



International
Energy Agency
Secure
Sustainable
Together

Mexico Energy Outlook

EXECUTIVE SUMMARY

World Energy Outlook Special Report

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
 - Improve transparency of international markets through collection and analysis of energy data.
 - Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
 - Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

IEA member countries:

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Korea
Luxembourg
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States



**International
Energy Agency**
Secure
Sustainable
Together

© OECD/IEA, 2016

International Energy Agency
9 rue de la Fédération
75739 Paris Cedex 15, France

www.iea.org

Please note that this publication is subject to specific restrictions that limit its use and distribution.

The terms and conditions are available online at www.iea.org/t&c/

The European Commission also participates in the work of the IEA.

Mexico's energy sector is in a period of profound change, catalysed by the comprehensive Energy Reform the government has enacted since 2013. The Reform was spurred by the recognition that key energy indicators were moving in the wrong direction, with the attendant risk of a widening gap between the performance of the oil, gas and power sectors and the needs and aspirations of a modern Mexico. The Reform recasts the structures that have governed the energy sector for over 80 years, and seeks to bring in new investment and technology across the hydrocarbons value chain by ending the monopoly of *Petróleos Mexicanos* (PEMEX) and by attracting new players into the power sector to ensure cost-efficient investment into both traditional and low-carbon sources of electricity. The changes reflect both the government's broader vision of modernising the Mexican economy, as well as its intention to show leadership on environmental issues – Mexico was among the first countries to submit a climate pledge in advance of the COP21 meeting in Paris and to embed its clean energy target in domestic legislation.

The Reform has been complicated by the period of lower international oil prices. Even though Mexico's economy as a whole has diversified away from reliance on the hydrocarbons sector, oil revenue still accounted for around one-third of fiscal revenue in 2014, and so the decline in prices had a significant impact on government finances (the share of oil in fiscal revenue fell by more than half in 2015) as well as those of the major state energy companies. Crude oil production fell further in 2015 and exports followed suit, all but eliminating an energy trade surplus that stood at \$25 billion as recently as 2011. However, lower prices have also had some upside: the increasing availability of relatively cheap natural gas imports from the United States has provided a welcome boost to Mexico's power sector. The government's determination to press ahead with the Reform has not diminished, as witnessed by successive and successful bid rounds for upstream oil and gas prospects, and competitive auctions for new electricity supply. The new projects promised in these bid rounds and auctions will need time to become operational, but the decisions and investments taken now are foundational for Mexico's energy future. The aim of this *World Energy Outlook (WEO)* Special Report is to assess the long-term impact of the changes brought by the Reform and to consider their potential ramifications for Mexico's economic development and environmental goals.

Time to turn the oil sector around

Mexico's projected crude oil output bottoms out at under 2 mb/d towards 2020 and then rises as the Reform efforts bear fruit, new projects – notably deepwater developments – start operation and higher oil prices improve profitability. By 2040, crude oil output returns to 2.4 mb/d, but adding in natural gas liquids and, by then, some tight oil takes total oil output in 2040 up to 3.4 mb/d. Mexico's long-standing position as one of the world's major producers and exporters has been weakened in recent years, with investment by PEMEX insufficient to arrest an output decline of more than 1 mb/d since 2004 (a loss of output greater even than Libya's over that period). The projected turnaround rests on three distinct pillars. In shallow water fields, which account for 70% of current production,

the task is to mitigate current declines through enhanced oil recovery techniques and the development of satellite fields around the main existing producing complexes, Cantarell and Ku-Maloob-Zaap. The main source of future growth, however, is anticipated to come from deepwater fields. This is a new frontier for Mexico where PEMEX has less experience and where other players are anticipated, alone or in partnership with PEMEX, to play a prominent role: deepwater fields account for almost half of Mexico's projected offshore oil output by 2040. The final pillar is onshore, with Mexico's tight oil potential and the huge, but hard-to-develop Chicontapac field. Investment is likewise critical to revitalise Mexico's downstream sector, which is beset by poor performance that has pushed up gasoline imports to around 50% of total demand. Upgrades to refinery units help to push up utilisation rates from a very low 60% today towards 90% by 2040, increasing refinery runs and reducing gasoline imports to a more modest one-third of consumption (while virtually eliminating the need for imported diesel).

Imports from the United States provide a very competitive source of natural gas for Mexico, although domestic production – including shale gas – picks up in latter part of the projection period to reach 60 bcm in 2040. The rising role of gas in Mexico's energy mix is facilitated by extensive infrastructure development, the ready availability of relatively cheap gas via new pipelines from the southern United States, and regulatory and pricing reforms that are targeting a liberalised gas market by 2018. Most of Mexico's current domestic output is associated with oil production and its anticipated recovery in the 2020s is closely linked to that of oil. A key determinant of non-associated gas development, including unconventional gas, is the point at which projects can compete with imported gas supply from the US: in our projections, a gradual rise in the US wholesale gas price steadily improves the commercial case for new upstream gas projects within Mexico, triggering larger-scale development from the late 2020s. The prospects for shale gas (a projected 15 bcm in 2040, although the estimated resource base could support considerably higher output) depend also on action to ensure public acceptance, with water availability and responsible water management key issues in the most promising areas.

A clean break with the past in the power sector

Further opening of the power sector to private participation helps Mexico mobilise the \$10 billion per year that it needs to meet an 85% increase in electricity demand to 2040: a more efficient power system brings a 14% decrease (in real terms) in industrial electricity prices to 2040, despite a projected increase in the natural gas price over the period. The unbundling of the *Comisión Federal de Electricidad* (CFE) and long-term auctions for energy, capacity and clean energy certificates provide new players with access to Mexico's power market on a competitive basis, as well as a cost-effective way to bring low-carbon generation into the mix. The first two auctions for new power supply, held in 2016, demonstrated strong private readiness to invest in new solar PV and wind generation, validating the innovative choice of market design. Investment in strengthening the grid and bringing down network losses, alongside a continued switch away from expensive oil-fired generation (which is all but complete by 2020), all help to keep the costs of electricity

supply in check, providing a boost to Mexico's industrial competitiveness. This also provides an opportunity to reduce the costs of subsidies for residential electricity consumers, which currently run at \$6 billion per year; we assume that these subsidies are removed gradually to 2035, in which case the cumulative subsidy bill would be around \$90 billion.

The new policy and market design also provides a substantial boost to Mexico's clean energy efforts: more than half of the 120 GW of new power generation capacity installed to 2040 is renewables-based. This halves the emissions intensity of power generation (from more than 450 g CO₂/kWh in 2014 to 220 g CO₂/kWh in 2040) and even produces an absolute decline in power sector emissions over the *Outlook* period. A distinctive feature of Mexico's Reform in the power sector is that clean energy has been integrated into the Reform package from the outset. This eases the achievement of a 35% share of electricity generation sourced from clean energy by 2024 (a target written into the Energy Transition Law), plays a large part in moving Mexico towards its climate pledge to reduce greenhouse gas emissions by at least 25% below business-as-usual by 2030, and also reduces emissions of other air pollutants.

Efficiency measures can put Mexico on a healthier path to growth

Energy demand in Mexico has grown by a quarter and electricity consumption by half since 2000, but per-capita energy use is still less than 40% of the OECD average, leaving strong potential for further growth. Opportunities for energy savings also exist, with the energy intensity of Mexico's economy higher than the OECD average and showing only a limited improvement since 2000. The energy mix is dominated by fossil fuels, particularly oil, which accounted for more than half of total demand in 2014, making Mexico one of the most oil-reliant major economies in the world. Transport is by some distance the largest end-use sector, accounting for almost 45% of final consumption. The vehicle fleet has grown from 14 million in 2000 to more than 30 million today, leading to traffic congestion that has taken a toll on urban air quality — all of Mexico's largest cities far exceed the World Health Organization's upper recommended limit for particulate matter concentrations.¹

In our main scenario, the economy doubles in size to 2040 but total primary energy demand grows only by around 20%: further growth is tempered by efficiency improvements and structural shifts in the economy that halve the energy intensity of Mexico's economy. Oil loses ground in the overall energy mix, its share declining to 42% in 2040 as that of gas continues to rise (reaching 38% by 2040) and low-carbon sources grow rapidly from a relatively low base. Among the main end-use sectors, robust growth in demand from industry, services and the residential sector is fuelled by gas and, particularly, by electricity, the latter accounting for almost half the increase in final energy consumption to 2040. Electricity demand grows at a pace more than three-times faster than the OECD

¹ See also "Energy and Air Pollution: World Energy Outlook Special Report 2016", available for free at www.worldenergyoutlook.org/airpollution.

average, as rising incomes and living standards feed through into higher ownership levels of a range of electrical appliances, and demand for cooling increases three-fold. Efficiency improvements, motivated in large part by tighter standards and more stringent codes, play a prominent role in mitigating the rise of consumption. Yet the potential for further savings is substantial. For example, no fuel-economy standards have yet been announced for freight transport: heavy goods vehicles currently consume less than 15% of total transport energy demand but they are expected to account for more than half of the increase in transport fuel consumption to 2040.

A “No Reform Case” highlights what is at stake for Mexico’s energy sector

Mexico’s pre-Reform energy pathway was not a sustainable one: the cumulative gains in GDP from the Reform to 2040 are estimated at more than \$1 trillion, compared with a case in which the reforms do not take place. A “No Reform Case” posits an outlook for Mexico in which none of the major reforms since 2013 are enacted, so the state monopoly is maintained in oil and gas and there is no additional private participation or restructuring in the electricity sector. The historical relationship between oil revenue and PEMEX upstream spending was used to derive an alternative outlook for upstream investment in the No Reform Case, a constraint that severely limits Mexico’s capacity to fund expansion and enhanced recovery projects in legacy fields, and delays the start of technically challenging deep water and tight oil development projects. This results in oil production being some 1 mb/d lower by 2040 than in our main scenario. In the power sector, without the same efficiency gains made in networks and other parts of the system, the costs of electricity supply are higher, meaning higher prices for industry and an expanded subsidy bill for households (a cumulative \$135 billion to 2040) to avoid sharper rises in residential electricity tariffs. Without specific policies to increase the role of clean energy, lower deployment of renewables leaves Mexico well short of its clean energy targets. The repercussions extend beyond the energy sector and into the wider economy: the net impact is to leave Mexico’s economy 4% smaller in 2040 than in our main scenario.

Successful Energy Reform is essential to secure the investment in energy supply required in our main scenario, \$240 billion in the power sector and \$640 billion in the upstream, and an additional \$130 billion in energy efficiency. Mobilising cost-efficient investment at average levels of \$40 billion per year represents a constant challenge for Mexico’s policy. Significant tasks remain, notably to ensure that the new regulatory bodies have the authority and capacity to oversee the transition to competitive, efficient and transparent market operation, that the reformed “state productive enterprises” of PEMEX and CFE focus on their strengths, and that effective regulation can allow other players to compete with them on an equal footing. But the initial signs are positive, in terms of the overall direction and design of the Reform effort, the readiness on the part of the government to ensure that the terms for investment remain attractive, and the response of the private sector in the bid rounds and auctions.

This publication reflects the views of the IEA Secretariat but does not necessarily reflect those of individual IEA member countries. The IEA makes no representation or warranty, express or implied, in respect of the publication's contents (including its completeness or accuracy) and shall not be responsible for any use of, or reliance on, the publication.

Unless otherwise indicated, all material presented in figures and tables is derived from IEA data and analysis.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

IEA/OECD possible corrigenda on:
www.oecd.org/about/publishing/corrigenda.htm

IEA Publications
9, rue de la Fédération, 75739 Paris cedex 15

Typeset and printed by IEA, October 2016
Cover design: IEA.
Photo credits: © Graphic Obsession

*The paper used has been produced respecting
PEFC's ecological, social and ethical standards*

Mexico Energy Outlook

Mexico is recasting its entire energy system, in line with a far-reaching Energy Reform package adopted by the government in 2013. How might the multiple changes being implemented today change the energy scene of tomorrow?

This analysis provides a comprehensive assessment of Mexico's energy demand and supply outlook to 2040. The report:

- Maps out the implications of the *Reforma Energética* across the energy economy.
- Explores the ambition of a reformed power market to meet rising demand, while tapping Mexico's abundant renewable resources and reducing the costs of power supply.
- Assesses how and when the new upstream bid rounds can turn around today's declines in oil and gas output.
- Identifies the challenges that remain, while also quantifying the value of Mexico's energy transformation in a "No Reform Case".

For more information, and the free download of the report, please visit:

www.worldenergyoutlook.org/mexico