nine selection criteria that could give a maximum of 45 points, which determined plot eligibility. Environmental criteria accounted for over 40% of total points. In 2010 there were 26 selection criteria for up to 106 points. Environmental criteria represented only 19% of possible points, with social and other secondary criteria accounting for the rest. The secondary criteria, which are intended to generate complementarities with other government programmes and ease the administrative process, accounted for more than 65% of possible points (Garcia Romero, 2012). If the PSAH is to meet its intended objective, substantially greater weight should be given to environmental criteria.

Box 5.3. **The National Programme of Payment for Ecosystem Services** *(cont.)*

Figure 5.8. **Targeting PES in Mexico**



Source: OECD (2010), *Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services.*

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Table 5.2. **Differentiated payments for ecosystem services**

PES eligibility	Payment region	Ecosystem type	Deforestation risk index	Eligible area (hectares)	Payment/ha/year (MXN)
Hydrological	I	Cloud forest	Very high	58 520	1 100
	II	Cloud forest	High, moderate, low	1 558 111	700
	III	Coniferous forest Tropical dry forest Oak forest Pine-oak/oak-pine forest	Very high, high, moderate, low, very low	22 133 267	382
Biodiversity	IV	Tropical rainforest	Very high, high, moderate, low, very low	6 559 680	550
	V	Tropical dry forest Thorn forest	Very high, high	4 531 672	382
		Mangrove	Very high, high, moderate, low, very low		
	VI	Tropical dry forest Thorn forest	Moderate, low, very low	18 677 587	280
		Desert and semi-desert	Very high, high, moderate, low, very low		
		Natural grassland			
Total				**53 518 837**	

Source: SEMARNAT, 2011.

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Another economic instrument for forests, adopted in 2005, is the Forest Land Use Change Compensation mechanism. In the case of land-use change for infrastructure, when the projects are of federal jurisdiction and require authorisation by SEMARNAT, a precondition of permission being granted is involvement in this mechanism. It requires successful land-use change applicants to reforest an area at least the same size as the deforested area (usually larger) and with species of the same type, with the aim of redressing the long-term balance of ecosystem cover. In this sense, the mechanism is akin to a biodiversity offset system. A developer is obligated by law to pay into a compensation fund managed by CONAFOR (Box 5.4). However, the current system has not assessed whether the reforestation activities linked to compensation are successful and whether their location and timing truly compensate for the environmental services lost. Better monitoring, reporting and verification are crucial. Timing has also been an issue; to help address it, INE is preparing an initiative in which SEMARNAT will develop a method of banking biodiversity offset credits. In addition, PROFEPA and CONABIO have formulated an agreement to launch an offset-like programme (the Programme for Environmental Restoration and Compensation) that aims to compensate for regulation violations and accidents through the planned restoration or recovery of ecosystems and natural resources on site, or, if that is not possible, avoiding or mitigating damage elsewhere.

Box 5.4. **The Forest Land Use Change Compensation mechanism**

The Biodiversity Code requires the environmental authorities to ensure that negative impacts of projects on wildlife and habitats are avoided, prevented, repaired, compensated or minimised. More specifically, Article 2.306 of the code stipulates that when *in-situ* reparation of environmental deterioration is impossible, it will instead be subject to indemnification. Once the indemnification is determined, the amount is transferred to the Biodiversity Restoration and Preservation Fund (Fondo para la Restauración y Preservación de la Biodiversidad), managed by CONAFOR.

The valuation of the indemnity in monetary terms can be carried out by SEMARNAT, the Environmental Protection Administration (Procuraduria de Proteccion al Ambiente del Estado de Mexico), qualified experts, educational institutions or research institutions (Darbi et al., 2009). The project developer can choose whether to create its own offset or to pay into the compensation fund. An example of a developer-created offset is PEMEX's Jaguaroundi project, in which the state oil company aggregated its required offsets into a single 961 ha tract of tropical rainforest near PEMEX refineries.

If the developer chooses instead to pay into the fund, Mexican legislation requires a compensation ratio greater than 1:1, with CONAFOR responsible for setting the ratio. CONAFOR then uses the resulting money to complete reforestation activities on behalf of the developer. The compensation amount per hectare is calculated using the average cost of reforestation activities (not including the cost of purchasing the land) instead of an estimate of the value of the environmental service affected.

Complementing these programmes is "ProÁrbol",[15] which includes a national reforestation programme, PRONARE. Managed by CONAFOR, PRONARE gives support to landowners/users for reforesting degraded forest land, providing seedlings, training and funding. Since 2007, 1.87 million ha have been reforested. A study has indicated that without this programme, the total area reforested annually in Mexico would be only 10% of

its present total (UACH, 2010). It is not clear, however, if this finding reflects the area of land where seedlings have been replanted, or, more comprehensively, if it reflects monitoring to assess tree survival over time. Secondary support was later introduced to the reforestation programme to protect and maintain reforestation. As demand for this support is considerably oversubscribed, additional features should be added to target and prioritise payments to areas with high benefits and high probability of enhancing provision of ecosystem services (similar to the PES programme). Indeed, as the eventual objective of the reforestation programme is to restore ecosystems and habitats for biodiversity, the design features should be adjusted so as to further these ends.

In response to increasing demand and interest of landowners regarding access to new productive activities in rural areas, in 2010, SEMARNAT launched the subsidy programme "Promoting the Conservation and Sustainable Use of Wildlife, through Management Units for Wildlife Conservation (UMAs) and Facilities for Wildlife Handling (PIMVS) in rural areas". This programme is aimed at poverty eradication in the local communities with the lowest human development index by supporting the establishment of management units for wildlife conservation (UMAs) for income and employment generation. Since 2010, 504 projects for establishing UMAs or reinforcing existing ones have been subsidised by this programme with a total of 225 million pesos. These new UMAs are now part of the SUMA, which covered more than 37 million ha as of 2012.

To assess the effectiveness of UMAs with respect to conserving species populations and their habitats, CONABIO is co-ordinating a project with financing from SEMARNAT that will include gathering data from the field.

Another subsidy programme concerns sustainable fishing promotion and conservation of the vaquita, probably the world's smallest and most at-risk cetacean. Since 2007, fishing in the northern California Gulf has been influenced by programmes and subsidies co-ordinated through a PACE for the vaquita. One element of the PACE is buyouts for fishers who are willing to stop fishing or "switch-outs" for those who agree to switch to alternative, vaquita-safe fishing methods. As of 2008, these subsidies resulted in the gill net permits being retired for about one-third of the legal fishers (Barlow et al., 2009). Switch-out subsidies have encouraged "technological reconversion" by helping replace gill nets and tangle nets (which have been responsible for accidental capture and drowning of vaquitas) with more sustainable alternatives, and buyout payments have helped encourage "productive reconversion" by giving fishers an incentive to take up other activities, including some directly related to biodiversity conservation. These measures are believed to have helped reduce threats to the conservation of vaquitas and to have begun decreasing the total level of fishing in the area, with conservation benefits for other marine species.[16] Table 5.3 gives a breakdown of the subsidies in the PACE for the vaquita.

4.3. *Voluntary agreements and other instruments, including private sector engagement*

Mexico has some voluntary agreements and information instruments, notably for green certification. Green certification has been established for products including coffee; 10% of all coffee producers in Mexico are in the certified coffee market, a higher percentage than in other countries. Although timber certification has also increased (with almost 1.8 million ha of forest certified or in the process of being certified by national and international standards), illegal timber extraction remains a major challenge. Eco-certification of tourism-related businesses presents key opportunities, especially as this is a large

Table 5.3. **PACE subsidy breakdown**

By year (MXN)

PACE subsidy type	2007	2008	2009	2010	**Total**
Technological reconversion	4 200 000	30 000 000	24 850 000	15 300 000	**74 350 000**
Productive reconversion	30 800 000	97 700 000	7 700 000	300 000	**136 500 000**
Conservation activities	–	25 341 500	21 249 000	31 620 000	**78 210 500**
Technological development	–	–	7 310 000	17 250 000	**24 560 000**
Subtotal	35 000 000	153 041 500	61 109 000	64 470 000	**313 620 500**
Operational costs and technical assistance	757 475	2 225 154	1 361 670	1 563 175	**5 907 473**
TOTAL	**35 757 475**	**155 266 654**	**62 470 670**	**66 033 175**	**319 527 973**

Source: CONANP, 2011, Unpublished data.

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growth sector; such opportunities should be further encouraged and developed (see also Section 4.2).

While some initiatives have been undertaken by the private sector (Box 5.5), further efforts are needed to engage the private sector in biodiversity and forest conservation and sustainable use, whether via voluntary approaches or through the use of regulatory approaches and economic instruments. Taxes on timber and other natural resource extraction, for example, can help provide correct price signals, induce more sustainable production and consumption patterns, and mobilise revenue.

Box 5.5. **Engaging the private sector in biodiversity conservation and sustainable use**

An alliance between WWF, SEMARNAT and the Carlos Slim Foundation, formed in 2009, has promised to mobilise USD 100 million to undertake actions that strengthen biodiversity conservation and sustainable development in Mexico. The initiative planned to target 17 natural reserves in six regions, including the northern deserts, tropical Caribbean beaches and eastern jungles. In co-ordination with beneficiaries of the Programme for Species at Risk (PROCER), the alliance partners invited other private sector organisations to become involved in efforts to implement the projects concerned. It is not clear to what extent such support has materialised.

Mexico should also work further to raise awareness in the private sector on the business risks and opportunities associated with biodiversity and forests. This can be undertaken through channels such as information on websites, training workshops and co-operation with state and municipal government. Such efforts have been undertaken in the context of climate change (including the development of guidelines – see Chapter 4), which could be used as models to develop such tools for biodiversity.

4.4. Public expenditure on biodiversity and forests

The SEMARNAT budget in 2011 was MXN 51.2 billion (see Chapter 2). The CONANP's share in 2011 was MXN 0.99 billion (1.9%), an increase from MXN 0.35 billion in 2002. CONAFOR's budget was MXN 6.46 billion (i.e. 12.6%), a threefold increase in real terms since 2002. In comparison, the SAGARPA budget in 2011 was MXN 73.00 billion. Mexican data indicate that expenditure on biodiversity increased from MXN 2.56 billion in 2001 to

MXN 8.41 billion in 2009, although the categorisation of data is not consistent over the years, making comparison difficult.

While the data are not complete, Salcido et al. (2009) examined financing sources for a sample of 1 013 conservation projects in Mexico and found that the public sector contributed the largest share (74%), followed by funds and foundations (18%), with the private sector accounting for just 0.06%.[17]

5. Mainstreaming biodiversity and forestry in other sectors and policy areas

Many of the drivers of biodiversity and forest loss are, directly or indirectly, related to policies in other sectors, such as agriculture, with conversion to crop and livestock production; urban planning and infrastructure such as roads; and tourism (Challenger and Dirzo, 2008; FAO, 2010; SEMARNAT, 2011). Thus mainstreaming and aligning biodiversity and forest objectives in these sectors is a crucial element of effective conservation and sustainable use. Mexico's National Development Plans since early 2000s have recognised the importance of this approach. Particularly since 2007, the government has included mainstreaming of environmental concerns as a necessary strategy for achieving sustainable development. The 2007-12 National Development Plan, for example, includes environmental sustainability as one of five key axes. The environment axis consists of 14 objectives and associated strategies, including slowing deterioration of forests and jungles, conserving ecosystems and biodiversity, and integrating conservation of natural capital with economic and social development. This section looks at key sectors for mainstreaming.

5.1. *Biodiversity and agriculture*

While the negative impact of agricultural subsidies on land-use change and, consequently, on biodiversity is widely recognised in various sectors in Mexico, effective mainstreaming and aligning of objectives has not yet taken place (CONABIO-UNDP, 2009). Policies addressing agri-environmental concerns are nascent. This is especially concerning as Mexico is projected to continue with strong growth in agricultural production in the coming decade, with the risk of further expansion of production onto environmentally fragile land (OECD, 2010b). Agriculture has also exerted pressure on aquatic environments (rivers, lakes, wetlands and coastal zones), from increasing levels of livestock effluents and diffuse pollution through the use of chemicals in arable farming. Other issues include the genetic erosion of maize varieties, which show a loss of 80% of local varieties compared to the 1930s, and more recently possible contamination of domesticated landraces and wild relatives from transgenic maize (OECD, 2008). While agri-environmental payments are possible under PROCAMPO for soil and water conservation, for instance, farmers' uptake of these payments has been limited. A number of programmes support forestry but only one is aimed specifically at the reforestation of farmland.

There is evidence, moreover, that subsidy programmes such as PROCAMPO (direct assistance to agriculture)[18] may promote clearing and burning, thereby accelerating land use change, a key driver of biodiversity loss (Gaytán and González, 1997; Cortez, 2000; Reyes-Hernández et al., 2003). "In the region of Calakmul, for example, Klepeis and Vance (2003) associate these subsidies with a higher rate of deforestation because they promote the cultivation of chili and pasture, and increase the clearance of mature forest to obtain soils suitable for crops. Abizaid and Coomes (2004) and Isaac-Márquez et al. (2005) obtained similar results regarding the effect of PROCAMPO on the expansion of deforestation

in the southern region of the Yucatán Peninsula and in the Tenosique region of Tabasco" (CONABIO-UNDP, 2009).

Munoz-Pina (2004) reported that, in the early 2000s, subsidies that potentially had the most negative impact on the environment had a budget almost double that of more environmentally benign subsidies (Guevara-Sanginé, 2009). Programmes to pay grain producers above-market prices (Programa Ingreso Objetivo), to give per-animal subsidies to cattle ranchers (Programa de Estimulos a la Ganaderia) and to underwrite purchases of farm equipment (Programa Activos Productivos) may have led to increased intensification and expansion of agriculture, with negative impacts on biodiversity (Guevara-Sanginé, 2009). Other harmful subsidies include VAT exemption for agrochemicals and electricity subsidies (OECD, 2008). Under the latter, pricing of electricity to pump water has been used to explain why so few farmers adopt water-saving technology despite significant pressure on water resources. In 2011, the government spent around USD 649 million in subsidies to irrigation agriculture (OECD, 2012). In July 2011, the government launched a pilot programme to partly decouple the amount of the subsidy from electricity use. The programme involves 13 aquifers and more than 8 000 potential beneficiaries. Farmers participating pay a higher electricity price, although still partially subsidised and below the average cost of electricity generation. In exchange, they receive a cash transfer equivalent to the forgone electricity subsidy, calculated on the basis on their last three years' average consumption. Thus, farmers' income is maintained while pressure on water resources is reduced (see Box 3.3).

5.2. *Biodiversity and tourism*

Tourism is the third most important economic activity in Mexico, generating more than 8% of GDP. In 2000, SECTUR, in co-operation with SEMARNAT, CONABIO and several other institutions from the public, private, social and academic sectors, published a National Policy and Strategy for Sustainable Tourism, with useful guidelines and action plans. More recently, the 2009 General Law on Tourism included clauses relating to sustainability. Within the Sustainable Tourism Programme in Mexico, SECTUR diagnosed major destinations so as to identify priorities for promoting sustainable tourism, and is currently working to promote eco-certification of tourism-related businesses, in conjunction with the Rainforest Alliance and EarthCheck programmes,[19] so as to comply with the Global Sustainable Tourism Criteria. Between 1997 and July 2011, for example, a total of 4 828 Clean Industry certificates and Environmental Quality certificates (including tourism quality) were issued. Ecotourism is an important sector with green growth potential and should be further promoted. In addition to access fees for federal protected areas and reserves, other instruments to capture the international public good benefits provided by protected areas should be explored (see also Alpizar, 2006). For instance, in Belize, an environmental tax is levied on visitors upon departure.

5.3. *Biodiversity and climate change*

Biodiversity and climate change are intricately linked, with opportunities for mainstreaming biodiversity in both climate change mitigation and adaptation. With regard to the latter, Mexico has recently developed a strategy for climate change adaptation in protected areas. In general, a key area where synergies can be captured is in forests, which provide carbon sequestration services as well as biodiversity benefits such as habitat provisioning. Recognising this, Mexico is developing a national strategy on REDD+

emphasising the need to capitalise on the opportunities REDD+ provides in terms of co-benefits for biodiversity conservation, sustainable forest management and sustainable rural development (see Chapter 4). Prioritising REDD+ finance to areas that have both high carbon benefits and high biodiversity benefits is one way to harness these synergies and Mexico is exploring how such benefits can be captured through approaches such as PES. The key elements of Mexico's REDD+ strategy are: 1) building and/or strengthening institutional capacities; 2) improving targeting and effectiveness of existing programmes and expanding the PES model; 3) promoting sustainable forest management; 4) improving monitoring capabilities for LULUCF based on the National Forest Inventory, including monitoring, reporting and verification in local communities; and 5) integrating new financing mechanisms (carbon finance) with a positive impact on biodiversity conservation and livelihoods of forest landholders and inhabitants (CONAFOR, 2010). To effectively enhance biodiversity co-benefits in its REDD+ strategy, Mexico will need to identify areas with both high-carbon and high-biodiversity benefits, as well as areas with high risk of deforestation and low opportunity cost. Pilot projects provide an opportunity for early testing and can build on experience from other projects, such as those which have met the standards of the Climate, Community and Biodiversity Alliance. These pilots could help in mobilising additional finance via premiums for the biodiversity benefits in voluntary carbon markets.

Notes

1. Also operating as a decentralised agency of SEMARNAT is the Mexican Institute of Water Technology (IMTA) (see Chapter 2).
2. CONAPESCA, the National Commission of Aquaculture and Fishing, is the decentralised agency under SAGARPA responsible for promoting sustainable exploitation and conservation of marine resources.
3. SEMARNAT, SAGARPA and the ministries of Social Development (SEDESOL), Health (SALUD), Public Education (SEP), Energy (SENER), Tourism (SECTUR), Foreign Affairs (SRE), Economy (SE), and Finance and Public Credit (SHCP).
4. SEMARNAT, SHCP, SAGARPA, SECTUR and the National Defence Ministry (SEDENA), plus CONAGUA.
5. Data based on INEGI's land use and vegetation maps (INEGI, 1994, 2002, 2007), in accordance with the criteria and methodology set out by the Food and Agriculture Organization (FAO).
6. PINE is an attempt to demonstrate the impact on Mexico's GDP of the costs of ecological and environmental degradation.
7. NOM-059-SEMARNAT-2010; NOM-022-SEMARNAT-2003; NOM-131-SEMARNAT-2010 respectively.
8. Note that the data on federal PA in Figures 5.4 and 5.5 differs. Data used by SEMARNAT in Figure 5.4 is calculated based on the year of the decree and the estimated areas provided by CONANP.
9. The corridors are Southern Sierra Madre (Sierra Madre del Sur, southern Chiapas), Maya-Zoque rainforests (Selva Maya-Zoque, northern Chiapas), Calakmul-Sian Ka'an (Campeche), Sian Ka'an-Calakmul (Quintana Roo) and Yucatan north coast (Costa norte de Yucatan, Yucatan and Quintana Roo).
10. The additional corridors are Coastal wetlands to Huimanguillo mountains (Humedales costeros-Sierra de Huimanguilla, Tabasco), Centla swamps to Usumacinta Canyon (Pantanos de Centla-Cañon de Usumacinta, Tabasco) and Tabasco mountains (Sierra de Tabasco).
11. General Law of Ecological Balance and Environmental Protection, Title First, Article 3, fraction XXIII.
12. That is, listed in the revised standard on threatened species, NOM-059-SEMARNAT-2010, or in Appendix I or II of CITES.
13. DOF 13-II-1992.

14. Art. 28 of LGEEPA.

15. The umbrella programme, ProÁrbol, includes the following in addition to the PES programmes: PROCOREF, for reforestation and restoration; PRODEPLAN, which includes promotion of commercial forest plantations, forest fire prevention and soil conservation; PROCYMAF, to improve forest ecosystem productivity; and PRODEFOR, the forest development programme.

16. Other elements of the vaquita PACE include commitment of additional resources by CONAPESCA and PROFEPA towards enforcement of regulations to eliminate fishing without a permit; a programme instituted by INAPESCA to test new fishing methods (*suripera nets*) that do not risk harming vaquitas; and bans on all gill net and trawl fishing in the Vaquita refuge, with enforcement by PROFEPA beginning at the start of the shrimp season in September 2008 (Barlow et al., 2009).

17. The remaining finance was contributed by academia, international organisations, NGOs, amongst other sources of finance.

18. Under PROCAMPO, eligible farmers receive payments based on the area planted in 1991-93 on the condition that the land is used for legal agricultural or livestock production, or within an environment programme.

19. See: *www.earthcheck.org/* and *www.rainforest-alliance.org*.

Selected sources

Abizaid, C. and O.T. Coomes (2004), "Land Use and Forest Fallowing Dynamics in Seasonally Dry Tropical Forest of the Southern Yucatan Peninsula, Mexico", *Land Use Policy*, 21: 71-84.

Adger et al. (1994), N. Adger, K. Brown, R. Cervigni, D. Moran (1994), *Towards Estimating Total Economic Value of Forests in Mexico*, CSERGE and UCL.

Alpizar, F. (2006), "The pricing of protected areas in nature-based tourism: A local perspective", *Ecological Economics*, 56: 294-307.

Barlow, J., L. Bracho, C. Muñoz-Piña and S. Mesnick (2009), "Conservation of the Vaquita (*Phocoena sinus*) in the Northern Gulf of California", Mexico, *www.ine.gob.mx/descargas/dgipea/ine-biodiv-pc-01-2009.pdf*.

Bezaury Creel, J.E. and L. Pabón Zamora (2009), "Valuation of Environmental Goods and Services Provided by Mexico's Protected Areas", The Nature Conservancy-México Program-Comisión Nacional de Áreas Naturales Protegidas, Mexico City.

Challenger, A. and R. Dirzo (2008), "Factores de cambio y estado de la biodiversidad", in Dirzo, R., R. Gonzalez and I. March (eds.), *Capital natural de México, Vol. II: Estado de conservación y tendencias de cambio*, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México, DF.

CONABIO – UNDP (2009), *Mexico: Capacities for Conservation and Sustainable Use of Biodiversity*, National Commission for the Knowledge and Use of Biodiversity and the United Nations Development Programme, Mexico City.

CONAFOR (2010), "Mexico's REDD+ Readiness Preparation Proposal", Powerpoint presentation to FCPC Participants Committee in Gabon in March, 2010.

CONAFOR (2011), Certificación forestal, *www.conafor.gob.mx/portal/index.php/temas-forestales/certificacion-forestal*.

CONANP (2008), "Programa de trabajo sobre Áreas Naturales Protegidas México", Comisión Nacional de Áreas Naturales Protegidas, México, DF.

CONANP (2010), Pago por Servicios Ambientales en Áreas Naturales Protegidas, Comisión Nacional para Áreas Naturales Protegidas, México, DF, *www.conanp.gob.mx/contenido/pdf/PSA%20en%20ANP%202003-2008%20coments%20FJMG-JMfinal-resumen.pdf*.

Cortez, R.C. (2000), "Inseguridad alimentaria, pobreza y deterioro ambiental en el marco de la globalización", *Sector agropecuario y alternativas comunitarias de seguridad alimentaria y nutrición en México*, Plaza y Valdez/UAM/INMSZ, México, pp. 39-59.

Darbi, et al. (2009), "International Approaches to Compensation for Impacts on Biological Diversity", Final Report, Dresden, Berlin.

DOF (Diario Oficial) (2010), "NORMA Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo", 30 December, 2010.

FAO (Food and Agriculture Organization of the United Nations) (2010), *Global Forest Resources Assessment 2010*, Rome.

Figueroa, F. and V. Sánchez-Cordero (2008), "Effectiveness of natural protected areas to prevent land use and land cover change in Mexico", *Biodiversity and Conservation, 17:3223-3240.*

Gandara, G., A.N. Correa Sandoval, and C.A. Hernández Cienfuegos (2006), "Valoración económica de los servicios ecológicos que prestan los murciélagos Tadarida brasiliensis como controladores de plagas en el norte de México", Tecnológico de Monterrey, Escuela de graduados de Administración Pública y Política Pública, *Cátedra de Integración Económica y Desarrollo Social, Working Paper,* 2006-5.

Gaytán, H.M. and R.R. González (1997), "La unión de comunidades Kyat-nuu y el problema del financiamiento", *Cuadernos Agrarios*, 15: 94-115.

Guajardo, R. and A. Martínez (2004), "Cuantificación del impacto económico de la caza deportiva en el norte de México y perspectivas de su desarrollo", Revista electrónica Entorno Económico, Centro de Investigaciones Económicas, Universidad de Nuevo León.

Guevara-Sanginés, A. (2009), "*Mexico Country Case Study: Desk-Review of the Importance of Biodiversity and Ecosystem Services for Economic Growth and Equity in Mexico*", report written for UNDP.

INEGI (2002), "Conjunto de datos de la carta de uso del suelo y vegetación, escala 1: 250,000: Serie III", Instituto Nacional de Estadística, Geográfia e Informatica, Aguascalientes, Mexico, DF.

INEGI (2004), "Conjunto de datos de la carta de uso del suelo y vegetación, escala 1: 250,000: Serie II", Instituto Nacional de Estadística, Geográfia e Informatica, Aguascalientes, Mexico, DF.

INEGI (2007), "Conjunto de datos de la carta de uso del suelo y vegetación, escala 1: 250,000: Serie IV (in preparation)", Instituto Nacional de Estadística, Geográfia e Informatica, Aguascalientes, Mexico, DF.

Isaac-Márquez, R., B. de Jong, A. Estmond, S. Ochoa-Gaona and S. Hernández (2005), "Estrategias productivas campesinas: un análisis de los factores condicionantes del uso del suelo en el oriente de Tabasco, México", *Universidad y Ciencia,* 21: 56-72.

Klepeis, P. and C. Vance (2003), "Neoliberal Policy and Deforestation in Southeastern Mexico: An Assessment of the Procampo Program", *Economic Geography*, 79: 221-240.

Martínez-Meyer, E., D. Arroyo-Lambear and E. Calixto-Pérez (2011), "Caracterización y evaluación de los sitios prioritarios para la conservación de las especies prioritarias ante los impactos del cambio climático en México", *Informe técnico,* Instituto de Biología de la UNAM, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad and Instituto Nacional de Ecología, Mexico, DF.

McAfee, K. and E.N. Shapiro (2010), "Payment for ecosystem services in Mexico: Nature, neoliberalism, social movements and the state", *Annals of the Association of American Geographers*, 100 (3), pp. 579-599.

Muñoz-Piña, C., M., Rivera, A. Cisneros and H. García (2011), "Retos de la focalización del Programa de Pago por los Servicios Ambientales en México", *Revista Española de Estudios Agrosociales y Pesqueros,* Vol. 228 No. 1, pp. 87-113.

OECD (2008), *Environmental Performance of Agriculture in OECD Countries Since 1990,* OECD, Paris.

OECD (2010a), *Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services,* OECD, Paris.

OECD (2010b), *OECD-FAO Agricultural Outlook 2010-19*, OECD, Paris, *www.agri-outlook.org*.

OECD (2010c), *Sustainable Management of Water Resources in Agriculture*, OECD, Paris.

OECD (2012), *Agricultural Policy Monitoring and Evaluation 2012: OECD Countries*, OECD, Paris.

Reyes, J.A., J.P. Gómez, R.O. Muis and R. Zavala (2012), "Potencial de Servicios Ambientales en la Propiedad Social en México", *Proyecto Registro Agrario Nacional (RAN)*, Instituto Interamericano de Cooperación para la Agricultura (IICA), México, DF.

Reyes-Hernández, H., S. Cortina-Villar, H. Perales-Rivera, E. Kauffer-Michel and J.M. Pat-Fernández (2003), "Efecto de los subsidios agropecuarios y apoyos gubernamentales sobre la deforestación durante el periodo 1999-2000 en la región de Calakmul", Campeche, México, *Investigaciones Geográficas, Boletín del Instituto de Geografía*, UNAM 51: 88-106.

Rivera-Planter, M. and C. Munoz-Pina (2005), "Fees for Reefs: Economic Instruments to Protect Mexico's Marine Natural Areas", *Current Issues in Tourism*, Vol. 8 (2-3).

García Romero, H. (2012), "Payments for Environmental Services: Can They Work?", *Field Actions Science Reports* [Online], Special Issue 6/2012, On line since 27 June, 2012, viewed 24 July, 2012, *http://factsreports.revues.org/1711*.

Salcido R., I. Quiroz R. and Ramirez (2009), "*Understanding investment in biodiversity conservation in Mexico*", *Biodiversity & Conservation*, Vol. 18 (5): 1421-1434.

SEMARNAT (2006), *La gestión ambiental en México*, Secretaría de Medio Ambiente y Recursos Naturales, México, DF, *www.semarnat.gob.mx/informacionambiental/publicaciones/Publicaciones/Gestion_Ambiental.pdf*.

SEMARNAT (2011), *Programa Anual de Trabajo*, 2011, Secretaría de Medio Ambiente y Recursos Naturales, México, DF, *www.semarnat.gob.mx/programassubsidios/pat/Documents/PAT2011/PAT_2011_Final.pdf*.

SEPESCA (Secretaría de Pesca) (1991), "Decreto que establece la veda total en la captura de las tortugas marinas", Diario Oficial de la Federación, No. 28 de mayo, México, DF.

Sisk, Castellanos, and Koch (2007), "Ecological impacts of wildlife conservation units policy in Mexico", *www.cefns.nau.edu/Academic/CSE/Lab/Publications/documents/Sisk_etal_2007_Frontiers.pdf*.

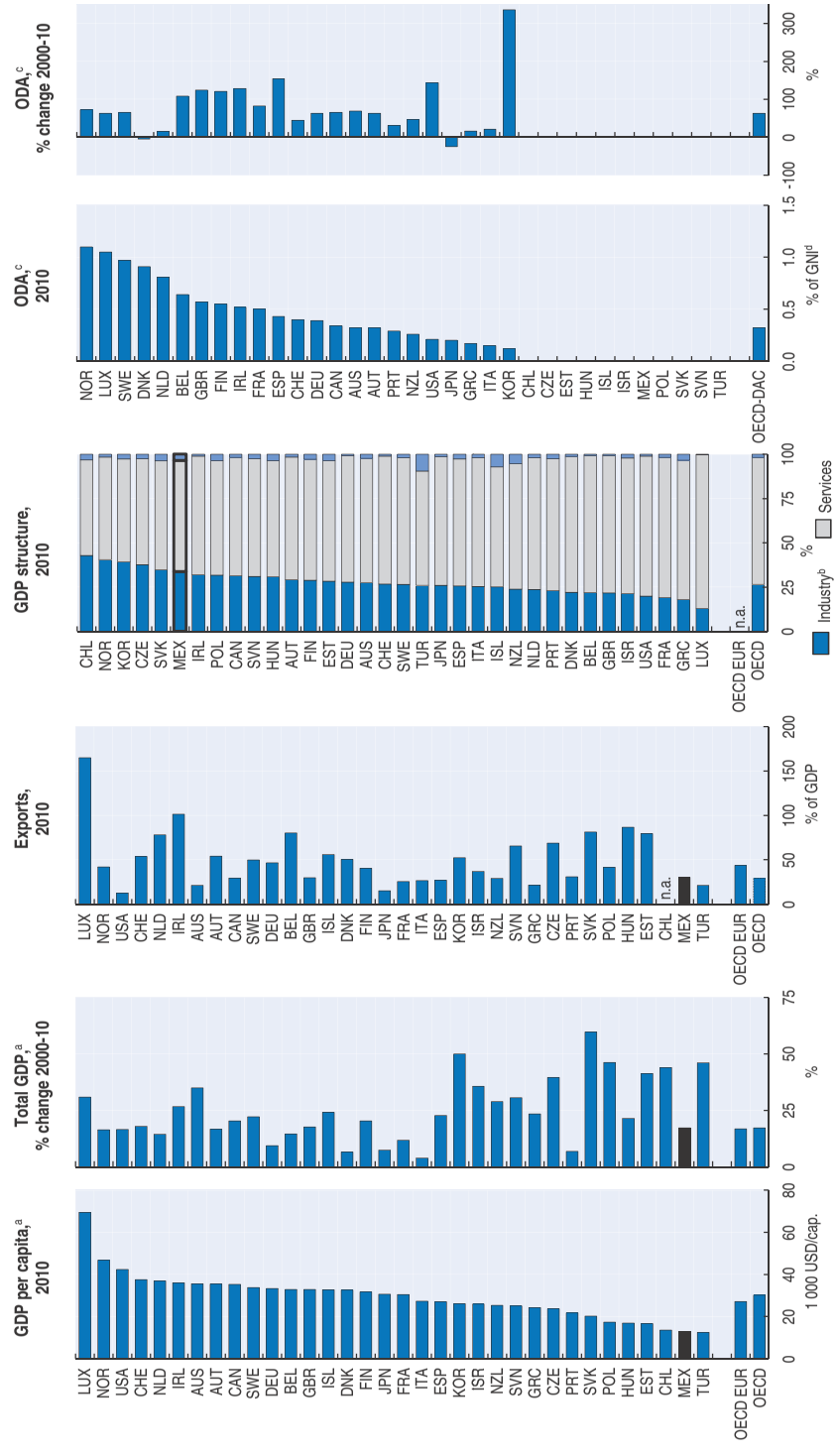
Sanjurjo, E., S. Cox and A. Anderson (2008), "Buy-outs and buy-in: Saving the vaquita in the Gulf of California", in *Workshop Proceedings for A Private Sector Approach – Conservation Agreements in support of Marine Protection*, Bainbridge Island, Washington State, USA, 16-19 June, 2008, viewed 24 July, 2012, *www.mcatoolkit.org/pdf/PMCA_Workshop/1_MCAWorkshop_FullProceedings.pdf*.

UACH (2010), "Informe de evaluación externa de los apoyos de reforestación, ejercicio fiscal 2009", *Universidad Autónoma de Chapingo*, Comisión Nacional Forestal, Texcoco, México, *http://148.223.105.188:2222/gif/snif_portal/administrator/sistemas/evaluaciones/1301593358_2009_reforestacion_resumen_eje*.

USAID (2009), "Assessment of Tropical Forest and Biodiversity Conservation in Mexico", *FAA Section 118-119 Report*, United States Agency for International Development.

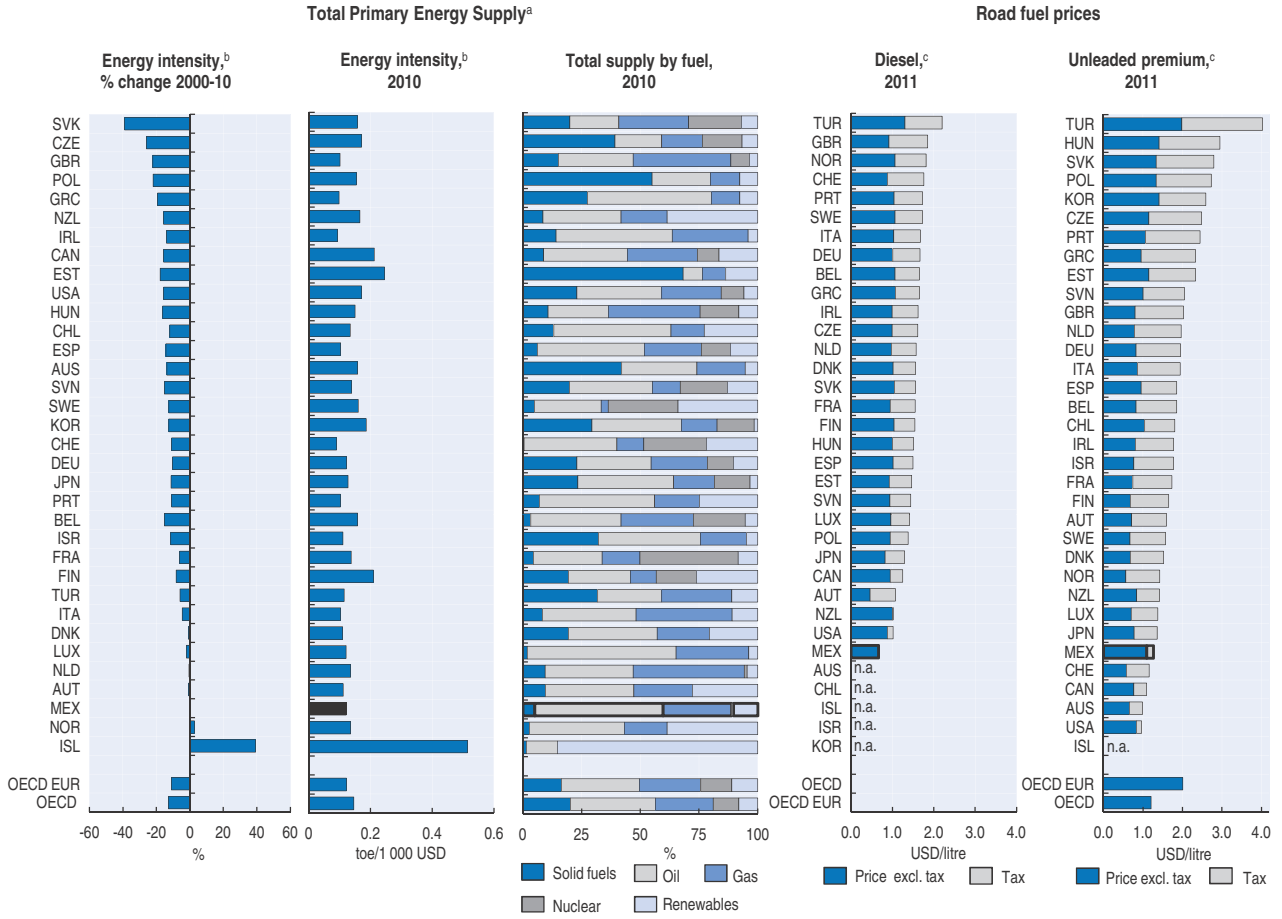
REFERENCES

Reference I.A. **Selected economic data*– Economic context**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) GDP at 2005 prices and purchasing power parities.
b) Includes mining and quarrying, manufacturing, gas, electricity and water, and construction.
c) Official Development Assistance by member countries of the OECD Development Assistance Committee. Total net disbursements at constant 2010 USD.
d) Gross National Income.
Source: OECD Environmental Data.

Reference I.A. **Selected economic data* – Energy**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.

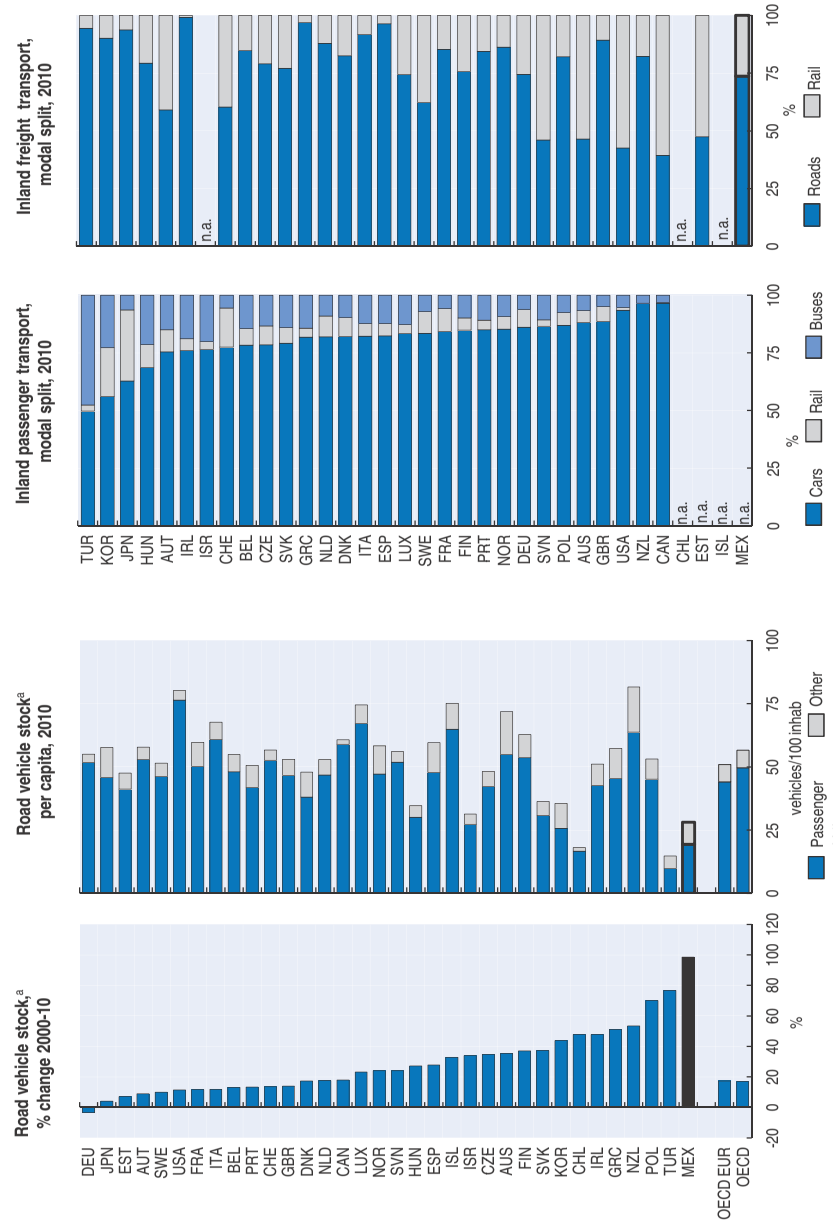
a) Excluding international marine and aviation bunkers.

b) Total primary energy supply per unit of GDP expressed at 2005 prices and purchasing power parities.

c) Diesel fuel: automotive diesel for commercial use, current USD; Unleaded petrol: Unleaded premium (RON 95): USD at current prices and purchasing power parities; JPN: regular unleaded; ISR: 2010 data.

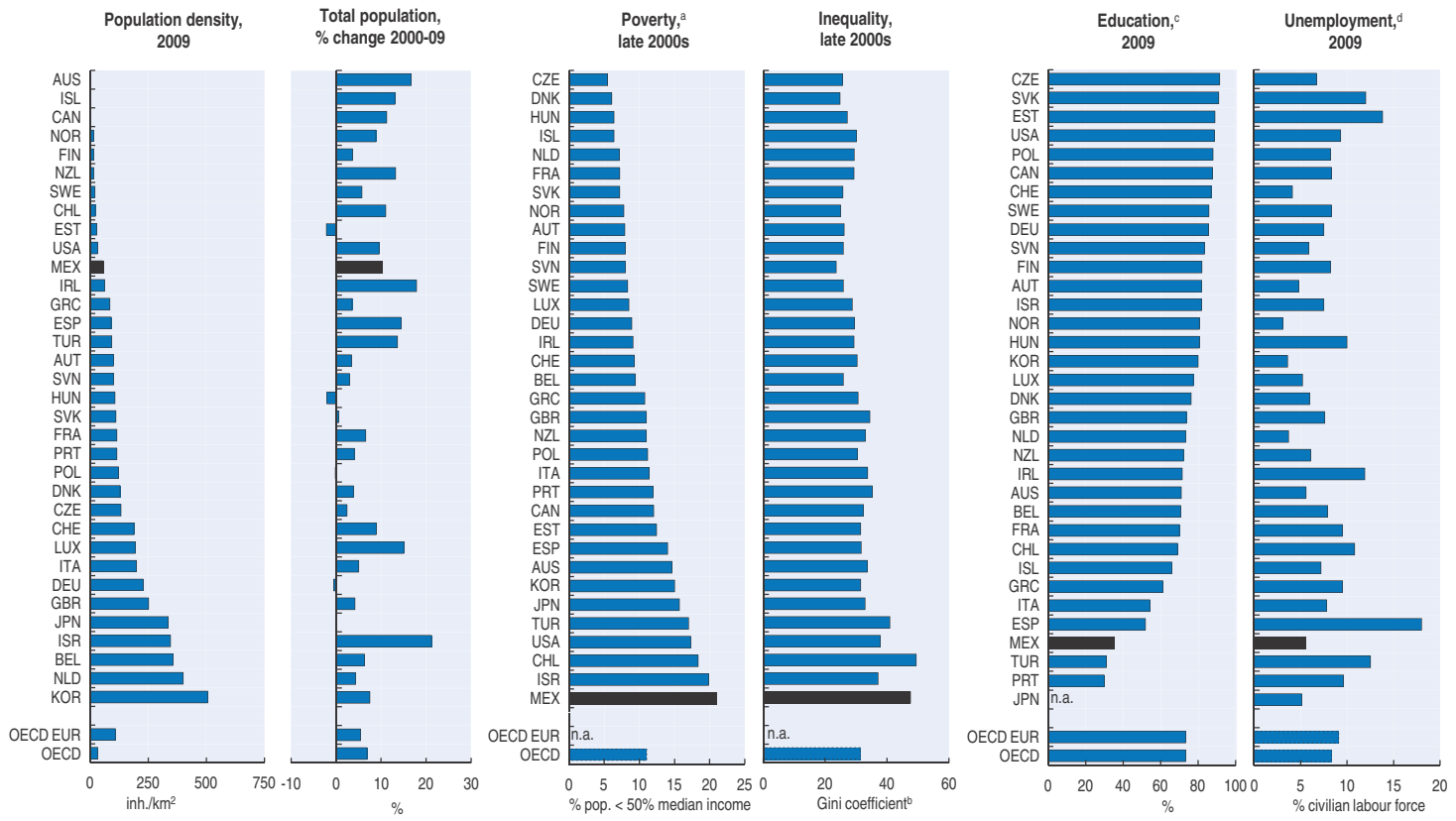
Source: OECD Environmental Data.

Reference I.A. **Selected economic data* – Transport**



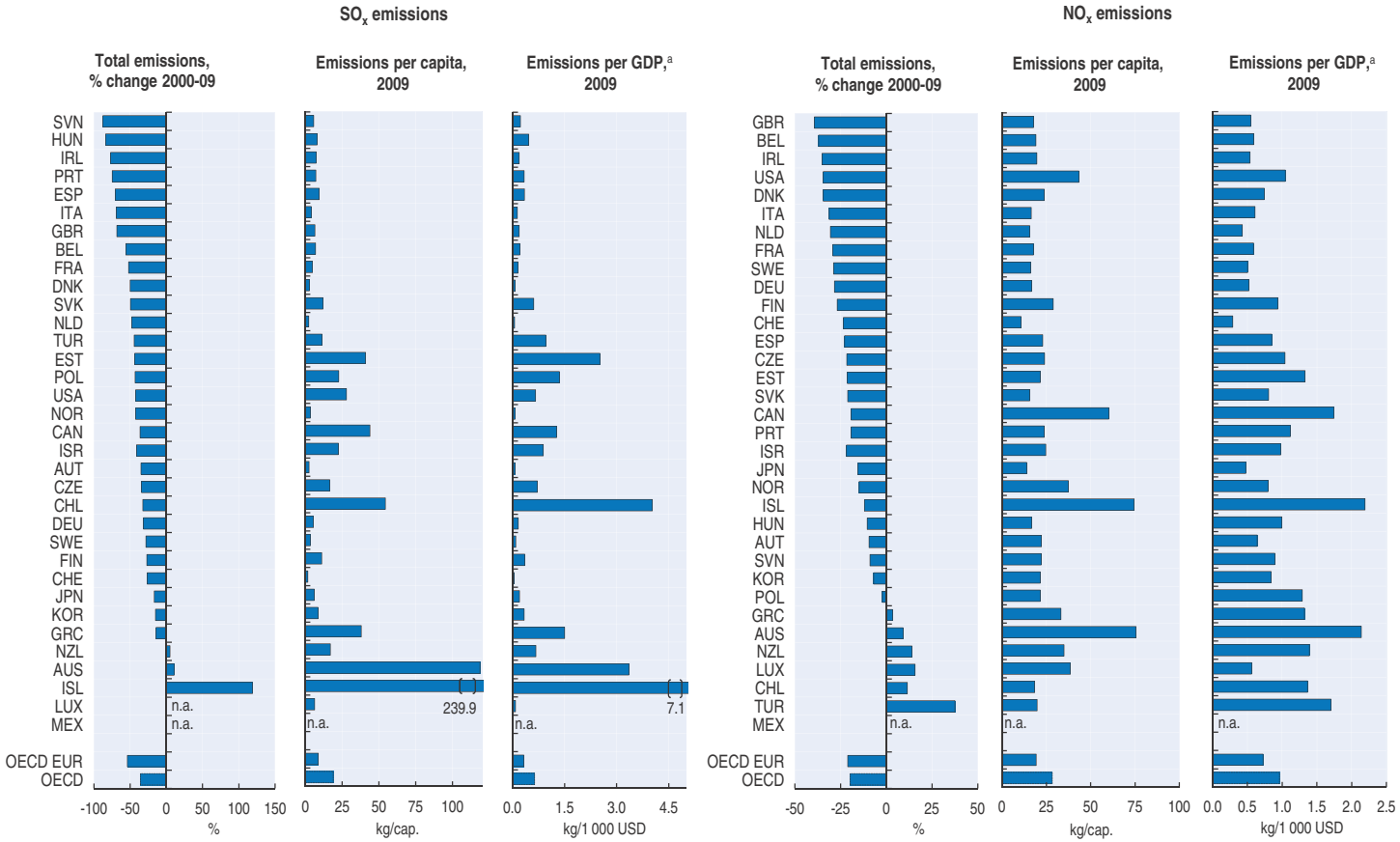
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Motor vehicles with four or more wheels.
Source: OECD Environmental Data.

Reference I.B. **Selected social data* – Social context**



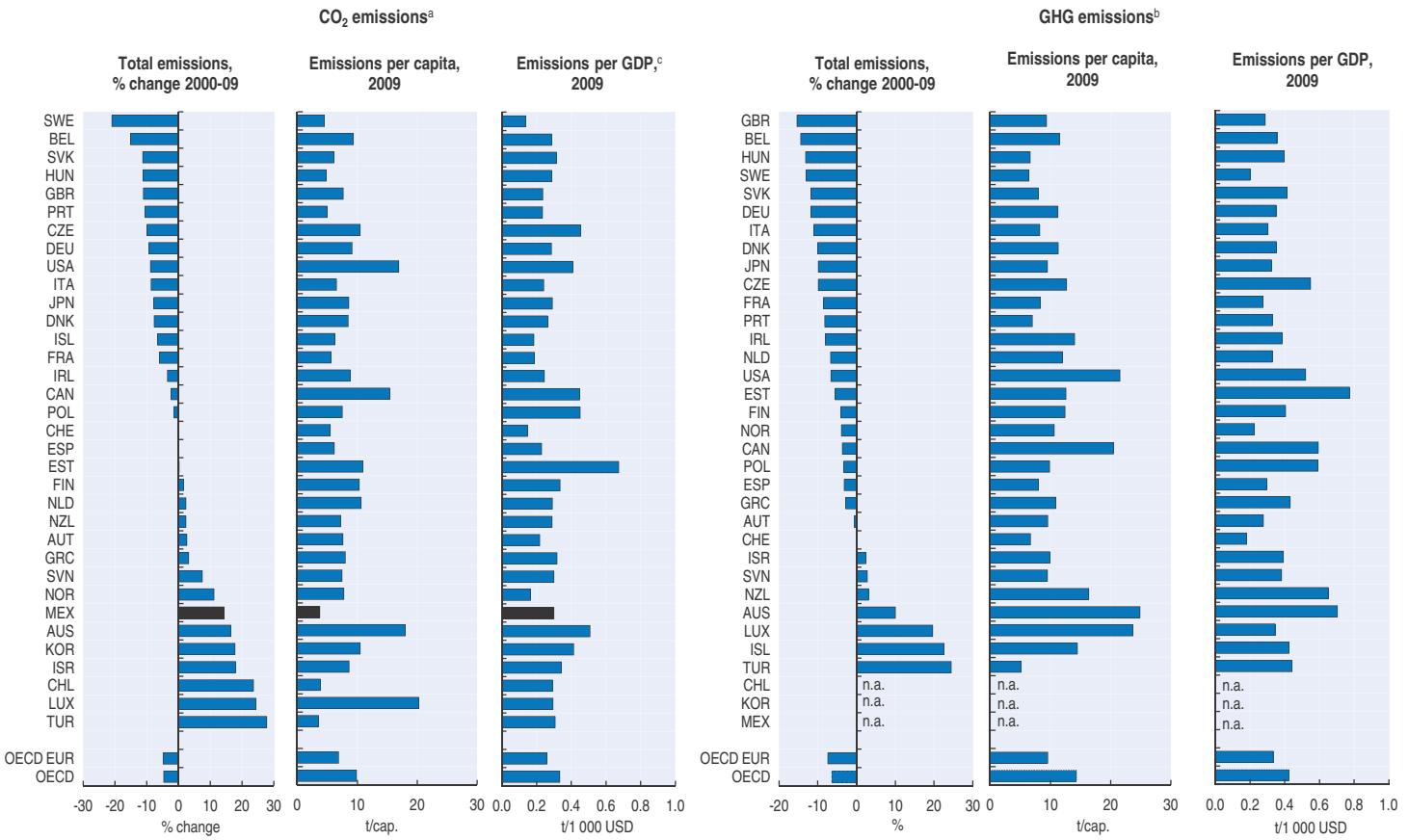
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Partial totals are indicated by dotted borders.
a) Share of population with an income under 50% of the median income.
b) Ranging from 0 (equal) to 100 (inequal) income distribution; figures relate to total disposable income (incl. all incomes, taxes and benefits) for the entire population.
c) Share of population aged 25-64 years with at least upper secondary education. OECD: average of rates.
d) Harmonised unemployment rates; MEX, ISL, TUR: commonly used definitions.
Source: OECD Environmental Data; OECD Factbook Statistics.

Reference I.C. **Selected environmental data* – Air**



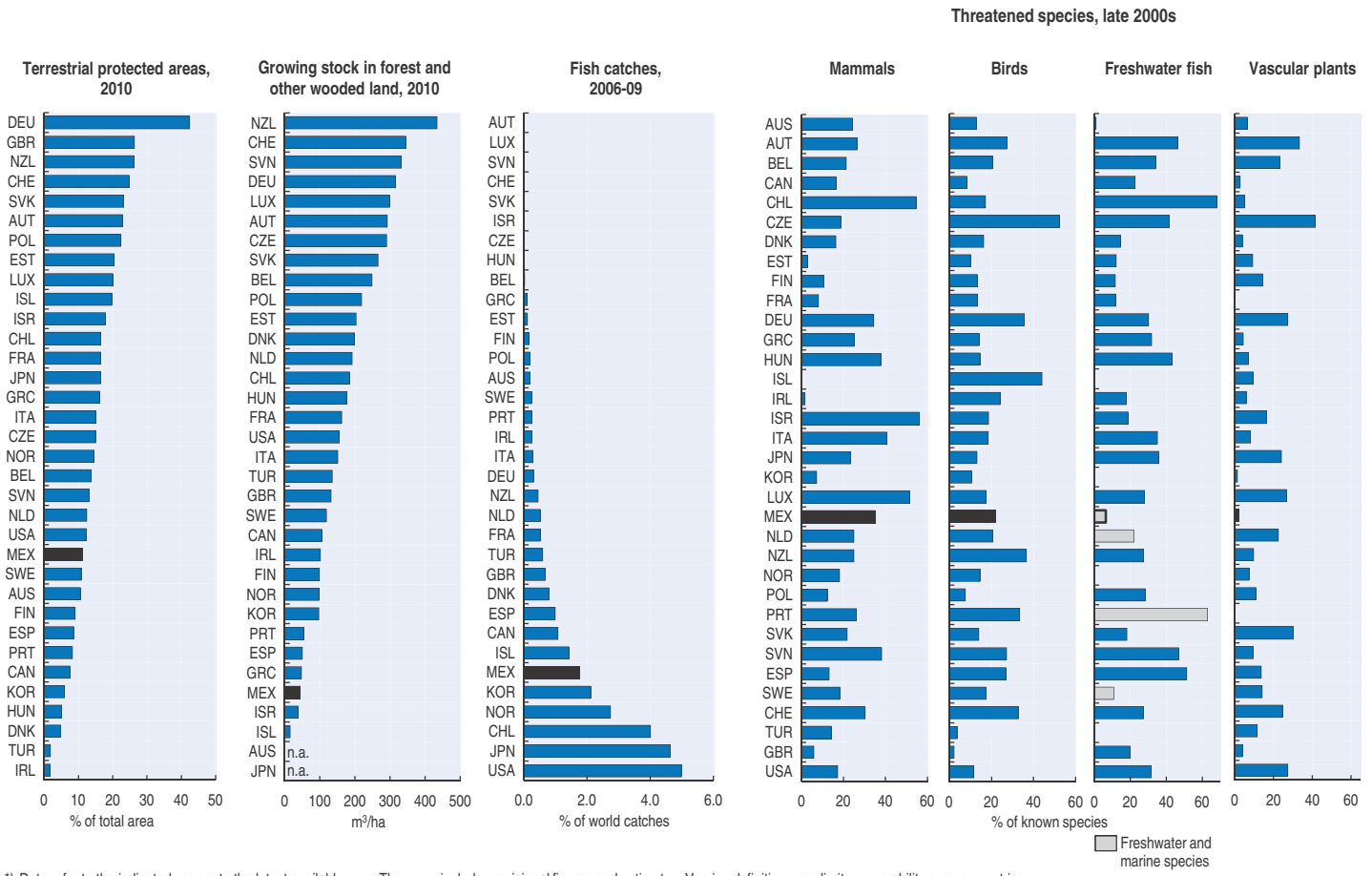
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries. Partial totals are indicated by dotted borders.
a) GDP at 2005 prices and purchasing power parities.
ISL: SO_x emissions include emissions from geothermal energy (190 kg per capita in 2009).
Source: OECD Environmental Data.

Reference I.C. **Selected environmental data* – Climate**



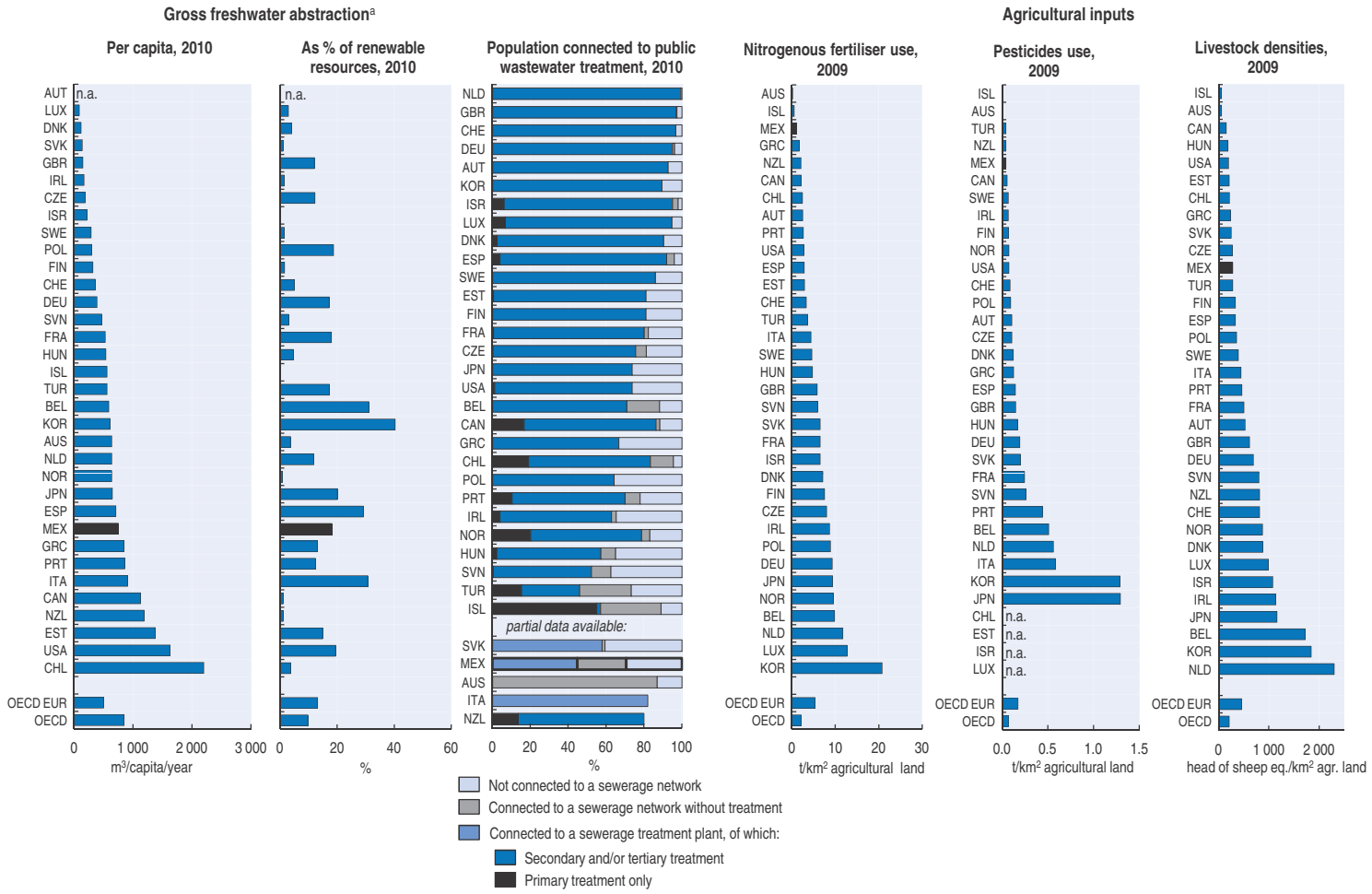
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries. Partial totals are indicated by dotted borders.
a) Emissions from energy use only; excluding international marine and aviation bunkers; sectoral approach.
b) Exluding emissions/removals of the land use, land-use change and forestry sector. ISR: 2000 data exclude F-gases.
c) GDP at 2005 prices and purchasing power parities.
Source: OECD Environmental Data.

Reference I.C. **Selected environmental data* – Biodiversity conservation and sustainable use**



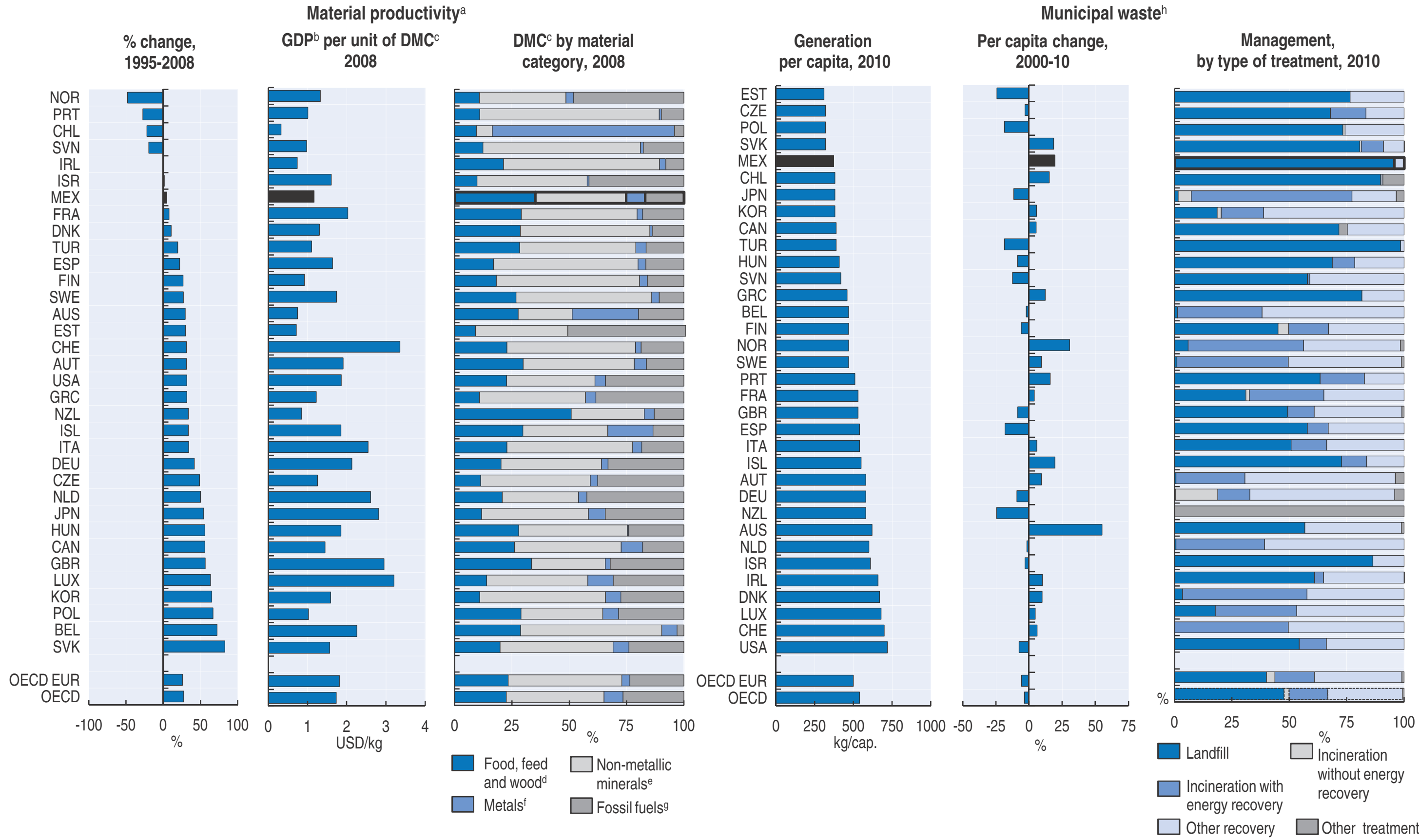
*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries.
a) Designated terrestrial protected areas. Includes different level of protection ranging from IUCN categories I to VI. National classifications may differ.
NLD: Threatened fish species: marine fish only.
Source: OECD Environmental Data.

Reference I.C. **Selected Environmental data* – Water and land**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries.
a) For some countries, data refer to water permits and not to actual abstractions.
GBR: Water abstraction and public wastewater treatment: England and Wales only; pesticides use: Great Britain only.
Source: OECD Environmental Data.

Reference I.C. **Selected environmental data* – Material productivity and waste**



*) Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Varying definitions can limit comparability across countries. Partial totals are indicated by dotted borders.

a) Amount of GDP generated per unit of materials used, ratio of GDP to domestic material consumption (DMC).

b) GDP at 2005 prices and purchasing power parities.

c) DMC equals the sum of domestic (raw material) extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).

d) Domestic production from agriculture, forestry and fisheries, plus trade of raw and processed products from these sectors.

e) Domestic extraction and trade of minerals used in industry and construction, plus trade of derived processed products.

f) Domestic extraction of metal ores, plus trade of metal ores, metal concentrates, refined metals, products mainly made of metals, and scrap.

g) Coal, crude oil, natural gas, peat and traded derived products.

h) Waste collected by or for municipalities; it includes household, bulky and commercial waste, and similar waste handled at the same facilities. CAN: household waste only and total incineration: NZL: lanfilled waste only.

Source: OECD Environmental Data.

REFERENCE II

Actions taken on the 2003 OECD Review Recommendations

	RECOMMENDATIONS	ACTIONS TAKEN
	Environmental management	
	1. Implementing more efficient environmental policies and developing the environmental infrastructure	
1.1.	Improve enforcement of environmental legislation, especially for nature and forest protection, by enhancing the human and financial capacity of PROFEPA and fostering partnerships with police authorities; review water-related enforcement and compliance and include wastewater discharge in integrated pollution control licences.	Between 2002 and 2011, PROFEPA's human capacity was limited and its budget increased by only 7% in real terms (Table 2.1). PROFEPA has been giving greatest priority to self-regulation and environmental audits. In 2007, Mexico launched a Zero Tolerance of Illegal Logging Programme involving federal and state security forces. Local communities are participating through voluntary committees for environmental surveillance in priority regions for natural resources. The 2004 reform to the Law on National Waters empowers PROFEPA to inspect wastewater discharges but its implementing regulations have not yet been approved. Municipal and industrial wastewater discharges are part of the self-regulated activities certified by PROFEPA.
1.2.	Extend the application of the user- and polluter-pays principles through better pricing of water and waste services, with due regard to social constraints.	Mexico has made some progress in implementing water charging systems: abstraction charges vary according to water availability, and pollution charges are based on the status of water bodies and type of pollutants, thereby applying the polluter-pays principle. However, these charges have provided limited incentive to reduce water losses and improve efficiency of water use. Water abstraction for agriculture is virtually free of charge. Very few cities charge for waste services.
1.3.	Review the scope for introducing new economic instruments such as product charges on hazardous waste streams, air emission charges, payments for environmental services and water pollution charges.	Mexico has made some progress in using market-based instruments other than taxes to create incentives for using natural resources more efficiently and reducing pollution and environmental damage. Economic instruments have been implemented mainly in the area of water (see Recommendation 1.2), biodiversity management and forest conservation (e.g. fees for access to protected areas, system of payments for ecosystem services) (Table 5.1). In the areas of pollution control and climate change mitigation Mexico has primarily used subsidy-based instruments (e.g. accelerated depreciation of environmental investments, zero tariffs on imports of pollution control equipment, vehicle scrapping programme, support to replace old electric appliances and for home retrofitting) to reward the purchase of more environment-friendly goods.
1.4.	Expand environmental infrastructure; in particular, increase related spending (e.g. from public, private and international sources), improve efficiency in the provision of environmental services, and develop public-private partnerships in the water and waste sectors.	Investment in water infrastructure nearly tripled between 2000 and 2010. Considerable progress was achieved in improving access to water services and related Millennium Development Goals were exceeded. However, substantial additional investment will be needed to bring the provision of environmental services up to the levels in other OECD countries. Tariffs for public water services remain relatively low and do not allow service providers to cover their costs. Overall, private-sector participation and direct private financing of water investment have been rare and, with few exceptions, have not improved the efficiency of water and sanitation providers and have increased the cost of service. Over the last decade, public investment on waste was reduced by one-third. However, infrastructure for hazardous waste treatment was developed and treatment capacity more than tripled from 5.2 million tonnes in 2000 to 17.6 million tonnes in 2011. Some cities (48 in 2005) grant concessions to private enterprises for waste management services.

	RECOMMENDATIONS	ACTIONS TAKEN
1.5.	Accompany decentralisation of environmental management to states and municipalities through commensurate devolution of powers to tax and charge for environmental services and determined efforts to build local administrative and technical capacity.	The federal budget continues to be the main source of funding for environmental expenditure. Subnational governments have some taxing power, but have made limited use of it due to weak enforcement capacity and political disincentives. Weaknesses in local waste management have allowed the informal sector to play an important role in provision of waste services, which constitutes a barrier to wider implementation of waste charging. In some cities, including the capital, household waste charging is prohibited by law. Progress has been made in implementing water charging systems (see Recommendation 1.2). Under the Environmental Institutional Development Programme, SEMARNAT gives financial and technical support for institutional capacity building in all state governments.
1.6.	Formalise institutional integration mechanisms relating to sustainable development; further integrate environmental concerns into economic, fiscal and sectoral policies (e.g. transport, energy, agriculture, tourism).	Mexico is increasingly placing environmental mainstreaming (*transversalidad*) at the core of its environmental policy framework. All other sectors are expected to help achieve the environmental sustainability objectives through their respective programmes. Several inter-ministerial commissions have been set up: on climate change (2005), biosafety of genetically modified organisms (2006) and sustainable management of coastlines and oceans (2008). See also Recommendations 6.1 to 6.6.
		2. Air management
2.1.	Continue to strengthen implementation and enforcement of the regulatory system.	Enforcement of regulations aimed at stationary sources has progressed. Less progress has been made in inspection and verification of mobile sources. Fourteen Air Quality Improvement Programmes (ProAires) have been developed since 2000. In 2011, ten ProAires were in force and five were in development, covering, respectively, 42% and 10% of the urban population.
2.2.	Extend air emission regulation to additional industrial branches and update existing regulations for SMEs; improve compliance rates, particularly for the most polluting firms.	Several Official Mexican Norms (NOMs) related to air quality and air pollutant emissions have been issued or reviewed. The rate of serious violations of regulations aimed at stationary sources declined from 1.3% to 0.6% of inspected cases. The National Programme of Environmental Auditing has focussed on the largest emitters. Recently, this voluntary mechanism has seen its coverage widened to include small and medium-sized enterprises, and local- and state-level renewable natural resource extraction operations. In addition, the Environmental Leadership for Competitiveness Programme helps companies go beyond regulations and reap the benefits of improved resource efficiency.
2.3.	Better enforce vehicle inspection, make it mandatory in the most polluted cities and extend it to buses and lorries; speed up renewal of the vehicle fleet; further develop and implement traffic management in urban areas, giving appropriate priority to public transport.	Vehicle inspection programmes have been implemented in metropolitan areas and some municipalities in only 15 states. Lack of adequate enforcement of vehicle emission standards has contributed to the import of old vehicles, particularly from the US. Measures to renew the vehicle fleet have included a vehicle scrapping programme in 2009, an exemption to the annual tax on new vehicles in 2010 and the provision of loan guarantees for the purchase of new vehicles in 2011. Programmes promoting sustainable urban transport have been successfully implemented in several big cities, such as Mexico City and Guadalajara.
2.4.	Strengthen integration of air quality concerns in the industry, transport and energy sectors through use of economic instruments as well as elimination of subsidies with harmful environmental effects.	Little progress has been made regarding this recommendation. See also Recommendations 6.2 and 6.3.
2.5.	Continue efforts to improve fuel quality; in particular, reduce the sulphur content of diesel and petrol, internalise externalities in fuel prices; proceed with appropriate investment to reduce emissions and to prevent accidents in the energy sector (e.g. in refineries, power plants).	Despite progress, deadlines to comply with the NOM on sulphur content of transport fuels (NOM-086-SEMARNAT-SENER-SCFI-2005) have been pushed back due to lack of funds for technological conversions at facilities of PEMEX, the state oil company. Mexico does not apply excise duties on transport fuels. The Impuesto Especial Sobre Producción y Servicios is only paid when controlled domestic fuel prices are higher than international reference prices. The Mexican price setting method resulted in net expenditure for fuel subsidies every year since 2006 except in 2009. SEMARNAT, PEMEX and SENER have developed a programme for disaster prevention and emergency drills. PEMEX has an industrial safety and environmental protection system and has carried out an analysis of the main potential threats to its operations, on the basis of which it has drawn up an environmental protection strategy.
2.6.	Give higher priority to pollutants with significant impacts on human health; in particular extend air quality monitoring to include $PM_{2.5}$ and VOCs.	Air quality monitoring networks have improved but remain insufficient to provide a full picture of air quality, in particular in small- and medium-sized metropolitan areas. Air quality data relate to only 40% of the Mexican population. Concentrations of $PM_{2.5}$ are measured in a limited number of zones (Valley of Mexico, Mexicali, Monterrey). In 2012, SEMARNAT issued the NOM-156 specifying the minimum conditions to be observed for the establishment and operation of air quality monitoring systems.
2.7.	Further develop the air management capacity of states and municipalities; extend air emission estimates to the whole country, including to all cities with over 500 000 inhabitants and to energy and industrial facilities; strengthen criteria in air quality emergency plans and extend such plans to the most polluted cities.	PROAIREs, the main policy instruments for air pollution management, are jointly developed by the three levels of government and promote municipal capacity building. The second and latest national air emission inventory dates back to 2005. It includes one-third more stationary sources located in all states and operating in all industrial sectors. The pollutant release and transfer registry has been updated and was released annually between 2004 and 2009. Air quality contingency plans exist in the Valley of Mexico, Guadalajara and Salamanca.

	RECOMMENDATIONS	ACTIONS TAKEN
		3. Water management
3.1.	Increase current water-related investments and management efforts, in order to meet Mexico's 2025 long-term objectives and the 2015 Johannesburg targets for water supply and sanitation, with due regard to the rural population.	Investment in water infrastructure nearly tripled between 2000 and 2010. Mexico has exceeded the Millennium Development Goals on water and sanitation and has set more ambitious objectives for 2015.
3.2.	Pursue current proposals to increase compliance by local utilities and industry with the effluent limits and deadlines of the 1996 standard.	Implementation of significant investment programmes has increased municipal wastewater treatment coverage to 46.5% of collected wastewater by 2011. Progress has been slow on implementing NOM-001-SEMARNAT-1996 (maximum allowed limits on effluent discharges to water bodies) and there have been many problems enforcing NOM-002-SEMARNAT-1996 (maximum allowed limits on effluent discharges to sewerage networks).
3.3.	Encourage drinking water and wastewater facilities to obtain ISO accreditation to improve the operational performance of treatment plants.	A technical assistance programme for the improvement of efficiency in water and sanitation sector (PATME) was launched in 2006 and extended in 2010 (PROME). The overall efficiency of participating utilities (an indicator used to measure both operational and commercial losses) increased from 37% to 44% in 2011.
3.4.	Continue efforts to improve the water efficiency of agricultural irrigation, particularly groundwater-fed irrigation; take measures to halt overexploitation of groundwater aquifers.	Between 2007 and 2011, Mexico modernised 1.03 million hectares under irrigation (out of a total of 6.5 million hectares), compared to the 2007-12 goal of 1.2 million hectares. Monitoring of water use in agriculture has been improved. However, subsidies for irrigation are not encouraging farmers' investments in more efficient water infrastructures. Strategic enforcement actions have been carried out, and a pilot programme has been implemented to convert electricity subsidies for water pumping into cash transfers; launched in 2011, it covers 13 aquifers and could potentially benefit 8 000 farmers.
3.5.	Further develop demand management measures that encourage sustainable water use and further progress in the transition towards pricing of water services, while giving attention to the special needs of the poor.	Information on water balances have been improved and are used to guide water licensing. Modulation of water tariffs has been carried out in Mexico City, taking affordability criteria into account.
3.6.	Strengthen and further develop an integrated watershed approach to both improve water and forest resource management and provide environment-related services more efficiently.	Water basin councils and water basin commissions have been created in all water districts as a result of new regulations. Programmes of payment for ecosystem services (PES) have been implemented. These PES programmes involve 3.25 million ha and represent one of the world's largest PES programmes.
3.7.	Reinforce current policies for awareness raising on water quality and for fostering stakeholder participation in water basin management.	Targets have been set for the development of Programmes for Water Culture in all 32 states, and from 2007-June 2012 there were 635 Water Awareness Cultural Centres created. Consolidation of mechanisms for stakeholder participation in river basin management has been carried out, and wide public consultation on the Water Agenda 2030 has taken place.
3.8.	Give greater weight in water management to the protection of aquatic ecosystems (e.g. rivers, lakes, estuaries, deltas, wetlands).	Developments include the adoption of the General Strategy for Environmental Rescue and Sustainability for the Lerma-Chapala basin, and the inclusion of "healthy rivers" as one of the four strategic pillars of the Water Agenda 2030. An inter-ministerial commission was created in 2008 to co-ordinate the National Environmental Policy for the Sustainable Development of Mexico's Coastlines and Oceans (published in 2006).
		4. Waste management
4.1.	Enforce waste regulations and reduce illegal disposal of hazardous and municipal waste, at national and local government levels.	Compliance with the NOM on landfills (NOM-083-SEMARNAT-2003, which regulates landfill construction) remains weak, in particular in small municipalities, and sanctions are low, with no incentive effects. Illegal disposal remains a matter of concern.
4.2.	Continue to enhance hazardous waste management, and to improve monitoring of hazardous waste generation, by working towards the completion target for the national registry (100% coverage by 2006).	Infrastructure for hazardous waste treatment has been developed and related capacity had more than tripled to 17.6 million tonnes in 2011, exceeding the target set for 2012 in the programme for environment and natural resources 2007-12. This infrastructure includes 14 options ranging from recycling, *ex situ* and *in situ* treatment, incineration and landfilling. Mexico has three operating hazardous waste landfills located in Jalisco, Coahuila and Nuevo León. Two other exist but they are not operating due to local opposition. Hazardous waste generation is estimated from reports by companies registered in the Registry of Producers of Hazardous Waste, but information is still lacking.
4.3.	Implement the newly adopted framework legislation for municipal waste management; increase the waste management capacity of municipal authorities and operating enterprises.	The General Law for the Prevention and Integrated Management of Waste took effect in 2004 and its implementing regulations were published in 2006. Limited capacity at the municipal level and the important role of the informal sector continue to constitute a barrier to the planning, implementation and operation of an efficient waste collection and management system.
4.4.	Develop a national strategy and local programmes to reduce urban and hazardous waste generation.	The National Programme for the Prevention and Integrated Management of Waste was adopted in 2009. By 2012, waste management plans had been adopted in 30 of the 32 states and 84 of the more than 2 000 municipalities.

	RECOMMENDATIONS	ACTIONS TAKEN
4.5.	Increase investment in infrastructure (e.g. new sanitary landfills, closure of illegal landfills) for municipal waste management and extend services to medium and small cities.	Over the last decade, public investment on waste was reduced by one-third. Nevertheless, the share of controlled and sanitary landfills in total municipal waste treatment increased from 55% in 2000 to 72% in 2011. Between 2000 and 2010, the share of population with municipal waste service rose from 84% to 92%, although wide variations exist between states.
4.6.	Improve and modernise recycling and reuse of municipal waste, introducing producer responsibility for selected waste streams and taking social factors into account (e.g. the role of the informal sector); increase composting of organic waste.	Recycling of municipal waste increased from 2% to 5%. A few examples of producer responsibility programmes (e.g. for plastic bottles) have had positive outcomes.
4.7.	Speed up identification of contaminated sites; develop and implement a national remediation strategy.	By 2012, the inventory of contaminated sites had been completed in 32 states and related information reported in the Contaminated Sites Information System. A national programme for the remediation of contaminated sites was adopted in 2010. Significant progress has been achieved in remediating sites posing serious risks to human health.
	5. Nature and biodiversity management	
5.1.	Integrate biodiversity concerns into the planning, execution and evaluation of public policies (e.g. agriculture, forestry, tourism, rural development), in line with the National Biodiversity Strategy and National Biodiversity Action Plan.	Progress has been made in integrating biodiversity into some sectors more than others. A number of instruments have been introduced addressing biodiversity, forestry and development objectives. SEDESOL is implementing a programme for sustainable tourism. Less progress has been made in other sectors, including agriculture.
5.2.	Significantly increase financial resources (from public, private and international sources) for biodiversity conservation at national, state and local levels, including through user charges.	Financial resources allocated to biodiversity from the public sector have increased substantially over the past decade, though user fees (applied in the context of entrance fees to protected areas) constitute a very small fraction of total financial resources. Finance mobilised via the private sector is still negligible.
5.3.	Further develop the National System of Protected Natural Areas: extending its geographical and ecological coverage; providing resources to develop and implement management plans; promoting the establishment of biological corridors; and stimulating participation by private initiatives, as well as indigenous and local communities, in their conservation.	The number of protected areas has increased substantially, with an additional 47 created since 2000, bringing the total to 174, equivalent to 12.9% of the national territory in 2010. Greater resources need to be mobilised to continue improvements in management effectiveness.
5.4.	Foster recovery of endangered species populations, protecting their natural habitats and reducing illegal trafficking in wild species.	Advances have been made in the development of Action Programmes for Species Conservation (PACEs) since 2007, with 27 PACEs published and in operation by 2010, including for the jaguar, vaquita and several eagle species , as part of the Programme to Conserve Species at Risk.
5.5.	Support conservation and management of terrestrial and aquatic ecosystems outside protected natural areas; expand ecological land planning.	The National Ecological Land Use Plan (ELUP), has been adopted in 2012. The use of Ecological Land Use Plans has expanded from 12 ELUPs decreed at various levels in 2000 to 85 ELUPs by 2012, with an additional 10 under way. A strategy for coastal and marine biodiversity is being prepared.
5.6.	Combat deforestation, particularly for tropical woods and forests: strengthening reforestation programmes; promoting sustainable forest management; encouraging forest certification; and redirecting agricultural subsidies in forest areas to finance public ecological assets.	Deforestation rate, though still high, fell from 354 000 ha/year between 1990 and 2000 to 155 000 ha/year over 2005-10. It declined in particular for primary arboreal vegetation. The total area of timber certification has increased with almost 1.8 million forest ha certified (486 000 ha) or in the process of being certified (1.3 million ha) by national and international standards.
5.7.	Consolidate information systems on Mexico's biological diversity and introduce monitoring and evaluation of biodiversity-related policies and actions.	Progress has been made in consolidating information systems, though data discrepancies remain. Monitoring and evaluation of biodiversity policies and actions need to be markedly improved to enable performance assessment over time.
5.8.	Promote new laws to regulate the access to and sustainable use of genetic resources, consistent with international trade and multilateral environmental agreements.	Draft legislation on access to genetic resources is before the Chamber of Deputies. It seeks to regulate access to and sustainable use of genetic resources, protect associated traditional knowledge and distribute the benefits among local and indigenous communities.

	RECOMMENDATIONS	ACTIONS TAKEN
		Towards sustainable development
		6. Integration of environmental concerns in economic decisions
6.1.	Fully take into account environmental concerns should fiscal reform be completed; there is a strong need for an increase in revenues to invest in environmental infrastructure.	Mexico needs to raise non-oil-related taxes and broaden the tax base, including by extending the use of environmentally related taxes. The federal budget continues to be the main source of funding for environmental expenditure. Only about 10% of subnational government revenue comes from subnational taxation and non-tax revenue.
6.2.	Improve the environmental effectiveness of energy and transport taxes, differentiated according to air pollutant emissions and fuel efficiency; consider wider use of green taxes (petrol surcharge) to internalise environmental externalities and raise revenues.	Mexico does not apply excise duties on energy products. There have been some government proposals to tax energy products while increasing social welfare programmes, but they have always met strong political opposition. Mexico levies taxes on purchase and ownership of vehicles, but related revenue is lower than in most other OECD countries and tax rates are not linked to the environmental performance of vehicles.
6.3.	Remove environmentally harmful subsidies (e.g. electricity and water) while giving due consideration to social concerns (e.g. replacement by direct income support for poor farmers and households so as not to distort price signals).	Mexico spends a considerable amount on support measures that have the potential to harm the environment. They include direct and indirect subsidies to energy use, agriculture, fishing and car use. Subsidies for electricity and transport fuels averaged about 1.7% of GDP per year over 2005-09. Subsidies linked to agricultural production still account for half of overall agricultural support. Many energy and agricultural subsidies have not efficiently supported low-income households and farmers. A pilot programme to replace electricity subsidies for pumping irrigation water with direct cash transfers was launched in 2011 (see Recommendation 3.4).
6.4.	Improve institutional integration within agriculture policies, including through creating an environmental unit within the Ministry of Agriculture, Rural Development, Fisheries and Food.	As part of the national development planning, the 2007-12 Agriculture Sector Programme includes the contribution of the sector to national environmental objectives. No environmental unit has been created within SAGARPA.
6.5.	Prepare a strategic environmental assessment of transport policy, including measures to reduce urban traffic congestion and develop rail and sea freight traffic, based on cost-benefit analysis.	Mexico has no strategic environmental assessment of transport policy.
6.6.	Finalise the strategy on energy and the environment, with nationwide objectives and targets and expected completion dates, including for PEMEX and the Federal Electricity Commission's facilities.	The Programme on Energy and the Environment never became fully operational. The Energy Sector Programme 2007-12 includes a section on climate change and environment. As many other ministries, SENER contributed to the development of the national climate change strategy and the Special Programme on Climate Change. The 2012 energy strategy aims at increasing electricity generation from non-fossil fuels to 35% and saving 15% of final energy consumption by 2026 compared to a baseline scenario. It includes operational and energy efficiency objectives for the oil and gas and electricity sectors.
		7. Integration of environmental and social concerns
7.1.	Further improve health and quality of life, particularly in areas with high marginalisation levels, by reducing the share of people who do not have access to basic services (e.g. safe water, basic sanitation, electricity).	Considerable progress has been achieved in improving access to water services and decreasing mortality from water-related diseases, although wide variations persist among states. Between 2000 and 2011, the share of the population with access to drinking water increased from 87.9% to 91.6% and sanitation coverage rose from 76.2% to 90.2%. Access to electricity has greatly improved: in 2010, 1.8% of households had no access to electricity, compared to 4.8% in 2000. However, access to basic services is lower in states with high level of marginalisation.
7.2.	Continue to promote initiatives that contribute to income and/or job generation together with environmental improvements (e.g. reforestation, ecotourism, sustainable forestry), particularly in rural and less developed regions.	"ProÁrbol", managed by CONAFOR, provides subsidies to landowners for activities aimed at protecting, restoring and using forests sustainably and creating job and income opportunities. CONANP runs similar subsidy programmes in protected areas, such as the Programme for Conservation for Sustainable Development, mostly channelled to poor rural and indigenous communities living in protected areas and other conservation priority regions. Similarly, SEMARNAT provides support to the management units for wildlife conservation, as tools for income and employment generation. Vulnerable population groups have also received most of the payments in the framework of the programme of payment for environmental services. In addition, SEMARNAT manages a programme providing temporary environment-related jobs and income in rural areas. SAGARPA also manages a range of support programmes targeting low-income farmers.
7.3.	Further strengthen environmental education and awareness, especially among young people.	A Strategy of Environmental Education for Sustainability was approved in 2006. Actions taken since then include the introduction of environmental education topics in the national curriculum (by 2010, 54% of all basic education programmes incorporated an environmental dimension) and the development of a "green schools" programme.
7.4.	Continue the development and use of indicators to measure environmental progress and related institutional effectiveness.	The Basic Indicators of Mexico's Environmental Performance were completed in 2010. The Environmental Sector Programme is indicator-based.
7.5.	Ensure practical implementation of the right of access to environmental information.	Access to environmental information has improved since the 2002 Federal Law on Transparency and Access to Public Government Information and the creation of the Federal Institute of Information Access and Data Protection. The 2007 National Development Plan included as one of its objectives the generation of information to facilitate informed and responsible public participation in environmental decision making. Between 2007 and 2011, SEMARNAT addressed more than 20 000 applications for environmental information.

	RECOMMENDATIONS	ACTIONS TAKEN
		8. Sectoral integration: agriculture and rural development
8.1.	Create synergies among agriculture, rural development, environment and natural resource management, particularly by reinforcing institutional integration between SAGARPA and SEMARNAT and their respective agencies at the federal and state levels and by developing a national agri-environmental strategy with quantified objectives.	See Recommendation 6.4. The attempt of the Special Concurrent Programme to undertake an integrated strategy for development in rural areas – including infrastructure, health, education, social and environmental policies – has not succeeded in establishing a strong enough planning tool for a truly horizontal policy strategy.
8.2.	Pursue efforts towards water pricing reform in agriculture, particularly by progressively eliminating environmentally harmful irrigation subsidies.	While farmers in irrigation districts pay fees for irrigation services, farmers with consumption below a certain threshold are exempt from the water abstraction charge. Even when applied, the charge remains below charges in other sectors and does not vary with water availability. Mexico spends more on subsidies to partly cover the cost of electricity for water pumping than it does to improve irrigation infrastructure. See also Recommendation 6.3.
8.3.	Contribute to the development of profitable forestry in the context of agricultural policy reform; in particular, further reduce incentives to intensify agricultural production and compensate populations engaged in forest management for otherwise unremunerated though environmentally beneficial public services, possibly through PROCAMPO.	Despite their decline, subsidies linked to agricultural production still account for half of the producer support estimate, a level higher than in many other OECD countries. Overall, as they stimulate production and input use, these forms of support provide environmentally harmful incentives and encourage intensification and expansion of agriculture, with a potentially negative impact on the use of water, land, fertiliser and pesticides. While agri-environmental payments are possible under PROCAMPO for soil and water conservation, for instance, farmers' uptake of these payments has been limited. A number of programmes support forestry but only one is aimed specifically at the reforestation of farmland.
8.4.	Promote consolidation of forest units on *ejido* land into viable larger-scale forest units in the context of land tenure reform, and introduce more flexibility to allow contracting out of forest management.	The Programme to Strengthen Forestry Self-Management was implemented in 2004 with the aim of consolidating forest units on *ejido* land. Under "ProÁrbol" (the federal umbrella programme that promotes sustainable forestry), the PROCYMAF programme consolidates forestry activities in *ejidos* and indigenous communities. Since 2007, PROCYMAF has supported 3 013 *ejidos* and indigenous and local communities in the development of forest management plans.
8.5.	Explore use of economic incentives to increase the revenues of rural populations; in particular, evaluate the potential for further promoting ecotourism in protected areas.	Through the Programmes for Regional Sustainable Development (PRODERs), a total of MXN 46.6 million was invested in activities and construction work for ecotourism projects over 2003-06. Between 2007 and 2010, a further MXN 129 million was invested in the Programme for Conservation and Sustainable Development (replacing PRODERs). In addition, CONANP has promoted joint projects for rural development with other federal government agencies, including the Inter-institutional Programme for the Development of Ecotourism and Rural Tourism, with SECTUR; the development of gender-based productive products in micro-watersheds and protected areas, with the National Institute for Women (INMUJER); restoration and community development projects, with SAGARPA; and sustainable production projects in indigenous communities, with the National Commission for the Development of Indigenous Peoples.
8.6.	Assess the environmental effects of PROCAMPO support payments, as well as the anticipated environmental effects of NAFTA.	There is evidence that subsidy programmes such as PROCAMPO (direct assistance in agriculture) may promote clearing and burning, thereby accelerating land use change, a key driver of biodiversity loss.
		INTERNATIONAL COMMITMENTS
		9. International co-operation
9.1.	Continue to emphasise the use of indicators and quantified targets in developing result-oriented international environmental strategies.	Mexico has promoted the use of indicators for evaluating progress in implementing multilateral environmental agreements (e.g. Convention on Biological Diversity, Forum of Ministers of the Environment of Latin America and the Caribbean). *Millennium Development Goals in Mexico: Progress Report* was released in 2011, as was *State of the Border Region 2010, Border 2012: U.S.-Mexico Environmental Program Indicators Report*, updating the 2005 version. Mexico was one of the first countries to apply the OECD green growth indicators to its domestic situation.
9.2.	Address the negative environmental impacts of growing international trade and investment in northern Mexico.	The ten-year Border 2012 programme recorded improved access to water and wastewater treatment services, establishment of an air monitoring system, retrofitting of diesel vehicles, remediation of contaminated sites, removal and sound disposal of used tyres, establishment of hazardous waste handling facilities and development of binational emergency response plans in all 15 sister cities. The new Border 2020 programme has been adopted in 2012. PROFEPA has strengthened the Programme of Environmental Inspection at Ports, Airports and Borders and now has 19 inspection offices in the Mexico-USA border where transboundary movements of wildlife species, forestry products, and hazardous waste, are controlled.

	RECOMMENDATIONS	ACTIONS TAKEN
9.3.	Strengthen both the institutions to enhance bilateral co-operation and the mechanisms that encourage international commitments, consistent with environmental management decentralisation.	The 1993 agreement between the Government of the United States of America and the Government of the United Mexican States Concerning the Establishment of a Border Environment Co-operation Commission ("BECC") and a North American Development Bank ("NADB") was amended in 2002 to create a single board of directors, assure the proper expedition of project certification and credit supports, and widen its area of influence from 100 to 300 km within Mexican territory. It entered into force in 2004.
9.4.	Develop like-minded countries' positions on international issues, such as biodiversity conservation, response to climate change, and international law, and assume leadership as appropriate.	Mexico has shown great leadership in supporting international efforts to address climate change. In 2010, it hosted the 16th Conference of the Parties to the UN climate change convention and was instrumental in brokering the adoption of the Cancún Agreements. In 2002, in Cancún, Mexico co-ordinated the formation of the Group of Like-Minded Megadiverse Countries, a consultation and co-operation mechanism to promote common interests of a group of 12 countries (now enlarged to 17) and priorities related to the conservation and sustainable use of biological diversity.
9.5.	Develop a national strategy to reduce the rate of growth of GHG emissions, with specific objectives and precise measures to be taken over the next few years, including under the proposed Clean Development Mechanism.	Mexico adopted a National Strategy on Climate Change in 2007 and a federal Special Programme on Climate Change (PECC) in 2009. These were requested by the Climate Change Inter-Ministerial Commission, led by the President. The PECC provides specific targets that are measurable and are expected to be met by the end of 2012. In 2005, Mexico established its Designated National Authority, the institution that approves climate change mitigation projects under the Kyoto's Clean Development Mechanism (CDM). As of June 2012, it had registered 141 CDM projects, representing a reduction of 12.4 Mt CO_2 eq per year. Mexico has the fourth largest number of projects registered and the fifth largest volume of certified emission reductions issued.
9.6.	Seek the development of integrated management of international water basins, with special emphasis on efficient use of water.	In the framework of the International Boundary and Water Commission, on the northern border, joint actions have been taken with the United States to develop an integrated management programme for the Colorado River delta, to ensure that flow from the Colorado continues to meet the environmental, agricultural and urban needs of both nations.
9.7.	Improve institutional mechanisms to provide better protection of the environment in marine waters, coastal waters and coastal zones, and increase involvement by SEMARNAT in this regard.	Mexico has adopted a National Environmental Policy for the Sustainable Development of Mexico's Coastlines and Oceans (2006) and a National Strategy for the Ecological Land Use Planning of Mexico's Coastlines and Oceans (2007). An Inter-Ministerial Commission for the Sustainable Management of Coastlines and Oceans was set up in 2008.
9.8.	Continue to develop institutions and measures to combat marine pollution from ships and to respond rapidly to oil emergencies.	The Navy is responsible for the National Contingency Plan to Prevent and Control Oil Spills and other harmful substances in the sea, which was updated in 2008. After the oil spill in the Gulf of Mexico, caused by the explosion of the Deepwater Horizon rig operated by BP, Mexico's federal authorities including PROFEPA, along with PEMEX, undertook a damage prevention programme, including a number of audits on the compliance standards of the drilling rigs, verification of all drilling activities on Mexican rigs and blowout prevention devices on exploratory wells.

Source: OECD, *Environmental Performance Reviews: Mexico*, 2003; country submission.

REFERENCE III

Abbreviations

BAU	Business-as-usual
BRT	Bus rapid transit
CCSD	National Consultative Council on Sustainable Development
CDM	Clean development mechanism
CER	Certified emission reduction
CFCs	Chlorofluorocarbons
CFE	Comisión Federal de Electricidad (Federal Electricity Commission)
CICC	Inter-Ministerial Commission on Climate Change
CIMARES	Inter-Ministerial Commission for the Sustainable Management of Coastlines and Oceans
CO	Carbon monoxide
CO_2	Carbon dioxide
CONABIO	Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (National Commission for Knowledge and Use of Biodiversity)
CONAFOR	Comisión Nacional Forestal (National Forestry Commission)
CONAGUA	Comisión Nacional del Agua (National Water Commission)
CONANP	Comisión Nacional de Áreas Naturales Protegidas (National Protected Areas Commission)
CONAPESCA	Comisión Nacional de Acuacultura y Pesca (National Commission of Aquaculture and Fishing)
CONEVAL	Consejo Nacional de Evaluación de la Politica de Desarrollo Social (National Council for the Evaluation of Social Development Policy)
COPLADES	Planning Committees for State Development
CTF	Clean technology funds
DAC	Development Assistance Committee, OECD
DOF	Diario Oficial de la Federación (Official Journal of the Federation, Mexico)
DMC	Domestic material consumption
EIA	Environmental impact assessment
ELUP	National Ecological Land Use Plan
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GHG	Greenhouse gas
GNI	Gross national income

GoM	Government of Mexico
IEA	International Energy Agency
IMP	Instituto Mexicano del Petróleo (Institute of Petroleum)
IMTA	Instituto Mexicano de Tecnología del Agua (Mexican Institute of Water Technology)
INAPESCA	Instituto Nacional de Pesca (National Institute of Fishing)
INE	Instituto Nacional de Ecología (National Ecology Institute)
INECC	National Environment and Climate Change Institute (new name of INE)
INEGI	Instituto Nacional de Estadística y Geografía (National Institute of Statistics and Geography)
INEGEI	National GHG Inventory
LGEEPA	General Law on Environmental Protection
LULUCF	Land Use, Land-Use Change and Forestry
MXN	Mexican Peso
NDP	National Development Plan
NMX	Mexican norm
NO_x	Nitrogen oxides
N_2O	Nitrous oxide
NOM	Official Mexican norm
ODA	Official development assistance
PECC	Special Climate Change Programme
PEMEX	Petróleos Mexicanos
PES	Payments for Ecosystem Services
R&D	Research and development
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food)
SALUD	Secretaría de Salud (Ministry of Health)
SCT	Secretaría de Comunicaciones y Transportes (Ministry of Communications and Transport)
SE	Secretaría de Economía (Ministry of Economy)
SECTUR	Secretaría de Turismo (Ministry of Tourism)
SEDESOL	Secretaría de Desarrollo Social (Ministry of Social Development)
SEGOB	Secretaría del Interior (Ministry of the Interior)
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (Ministry of the Environment and Natural Resources)
SENER	Secretaría de Energía (Ministry of Energy)
SHCP	Secretaría de Hacienda y Crédito Público (Ministry of Finance and Public Credit)
SMEs	Small and medium sized enterprises
SOx	Sulphur oxides
SRE	Secretaría de Relaciones Exteriores (Ministry of Foreign Affairs)
TFC	Total final consumption
TPES	Total primary energy supply
TWh	Terawatt hour
UMA	Management Unit for Wildlife Conservation
UNAM	Universidad Nacional Autónoma de México (National Autonomous University of Mexico)
UNDP	United Nations Development Programme

UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
WWF	World Wildlife Fund
ZMVM	Metropolitan Zone of the Valley of Mexico

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