Chapter 12

Energy Policy

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The energy sector in Mexico has great potential to foster economic growth and job creation. The extent to which this will be realised depends on the reforms that the new Mexican government decides to implement in the years to come. In this sense, the commitments included in the Pact for Mexico of pursuing an energy reform, oriented to increase the exploration and production capacity of PEMEX and facilitating competition in refinery, petrochemical sector and transportation of hydrocarbons, as well as supporting development of renewable energy and energy efficiency, are welcome. Emphasis should be placed on increasing investment in the energy sector, in order to enable development of new resources and the deployment of cutting-edge technologies. It is equally important to reform the system of energy subsidies, which the new administration has also shown commitment to revise and reduce. Without such reform efforts, Mexico will find it difficult to reap the huge benefits that energy efficiency can provide.

In the years to come, Mexico's energy sector can play a crucial role in fostering economic growth, creating jobs, and putting the economy on a more sustainable development path.[1] Mexico indeed has tremendous potential to tap into and develop new energy resources: not only deepwater oil or unconventional gas, but also renewables – especially wind and solar. On the demand side, Mexico also has huge potential to enhance energy efficiency. However, to achieve this potential, massive investments are required to modernise the energy sector and introduce cutting-edge technologies. Meeting the investment challenge is critical to the success of Mexico's energy policy in the medium term. PEMEX is already facing this challenge today, as it struggles to increase investments just to maintain current levels of oil production. Meanwhile, billions of dollars are spent each year on fossil fuel subsidies that largely benefit the better off. Sound reform of the subsidy regime in Mexico could free up the resources Mexico needs to further fight poverty, support long-term growth, and put the country on the road to a prosperous and sustainable energy future. This chapter looks into a few of the key energy policy reforms required and provides a number of key recommendations.

Unleashing the potential of energy efficiency

Energy efficiency is often the most cost-effective way to reduce emissions and increase energy security. It is a strategic choice not just for energy-importing countries but for energy exporters as well, as domestic oil production can be freed up for export. Often, energy efficiency investments create jobs while offering a profitable business strategy for equipment manufacturers and energy service companies. Despite having taken some important first steps, Mexico has only just begun to tap its efficiency potential across the transport, industry, buildings and household sectors. The main ongoing programme is the National Program for Sustainable Use of Energy (PRONASE). The goal of PRONASE is a reduction in electricity demand of up to 18% by 2030.

[1] The authors gratefully acknowledge valuable input from Janos Bertok (OECD Private Sector Integrity Division), Adam Brown (IEA Renewable Energy Division), Hans Christiansen (OECD Corporate Affairs Division), Michael Cohen (IEA Oil Industry and Markets Division), Tim Gould (IEA Resources and Investment Unit) and Grayson Heffner (IEA Energy Efficiency Unit).

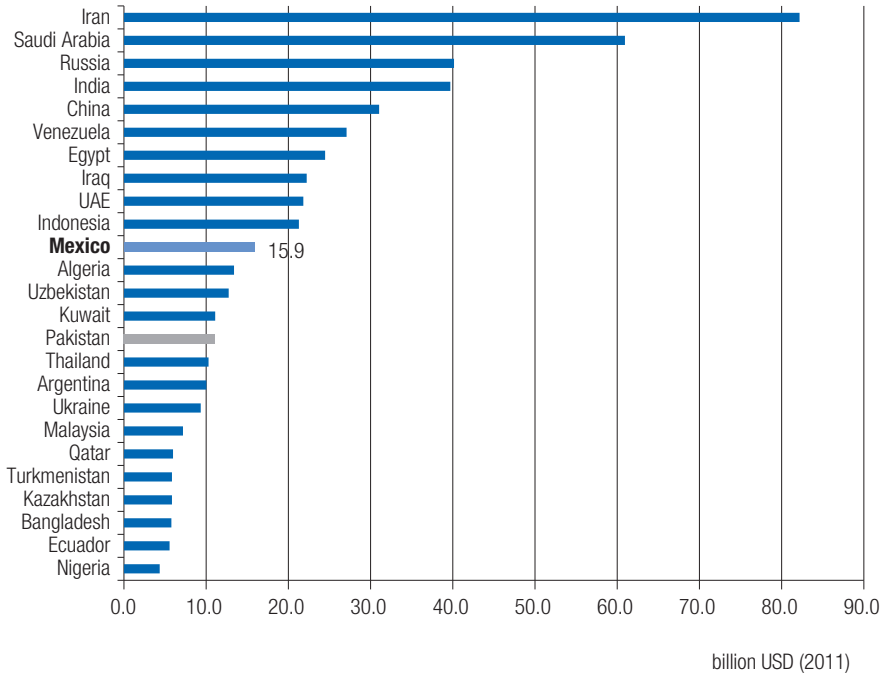
To achieve energy efficiency, well-defined policies are needed in various sectors. In the *transport* sector, implementation of fuel efficiency standards will be crucial to avoid a ballooning of emissions as car ownership rapidly increases. The availability of lowçcost imports of used cars from the US may delay the achievement of the goals. In *industry,* a large potential for cogeneration remains untapped due to complicated permit procedures that discourage investment. The cogeneration potential in PEMEX alone has been estimated at three times the company's own electricity consumption. Tapping this potential will depend crucially on private investments. In this area, PEMEX should make greater efforts – in accordance with the commitment in the Pact for Mexico, to turn the company into one of the pillars in the fight against climate change by saving energy (commitment 60). In the *building sector,* Mexico has already put in place a number of regulations on insulating materials used in construction. However, these are mainly applicable in regions with extreme weather conditions, leaving a large share of the country's building stock unregulated. In *the residential sector,* progress has been made through programmes to replace inefficient light bulbs and refrigerators, appliance labelling and minimum energy performance standards (*Normas Oficiales Mexicanas* – NOM). However, large challenges remain:

- energy price subsidies that encourage inefficient use of energy
- limited access to finance for energy efficiency projects
- lack of private sector capacity to identify energy efficiency investment opportunities

In 2011, Mexico spent almost USD 16 billion on fossil fuel subsidies. Such subsidies are not unique to Mexico (Figure 12.1); however, their trade and fiscal impacts increase as domestic demand and oil prices rise. Importantly, energy subsidies reduce the potential savings from energy efficiency, distort markets and raise investment barriers to energy efficiency projects. Furthermore, the distribution of the fuels subsidy in Mexico is regressive, benefitting mainly the higher-income segments of the population (see Chapters 2 and 3 on poverty and fiscal issues). Instead, public support should be targeted to the poorest, while energy prices are gradually brought to market levels. This would not only remedy the adverse distributive effect of the current system, but also free up resources to reinforce social expenditure as well as greater and more productive investments elsewhere, notably in the energy sector. The ongoing policy of raising gasoline prices by 9 centavos per month (0.7 US cent, for the *Magna* type) is a step in the right direction, but much more determined action is needed to actually phase out the subsidy and avoid its negative consequences in terms of fiscal, environmental and social sustainability (see also Chapter 11 on green growth).

As regards access to financing, commercial banks have limited experience with energy efficiency investments; bankers often perceive these investments as risky. This leads to their underestimation of potential profitability of such projects, overestimation of transaction costs, and a general tendency to avoid

Figure 12.1. **Economic value of fossil-fuel consumption subsidies by fuel for top 25 countries, 2011**



Source: IEA (2012), *World Energy Outlook 2012*, OECD/IEA, Paris, p. 71.

engagement in this type of project. Box 12.1 offers a best practice example on how to overcome financial barriers to energy efficiency projects. The lack of knowledge and capacity in the private sector also calls for more efforts to promote capacity building, standardised measurement and verification protocols, and to foster efficiency technology, research, development and demonstration (RD&D).

Box 12.1. **Mobilizing investment in energy efficiency: The approach of KfW in Germany**

Energy consumption in Germany has been stable since the 1990s, with energy intensity steadily decreasing. The 2007 National Energy Efficiency Action Plan aims at a 9% improvement in energy efficiency between 2007 and 2016 in all sectors. However, most of the savings are likely to come from the residential sector as it provides a still vast and cost-effective improvement potential (Pasquier and Saussay, 2012). The *Kreditanstalt für Wiederaufbau* (KfW), a non-profit public bank, has set up a number of incentive schemes with the aim of increasing energy efficiency in the housing sector, in small and medium

enterprises and in communes and social institutions. The programmes are funded by the German government, partly through federal budget allocations and partly through the Energy and Climate Fund, which is resourced through the auctioning of CO_2 certificates in the framework of the CO_2 cap and trading system.

Programmes: "CO_2 refurbishment of buildings" and "Energy efficient refurbishment"

Characteristics	CO_2 refurbishment of buildings	Energy efficient refurbishment
Duration	August 2001 – March 2009	April 2009 - ongoing
Tipo	Créditos preferentes, desde 2007 también subvenciones; no se pueden solicitar ambos: crédito y subvención	Créditos preferentes y subvenciones. No es posible solicitar ambos. Los créditos para medidas de acondicionamiento muy ambiciosas incluyen un subsidio para el pago del crédito.
Type	Preferential loans, since 2007 also grants; no possibility to apply for both loan and grant.	Preferential loans and grants. No possibility to apply for both. Loans for very ambitious retrofitting measures include a loan repayment allowance.
Target	Refurbishment of existing residential buildings	Refurbishment of existing residential buildings
Eligible measures	Thermal insulation, HVAC, renewable energy (for warm water and heating)	Thermal insulation, HVAC, renewable energy (for warm water and heating)
Efficiency requirements	Choice of predefined packages of measures; since 10/2008 added measures leading to compliance with EnEV (Energy Saving Regulation) standards for new houses	Introduction of the KfW Efficiency House as a benchmark using the EnEV standard for new houses. Size of grants and loans depends on the efficiency level reached with regard to this benchmark. Also, single measures become eligible

Source: IEA, based on Clausnitzer *et al.*, 2010.

Volume: The volume of loans disbursed between 2001 and 2010 amounts to over EUR 23.3 billion (USD 29.8 billion). The average size of loans between 2005 and 2010 has been about EUR 80 000 (USD 102 800) for the refurbishment of on average 4 housing units. The proportion of overall investments to loan size has been rising, from 1.1 in 2008 to 1.39 in 2010. Much higher proportions can be found for the promotion of new low-energy buildings, *e.g.* 3.91 in 2010 (Kuckshinrichs *et al.*, 2011). From 2007 onwards, part of the modernization cost could be financed by a grant of up to 5000 EUR per apartment. The percentage of the grant depended on the efficiency gains achieved by the modernization measure. Between 2007 and 2010, grants approved amounted to about EUR 228 million (USD 292 million).

Results: Overall emission reduction during the years 2005 to 2010 cumulates to around 3.7 million tons of CO_2e (carbon dioxide equivalent). About EUR 0.02 of public money was needed to save 1 kWh final energy use

through the programmes, with a slightly decreasing tendency**.** Public funds needed to save a tonne of CO_2e emission have been decreasing, from EUR 57 in 2008 to EUR 41 in 2010. The programme thus helped to reduce the public budget expenditure. With their strict efficiency requirements, based on overall energy performance, the programmes promote the uptake of the most efficient technologies available.

Sources: Ryan, L. (2012),, *Mobilising investment in energy efficiency: Economic instruments for buildings*, OECD/IEA; Pasquier, S. and A. Saussay (2012). *Progress implementing the IEA 25 energy efficiency policy recommendations: 2011 evaluation*, Insights Series, OECD/IEA; Clausnitzer, K.-D. *et al.* (2010), *Effekte der Förderfälle des Jahres 2009 des CO2-Gebäudesanierungsprogramms und des Programms "Energieeffizient Sanieren"*, Bremen/Darmstadt; Kuckshinrichs, W. *et al.* (2011), *Wirkungen der Förderprogramme im Bereich "Energieeffizientes Bauen und Sanieren" der KfW auf die öffentlichen Haushalte*, Jülich.

Improving oil sector performance

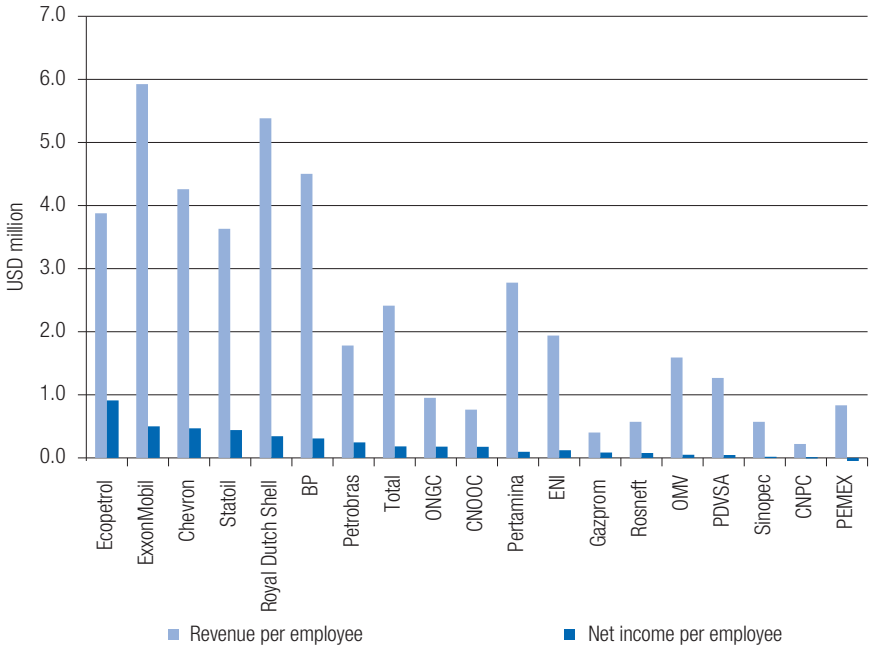
There are three main criticisms of the performance of Mexico's oil sector:

- declining production, placing government budgets at serious risk
- historical underinvestment in exploration
- paucity of domestic technical capability.

Mexico today produces 2.5 million barrels of crude oil per day – almost 1 million barrels less than in 2005. Further decline in production could turn Mexico into a net importer in the coming decade. Given that almost one-third of public budget revenues comes from oil production and export, such a decline would have a serious impact on the public deficit and trade balance (see Chapter 3 on fiscal issues). Mexico can increase oil output either by producing more oil from mature fields, or by developing new deepwater and onshore resources; both alternatives entail significant investment and new technologies. This basically provides two main options for reform: improving PEMEX's own ability to invest, and/or attracting more private domestic and foreign investment. On the assumption, that sufficient investment is made, total oil production is projected to bottom-out at around 2.5 mb/d by the mid-2020s and the recover slowly. Production could respond faster, indeed the Energy Strategy 2012-2026 calls for crude oil production alone to growth to 3.3 mb/d by 2026 (SENER, 2012).

As a national oil company, PEMEX has a social role in terms of job creation and public revenue provision. However, its investment capability is severely impaired by the high tax burden. Under current conditions, PEMEX would not be able to raise the capital necessary to develop Mexico's deepwater energy resources. Figure 12.2 shows the per capita revenue and net income for a range of private and national oil companies. PEMEX is the only major oil company

Figure 12.2. **Oil companies' per capita revenue and net income per employee, 2011**



Source: IEA compilation from annual reports and company websites.

worldwide to report a negative net income, again mainly due to its large tax burden. Broadening the Mexican tax base and reducing the tax burden on PEMEX would allow PEMEX to invest more in its essential business, that of developing Mexico's resource potential.

In terms of the framework for foreign investment, a balance must be struck between maintaining the state's fiscal balance and creating the necessary incentives to attract investment to Mexico. The 2008 energy reform was a first step, but it remains uncertain whether private investors will be willing to risk capital to enter the agreements in their current "cost-plus" form once they are applied to deepwater or shale exploration. There is no one-size-fits-all approach to oil sector governance or taxation. Any framework needs to take into account country-specific constraints such as constitutional rules on ownership of natural resources, the legislative process, geological conditions and the maturity and development stage of the country's resources. Figure 12.3 illustrates the frameworks in place worldwide:

- *Concessions* allow companies to produce in a given geographic area in exchange for royalties and taxes;
- *Production sharing contracts (PSCs)* define how the produced oil from a given area is shared between the operator and the state/national oil company;

Figure 12.3. **Upstream oil frameworks worldwide**

Source: Baker & McKenzie.

- *Service contracts* define the payment (in kind or not) for services that private oil companies agree to perform for the state/national oil company;
- *Mixed system* refers to concessions, PSCs and/or service contracts applied in parallel.

The Mexican constitution reserves for the state the exclusive right of oil production. As a result, Mexico is one of a few countries that relies exclusively on service contracts to develop its oil and gas resources. Article 60 of the PEMEX Law explicitly rules out production-sharing agreements or any agreement that involves percentage sharing in the production or the sales of hydrocarbons or its by-products, or sharing in the profits of the contracting entity. The Pact for Mexico reiterated the principle of exclusive state ownership and state production of oil (commitment 54). Any reform, therefore has to find ways to adapt the service contracts to the risk profile of deepwater and unconventional gas projects.

Box 12.2. **PEMEX procurement strategy: Optimising the supply process to maximise value creation**

In 2011-2012, the OECD carried out a review of the procurement function of PEMEX to enhance its efficiency and integrity. The OECD review provided a set of recommendations to transform procurement into a strategic function in line with the commitments of the Pact for Mexico to enhance transparency, efficiency and corporate governance in PEMEX. Some of the specific recommendations of the review included the following:

- In line with commitment 55 of the Pact for Mexico to reform its corporate governance structure, nominating a single unit with formal authority to improve the procurement function of the various entities of PEMEX and to implement a single and common procurement model applicable to every entity.
- Enhancing the monitoring and management of the procurement function, including the efficiency and savings achieved through contractual instruments and strategies put in place by PEMEX. This will require improving the data availability and accuracy, potentially through the development and integration of common IT tools and databases.
- Increasing the level of competition and efficiency in its procurement activities, through the consolidation of procurement and use of contractual instruments such as framework agreements, open contracts, and contracts with options.
- Improving the internal capacity and time available for effective market research – to better identify available or potential solutions to PEMEX's requirements and the prevailing market conditions – as well for drafting clear requirement specifications and evaluation criteria.
- Enhancing PEMEX's interaction with suppliers, for example through verbal debriefings to bidders following a tender process, higher management and monitoring of the performance of suppliers under their contracts, effectively implementing the Centre of Excellence for Technology Supply (*Centro de Excelencia para el Suministro de Technologia*) to facilitate open, structured and transparent dialogue with the industry, as well as pursuing PEMEX's suppliers' development activities (for example, by assessing the impact of the strategy put in place in 2009 and revising it).
- Focusing PEMEX workforce management on strategic planning, competencies and performance management in order to better align its current and future human capital (number and skills) with its strategic needs.
- Taking actions to promote integrity in procurement functions. Examples include developing a long-term strategy for preventing corruption; reforming and promoting the company's Code of Conduct; putting in place mechanisms to facilitate reporting of wrongdoing and protection of whistleblowers; and fighting suppliers' collusion in collaboration with the Mexican Competition Authority (*Comisión Federal de Competencia*).
- Intensifying internal communication and training on the PEMEX Law to reduce remaining confusion and concerns, and maximising the use of the flexibilities provided by the Law.

Source: OECD (2013) Public Procurement Review of PEMEX: Optimising the Supply Process to Maximise Value Creation.

In order to turn PEMEX into a competitive, world-class company, commitment 55 of the Pact for Mexico pledges to adopt international best-practices of corporate governance and transparency. In this regard, the 2008 energy reform package has already taken important first steps, such as the separation of the responsibility for upstream regulation from PEMEX, and transferring this responsibility to the *Comisión Nacional de Hidrocarburos* (CNH). However, there is still considerable room for improvement in terms of the process of setting and monitoring goals for the company. Important points for further reform are, for example, the replacement of direct ministerial representatives on the company's board with directors that have proven commercial expertise; clearer communication – on an annual basis – of financial and non-financial goals by the state; and the establishment of an independent internal audit at the service of the board of directors. In addition, there is clear potential for improving the way in which PEMEX sources its supplies and services (see box 12.2). Prudent design of procurement rules can contribute to raising efficiency: other energy companies estimate that their contract cost could be 10% to 35% higher without competitive tendering.

Overall, the coming years it will be crucial to ensure the viability of the Mexican oil sector by:

- introducing reforms to attract more investment and new technology,
- broadening the general tax base while reducing the tax burden on PEMEX,
- improving PEMEX's corporate governance and procurement process.

Unconventional gas: Regulation as the key to success

Over the past years**,** there have been two fundamental drivers of change in the Mexican energy mix. One is the decline in production of Mexico's largest oil field (Cantarell); the other is the surge in unconventional gas production in the United States, which has led to a drop in regional gas prices. As a consequence, the share of fuel oil in Mexico's power mix has fallen sharply, from 48% to 16%, between 2000 and 2011, whereas the share of natural gas has risen from 17% to 50%. In terms of carbon emissions and fuel cost savings, the shift from fuel oil to natural gas should continue and use of fuel oil should be completely phased. Discussions are underway on how to use the country's abundant domestic shale gas resources to underpin the future expansion of the natural gas market in Mexico, including PEMEX' greater involvement in fertilizer production (commitment 59).

Mexico's large shale gas resources make it one of the most promising countries for shale gas development globally. Estimates of recoverable resources vary between 4.24 trillion cubic metres (PEMEX low estimate) and 19 trillion cubic metres (US Energy Information Agency – EIA). Shale gas could make a significant

contribution to meeting Mexico's gas needs in the longer term. In an optimistic scenario, Mexico's natural gas production would rise from 50 billion cubic meters today to close to 90 billion cubic meters in 2035, with most of the increase coming from unconventional gas (IEA, 2012b p. 114). In view of the highly competitive unconventional gas industry in the United States, the challenge for Mexico will be to keep development costs down and to attract the necesary investments. US natural gas prices are expected to rise moderately, but will continue to be very competitive. It is equally important to prevent the environmental impact associated with unconventional gas production – notably related to the use and recycling of water for hydraulic fracturing.

Hydraulic fracturing, or fracking, is a production process involving the use of water, sand and chemicals to fracture the shale formation and liberate the gas stored in its pores. Due to the composition of the fracking fluid and the uptake of potential contaminants in the process, the "flowback" water needs treatment and disposal after use. The drilling of a single shale gas well requires on average about 230 to 3000 cubic metres of water, depending on the geological conditions. The process of hydraulic fracturing consumes another 8700 to 14400 cubic metres of water for each well. By comparison: per capita availability of renewable water in Mexico stood at 4,263 cubic metres/year in 2009, with about two thirds of it occurring in the South-East of Mexico. However, much of Mexico's unconventional gas resource is located in the more arid north; in addition, precipitation is largely concentrated during four months of the year (June-September) so that water use is particularly sensitive. In practical terms, the regulation of water use poses challenges of multi-level governance, involving not only national, state, municipal and water basin-level institutions, but also informal water management mechanisms at the local level (see Chapter 14 on general water management issues).

To address environmental sensitivities and ensure public confidence in unconventional gas development, Mexico could draw from Canada's experience with "Multi-Stakeholder Advisory Committees" (MACs). Between 2003 and 2009, a MAC brought together environmental organisations, resource right holders, farmers and the energy industry as well as local and Alberta provincial government representatives, to provide and monitor application of recommendations on the regulation of Coal Bed Methane development. The process resulted in 44 recommendations related to protection of water resources; royalties and taxes; enhancement of public information and knowledge; minimisation of surface impacts; and communication and consultation (see *e.g.* CBM/NGC Multi-Stakeholder Advisory Committee, 2006). On the issue of water resource management, the concept of "cumulative management areas" introduced in Australia provides a way of monitoring and managing the impact of water extraction in a given geographical area by multiple oil and gas developments (see *e.g.* Queensland Water Commission, 2012).

Mexico's shale gas potential will not be utilised unless the investment framework is attractive enough and environmental and public concerns are addressed. Key recommendations[2] are:

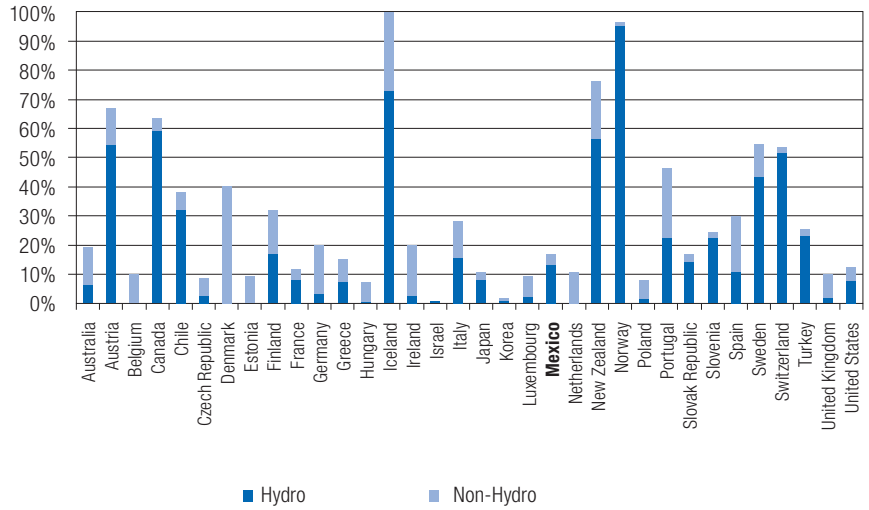
- To put in place contract models sufficiently attractive for investors – otherwise, unconventional gas and the associated jobs will be developed elsewhere in the world
- To define regulatory responsibilities clearly and ensure high levels of environmental performance
- To be as transparent as possible, by
  - Engaging with local communities, residents and other stakeholders, prior to exploration and throughout project development,
  - Establishing baselines of environmental indicators, and measuring and disclosing operational data.

Renewables: Towards a low-carbon power sector

The transition to a low-carbon power sector in Mexico requires extensive deployment of clean energy technologies. Renewable energy resources can provide much needed diversification, and there once again Mexico has excellent potential. However, out of 34 OECD countries, Mexico ranks 19th in terms of renewable energy utilisation and only 26th in terms of non-hydro renewable (Figure 12.4). For a country with very high sunshine levels – and some of the strongest winds in the world – Mexico could belong to the leaders in this ranking. First steps were taken to foster renewables with the 2008 energy reform: The Law for the Use of Renewable Energy and Finance of the Energy Transition (LAERFTE) called for a revision of CFE's (Comisión Federal de Electricidad) cost-based planning process to include externalities associated with both conventional and renewable energy sources.[3] In addition, Mexico has launched a "Special Programme for the Use of Renewable Energy". Among other things, this programme seeks to promote renewables by disseminating information and building a national renewable energy inventory.[4] Wind and solar are expected to be the fastest-growing technologies in the medium term (Figure 12.5).

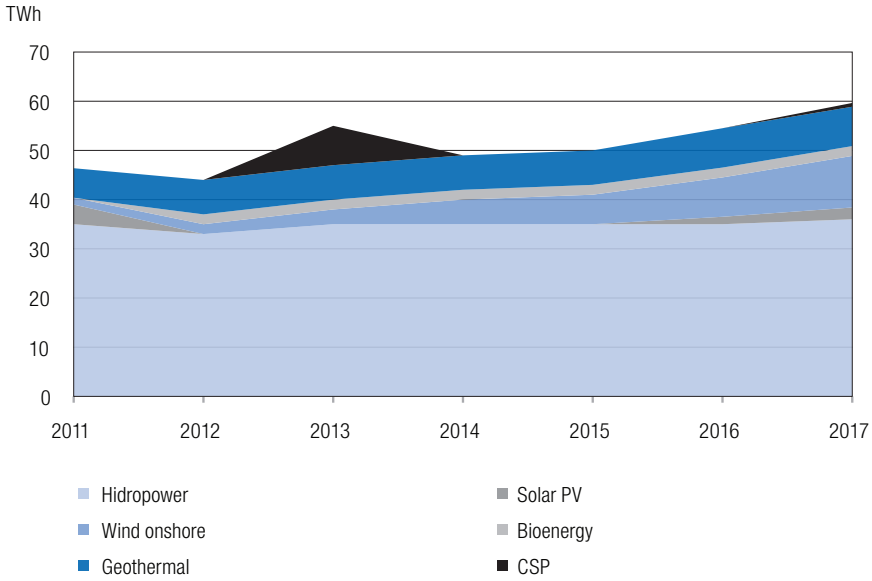
[2] For more recommendations on unconventional gas regulation, see IEA, 2012a, p. 13-14.
[3] The new methodology is currently being developed by the energy ministry in co-operation with the finance, environment and health ministries and should allow the utility to tap renewables more forcefully in the future.
[4] Furthermore, the programme acknowledges the need to further reform regulatory and financing mechanisms to better tap the nation's renewable energy sources, adapting infrastructure to the inclusion of renewables and fostering research and development in that area. To support this programme, two funds were created: the Energy Transition Fund (*Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía*) and the Energy Sustainability Fund (*Fondo de Sustentabilidad Energética*).

Figure 12.4. **Renewable electricity share in the electricity mix in the OECD area, 2011**



Source: IEA data.

Figure 12.5. **Forecast of Mexico's renewable generation, 2011-17**



Source: IEA projections.

However, large-scale deployment of renewables is still mainly restricted to demonstration, off-grid or export-only projects. Further measures are needed to remove persistent barriers and stimulate the deployment of renewables in Mexico, as pledged in the Pact for Mexico (commitment 49). In this regard, the IEA recommends a "policy portfolio" (IEA, 2011a):

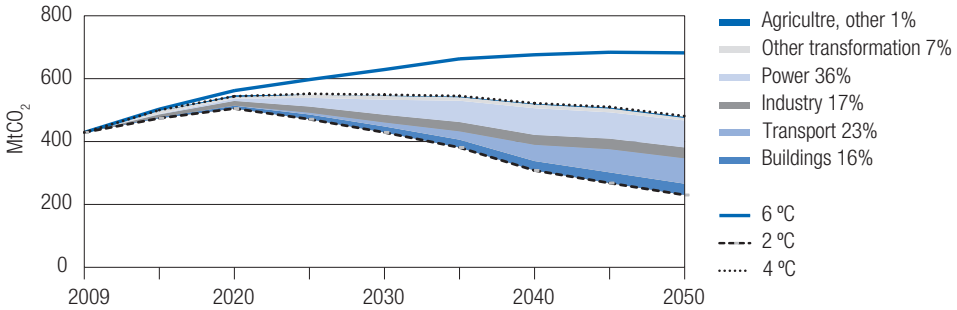
- Firstly, *long-term stable policy and targets* – to create a reliable environment for investments in renewables. In this regard, Mexico has set a goal of generating 35% of its electricity from non-fossil sources by 2024. However, there are important gaps when it comes to effective public policies. For example, Mexico is lacking a law on geothermal energy, which creates uncertainties for investors and leads to the underutilisation of this energy source.
- Secondly, *transitional incentives* to introduce renewable energy into the market and allow for gradual cost reductions, which in turn enable the phase-out of public support over time.
- Thirdly, measures to enable the *integration of variable renewables* into the grid. In this regard, smarter electricity grids, a switch from conventional direct current (DC) to alternating current (AC) lines, and co-ordination with adjacent areas – the western United States, Texas and Belize – would help tackle the balancing challenge (IEA, 2011b).
- And lastly, *tackling non-economic barriers* to the deployment of renewables, including fossil fuel subsidies and complicated permit procedures.

Low-carbon scenarios for Mexico

Mexico has passed one of the world's most stringent national climate change laws. Among its provisions is a mandate to reduce emissions of carbon dioxide by 30% below business-as-usual levels by 2020, and by 50% below 2000 levels by 2050 (see Chapter 11). Alternative ways of achieving these goals should be evaluated based on each option's profitability. Figures 12.6 and 12.7 show the results of cost-effective CO_2 reductions in Mexico seen through three scenarios: The 6°C Scenario (6DS) is largely a projection of the alarming current trends whereby the average global temperature increases by 6 degrees Celsius; the 4°C Scenario (4DS) takes into account recent pledges made to limit emissions; and the 2°C (2DS) scenario incorporates an energy system offering an 80% chance of limiting the average global temperature increase to 2 degrees. Figure 12.6 shows the 6 degree scenario for Mexico as well as the sectoral contributions required for the reductions to reach 2DS from 4DS.

Under 6DS, or the business as usual scenario, Mexico is on track for a 47% increase of emissions; however, 2DS requires to practically a halving of emissions by 2050 compared with 2009 levels. The power sector provides the largest share

Figure 12.6. **Scenarios for sectoral contributions to achieve CO_2 emission reductions in Mexico**



Source: International Energy Agency (2012), *Energy Technology Perspectives 2012*, OECD/IEA, Paris, p. 590.

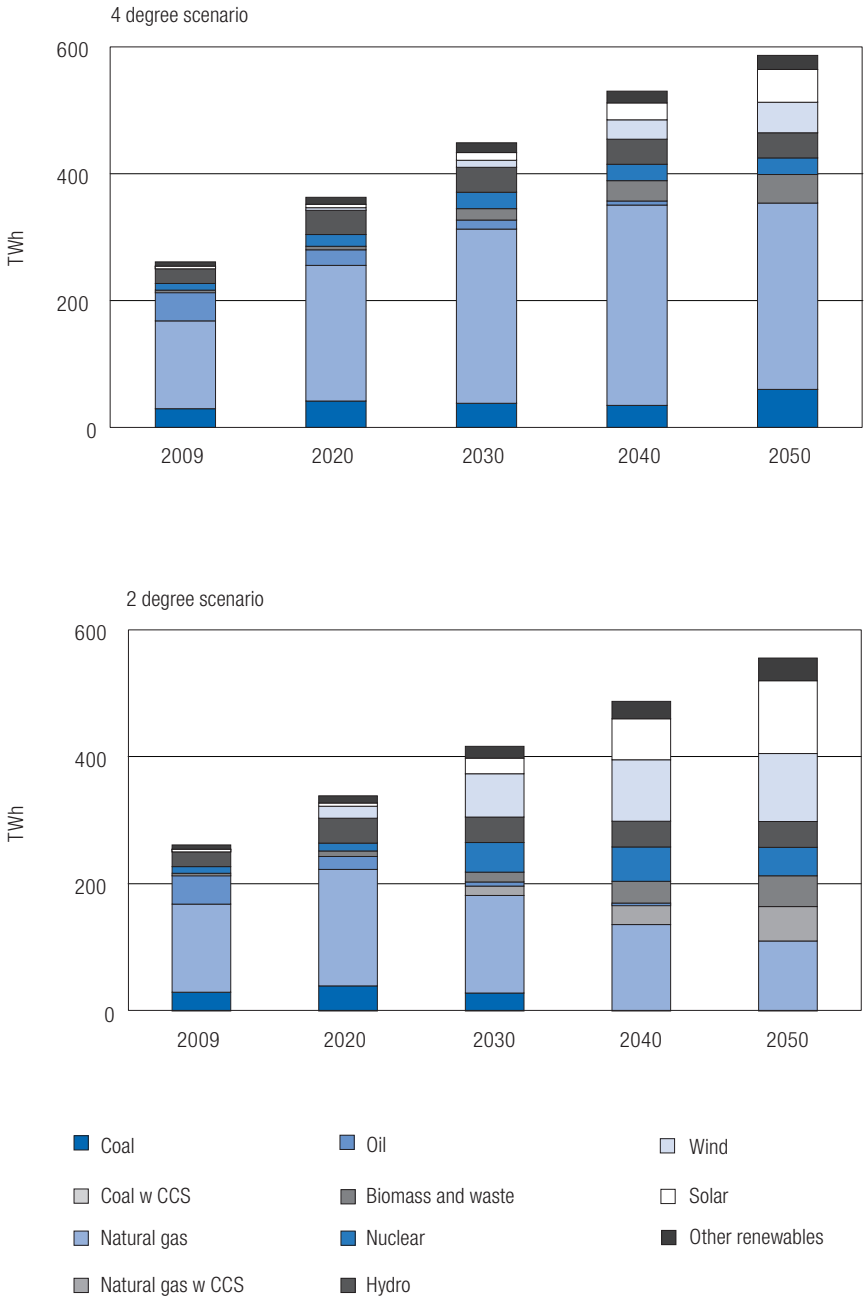
of reductions (36%). Electricity savings for end-users and increased use of solar and wind power are the key mitigation options through 2050. The second-largest contribution comes from the transport sector, with 23% of total reductions. In 2DS, the implementation of Mexican fuel economy standards for passenger light-duty vehicles (PLDVs) – along with new bus rapid transit (BRT) systems in Mexico City and elsewhere – is helping the move towards a cleaner and more efficient transport system.

Under 4DS, the electricity mix continues to be dominated by fossil fuels, especially natural gas. Electricity generation more than doubles between 2009 and 2050; however, more efficient use of gas in power generation – in combination with the increased use of renewables – limits the growth in CO_2 emissions to 56%. In 2DS, annual CO_2 emissions in the power sector are more than halved compared to 2009. Natural gas is replaced by strong growth in solar and wind energy, but CO_2 capture from natural gas plants is also an effective option. Increased use of cogeneration plants in industry, fired by gas or biomass, contributes to the emission reductions as well. Installed cogeneration capacity grows to 15 GW by 2050.

Removing subsidies and introducing carbon pricing should form an important part of a low-carbon energy strategy. To some extent, participating in emission trading systems would be more attractive to Mexico than raising carbon taxes, as it opens opportunities to obtain funds from abroad to finance investments in energy efficiency. It would also be more efficient in the sense that it would ensure that households exploit the cheapest mitigation strategies first – and these may not always coincide with the measures that the government has chosen to subsidise.

In any case, under discussion here is a full strategy change by passing from subsidy to attacking the known enemy: CO_2 emissions.

Figure 12.7. **Mexico's electricity mix in the 4° and 2° scenarios**



Note: CCS is *Carbon capture and storage*.

Source: International Energy Agency (2012), *Energy Technology Perspectives 2012*, OECD/IEA, p. 595.

Key Recommendations

- In order to free up resources for investment in renewable energy (commitment 49 of the Pact for Mexico): reform the system of energy subsidies and ensure more targeted support for the poor.
- In order to increase hydrocarbon exploration and production (commitment 56): reform the oil & gas sector investment framework to enable higher inflows of capital investment and technology.
- In order to transform PEMEX into a world class, competitive company (commitment 55): improve the corporate governance and the procurement policy of PEMEX.
- Put in place a regulatory regime for shale gas development that meets the requirements of both attracting foreign investment and ensuring environmental sustainability. A stronger *Comisión Nacional de Hidrocarburos* (CNH), as foreseen by commitment 58, may form the foundation for such a regime.
- Tackle remaining regulatory barriers to the deployment of renewables and cogeneration.
- To underpin the transition to a low-carbon economy (commitment 49) puta price on carbon emissions in parallel with other mitigation strategies.

Further reading

CBM/NGC Multi-Stakeholder Advisory Committee (2006), Coalbed Methane/ Natural Gas in Coal: Final Report, *www.energy.gov.ab.ca/NaturalGas/Gas_Pdfs/ MACFinalReportJan06.pdf*.

Clausnitzer, K.-D. *et al.* (2010), *Effekte der Förderfälle des Jahres 2009 des CO2-Gebäudesanierungsprogramms und des Programms "Energieeffizient Sanieren"*, Bremer Energie Institut, Institut Wohnen und Umwelt GmbH, Institut für Statistik, Universität Bremen, Bremen/Darmstadt.

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