CONECC
Conectando energía y cambio climático

Alianza Energética
Energiepartnerschaft
MÉXICO - DEUTSCHLAND

Improving and Refocusing Electricity Subsidies

Options for optimization in Mexico

Imprint

Publisher

Enhancing the Coherence of Climate and Energy Policies in Mexico (CONECC) and the German-Mexican Energy Partnership.

CONECC is an initiative by the Federal Ministry for the Enviroment, Nature Conservation and Nuclear Safety of Germany (BMU) and the Ministries of Environment and Natural Resources (SEMARNAT), and Energy (SENER) of Mexico.

The German-Mexican Energy Partnership is an initiative by the Federal Ministry for Economic Affairs and Energy (BMWi), and the Ministry of Energy of Mexico (SENER).

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Design

https://sporapublicidad.com

Status

December 2018

Photography & Illustration

BMWi (p.1) / SENER (p. 7, 11)

Acknowledgements

The authors want to thank the following individuals for taking part in the study's interviews on assessing the reform options: Ana Moreno, from Centro de Investigación para el Desarrollo A.C. (CIDAC); Carlos Muñoz, from Secretaría de Hacienda y Crédito Público (SHCP); the Comisión Reguladora de Energía (CRE); Daniel Chacón, from Iniciativa Climática de México (ICM); Dr. Fabián del Valle Medina, from Centro Mario Molina (CMM); the Fideicomisos Instituidos en Relación con la Agricultura (FIRA); Jorge César Ramírez Mata, from the World Bank (WB); Dr. Juan Carlos Belausteguigoitia, from Instituto Tecnológico Autónomo de México (ITAM); Dr. Juan Rosellón and Tomas Damerau, from Centro de Investigación y Docencia Económicas (CIDE); Dr. Lourdes Melgar, from Massachusetts Institute of Technology (MIT); Lucas Grosseheide, from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); Manuel Molano, from Instituto Mexicano para la Competitividad (IMCO); Dra. Maria Eugenia Ibarrarán, from Universidad Iberoamericana Puebla; Dr. Miriam Grunstein, from Universidad CIDE-Rice; Odón de Buen, from Comisión Nacional para el Uso Eficiente de la Energía (CONUEE); Rolando Fuentes, from King Abdullah Petroleum Studies and Research Center (KAPSARC); the Secretaría de Energía (SENER).

In addition, the authors want to thank the following individuals for their advice and peer review of this report: César Alejandro Hernández; Inder Rivera y Juan Carlos Altamirano, from the World Resources Institute (WRI), David Coady, Ian Parry and Baoping Shang from the International Monetary Fund (IMF).

Contents

Acronyms

APEC	Asia–Pacific Economic Cooperation
ASCM	Agreement for Subsidies and Countervailing Measures
ASIC	Administrador del Sistema de Intercambios Comerciales (Administrator of the Commercial Exchange System)
BPL	Below poverty level
CEL	Certificado de Energía Limpia (Clean Energy Certificate)
CENACE	Centro Nacional de Control de Energía (National Energy Control Center)
CENAGAS	Centro Nacional de Control del Gas Natural (National Natural Gas Control Center)
CFE	Comisión Federal de Electricidad (Mexican national electricity company)
CNH	Comisión Nacional de Hidrocarburos (National Hydrocarbons Commission)
CONAGUA	Comisión Nacional del Agua (National Water Commission)
CONAVI	Comisión Nacional de Vivienda (National Housing Commission)
CONEVAL	Consejo Nacional de Evaluación de la Política de Desarrollo Social (National Council for the Evaluation of Social Development Policy)
CRE	Comisión Reguladora de Energía (Energy Regulatory Commission)
CREG	Comisión de Regulación de Energía y Gas Colombia
DAC	Tarifa doméstica de alto consumo (High consumption tariff for the residential sector)
DBTL	Direct Benefits Transfer for LPG
ENIGH	Encuesta Nacional de Ingresos y Gastos en los Hogares (National Survey on Household Income and Expenditure)
EPDK	Enerji Piyasası Düzenleme Kurumu (Energy Market Regulatory Authority of Turkey)
ETS	Emission Trading System
FAZNI	Fondo de Apoyo Financiero para la Energización de las Zonas No Interconectadas (Financial Support Fund for the Electrification of Non-interconnected Areas)
FFFSR	Friends of Fossil Fuel Subsidy Reform
FFS	Fossil Fuel Subsidies
FIBRA-E	Fideicomisos de Inversión en Energía e Infraestructura (Trust Funds for Energy and Infrastructure Investments)
FIDE	Fideicomiso para el Ahorro de Energía Eléctrica (Energy Savings Trust Fund)
FIRA	Fideicomisos Instituidos en Relación con la Agricultura (Trust Funds for Rural Development)
FMPED	Fondo Mexicano del Petróleo para la Estabilización y el Desarrollo (Mexican Petroleum Fund for Stabilization and Development)
FOES	Fondo de Energía Social (Social Energy Fund)
FOTEASE	Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía (Energy Transition and Sustainable Use of Energy Fund)
FSSRI	Fondo de Solidaridad para Subsidios y Redistribución del Ingreso (Fund of Solidarity for Subsidies and Redistribution of Income)
FSUE	Fondo de Servicio Universal Eléctrico (Universal Electricity Service Fund)
G20	Group of Twenty
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GSI	Global Subsidies Initiative
IEA	International Energy Agency
IEPS	Impuesto Especial sobre Producción y Servicios (Special Tax on Products and Services)
kWh	kilowatt hour
LIE	Ley de la Industria Eléctrica (Electricity Industry Act)
LPG	liquefied petroleum gas
LTE	Ley de Transición Energética (Energy Transition Act)
MC11	Eleventh Ministerial Conference
NAFIN	Nacional Financiera (Mexico's Development Bank)
NGO	Non-governmental organization
OECD	Organization for Economic Co-operation and Development
OMC	oil marketing companies
PEF	Presupuesto de Egresos de la Federación (Federal Expenditures Budget)
PEMEX	Petróleos Mexicanos (Mexican national oil company)

PMUY	Pradhan Mantri Ujwala Yojana (LPG-targeting program)
PRODESEN	Programa de Desarrollo del Sistema Eléctrico Nacional (Program for the Development of the National Electricity System)
PV	Photovoltaic
RENE	Registro Nacional de Emisiones (National Emissions Registry)
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food)
SC	Subsistence Consumption
SEDESOL	Secretaría de Desarrollo Social (Ministry of Social Development)
SENER	Secretaría de Energía (Ministry of Energy)
SHCP	Secretaría de Hacienda y Crédito Público (Ministry of Finance)
SOE	State-owned Enterprise
tCO_2e	ton of carbon dioxide equivalent
VAT	Value Added Tax
WTO	World Trade Organization

Executive summary

Energy subsidy reform in Mexico has become a topic of high public and political importance. In the past few years, the country has gone through great efforts to reform inefficient fossil fuel subsidies. In 2017, it completed the reform of subsidies to diesel, gasoline and liquefied petroleum gas (LPG), which cost up to MXN 244 billion (USD 18.6 billion) in its peak in 2012. The reform responded to related commitments to reform inefficient fossil fuel subsidies by international groups of which Mexico is part, such as the G20 and the Asia–Pacific Economic Cooperation (APEC).

The electricity sector has also gone through significant institutional reforms, notably following the 2013's Energy Reform (Reforma Energetica) -a wide set of policy changes that affected the structure of the Mexican energy sector. The Energy Reform did not directly attempt to reform energy subsidies, but one of its main goals was to improve the efficiency of the sector and reduce costs, which could have a direct impact in the reduction of subsidies. Nevertheless, subsidies for the consumption of electricity are still considerable. In 2016 subsides to the electricity tariffs were estimated at MXN 130 billion (USD 6.8 billion), where 78 per cent of these subsidies were directed to residential tariffs and 11 per cent to the agricultural tariffs.

The subsidies to these two end-user groups create two main problems: their regressive effects (they disproportionally benefit those that consume more) and their opportunity cost (subsidies could be directed to other development goals). Further, in the case of agriculture, electricity subsidies lead to the misuse of water resources and overexploitation of aquifers.

To identify viable reform options for electricity subsidies in Mexico, various options to reform the residential and agriculture electricity tariffs were assessed. This report provides a qualitative analysis of some subsidy reform options proposed by Mexican experts (see table ES 1). The analysis of the options was conducted considering a series of possible environmental and socioeconomic impacts on different income groups. The options were evaluated through two main sources: i) interviews conducted with a wide range of Mexican and international experts; and ii) the analysis of existing

Table ES. 1 Summary of electricity reform options in residential and agriculture sectors

Reform Option	Definition
Residential	
Subsidy Targeting	
Reduction of the DAC threshold	Decrease the consumption threshold of the DAC tariff for each tariff category (1 to 1F) to include a total of 20 per cent of the population under this tariff, reducing the total number of subsidized electricity users. By doing this, vulnerable households with lower consumption levels would continue to benefit from the electricity subsidy.
Mitigation Mechanisms and Alternative Social Protection Programs	
Subsidy reform and reinvestment in renewable energy	Transform residential electricity subsidies into financial support for rooftop solar PV installations, reducing subsidies, decreasing electricity bills and engaging electricity consumers by transforming them in renewable energy producers.
Subsidy reform and reinvestment in energy efficiency measures	Transform residential electricity subsidies into financial support for energy-efficiency measures at households. The measures can range from the substitution of old household appliances by new and more energy-efficient ones, to the application of high insulation standards in the construction of new dwellings.
Subsidy reform and reinvestment in an expanded healthcare system	Remove all subsidies to electricity and dedicate the fiscal savings to financing a system of universal health care coverage. The example illustrates how fiscal savings from subsidy reform could be spent and estimates the mid- and long-term welfare impacts of such a reform.
Agriculture	
Decoupling subsidy and use of energy efficient technologies	Breaking the link between subsidy benefits and volumetric consumption, so that subsidies are granted according to other parameter such as: the historic amounts received, the number of cultivated hectares or a staggered payment system. Complement the new system with energy efficiency measures (for example: more efficient water pumps).
Energy efficiency in the agriculture sector	Replacement of inefficient water pumps with more efficient ones, via the implementation of a funding scheme supported by SAGARPA.

studies that had explored the anticipated impacts of the given options.

The analysis concluded that all options present their strengths and weaknesses, and the best option would be a combination of the proposed measures, defining specific support mechanisms adapted to the socio-economic conditions of the affected population groups. IISD recommends that a reform strategy should be founded on the following general principles:

- Vulnerable population groups should not be affected, meaning that the share of their household expenditure which goes to electricity should not increase.
- Energy efficiency and distributed renewable energy are powerful tools to compensate price increases, especially for low- and middle-income population groups. Mexico can use, expand and build upon recent and ongoing financing schemes supported by the government.
- A further reduction in electricity subsidies will be achieved if consumers with the ability to pay are effectively moved to non-subsidized tariffs.
- Applied compensatory schemes should result in acceptable social welfare benefits and should be designed so that their financial cost is less to government than the cost of subsidies. The government is in effect making a swap from providing electricity subsidies to providing a lower level of alternative compensation measures that are more effective.

Based on that, the report concludes with a possible implementation plan, which considers: the population segments, a plan to scale up and implement compensation measures, a communication plan, and the main public actors that will intervene in the reform. The main elements of the reform proposal are the following:

- Expand the DAC to be applicable to higher-income deciles, adding the criterion of income to the application of the tariff.
- Reform subsidies gradually for mid- and lower-income population deciles. We recommend that the removal of subsidies for these groups be conditional on the implementation of compensatory measures, and, more concretely, on energy efficiency (as a first step) and distributed solar PV for users that have already implemented basic energy-efficiency standards. Schemes should focus on being pro-poor as far as possible.
- Finance compensatory measures by the electricity savings, at least partly.

These recommendations would require a further analysis of the population segments, the potential of the proposed compensation measures and the financing systems, as well as the actors involved. Mexico can take as a reference the international experiences of other countries that have successfully carried out reforms, and thus continue to be an international example of leadership committed to the reform of inefficient subsidies. In that regard, it is recommended to further elaborate such a possible "roadmap for implementation" in close cooperation with civil society and the public sector.

Introduction

Energy subsidy reform in Mexico has become a topic of high public and political importance. In the past few years, the country has gone through great efforts to implement sweeping reforms of inefficient fossil fuel subsidies. In 2017, it completed the reform of subsidies to diesel, gasoline and liquefied petroleum gas (LPG), which has saved hundreds of billions of Mexican pesos[1] in public funds.

This reform has been matched by strong international actions to promote fossil fuel subsidy (FFS) reform. As part of the G20 and Asia–Pacific Economic Cooperation (APEC) agreements, Mexico committed in 2009 to "phase out and rationalize over the medium term inefficient fossil fuel subsidies … that encourage wasteful consumption… while providing targeted support for the poorest."[2] It has renewed this pledge in subsequent leaders' statements. Mexico's international leadership in this area has been further demonstrated through a number of initiatives since this time, including:

- In 2015, Mexico joined 41 countries in a communiqué released by the Friends of Fossil Fuel Subsidy Reform, "supporting accelerated action to eliminate inefficient fossil fuel subsidies in an ambitious and transparent manner."[3]
- In 2017, Mexico published with Germany its Peer Review of Fossil Fuel Subsidies under the G20.[4]
- More recently in 2017, Mexico was one of the 12 World Trade Organization (WTO) members that presented a Ministerial Statement at the Eleventh Ministerial Conference (MC11) to advance the discussion of FFS in the WTO.[5]

However, the cost of electricity subsidies to the public budget is still very high. In particular, subsidies to electricity tariffs reached MXN 130 billion in 2016 (USD 6.8 billion), representing around MXN 1,000 per Mexican per year or 0.65 per cent of Mexico's GDP.[6]

Governments typically use energy subsidies in an attempt to protect citizens from high energy prices and price volatility. However, some subsidies are ineffective, inefficient or have unintended negative effects. Electricity subsidies in Mexico are regressive, that is, a disproportionate share of benefits goes to richer households. The subsidies also have an important opportunity cost to society, and they incentivize lock-in of unsustainable energy use, with negative consequences for the environment.

The purpose of this report is to identify and evaluate options for reforming Mexico's electricity subsidies. In 2016 electricity subsidies amounted to MXN 130 billion (USD 6.8 billion). Households received 78 per cent of this subsidy, followed by the agricultural sector (11.3 per cent), industry (10 per cent) and services (0.7 per cent). The options are drawn from public reform discussions that have been taking place in Mexico and have been proposed by Mexican experts, focusing on the two most subsidized categories of electricity consumer: residential and agriculture. The evaluation is conducted considering a series of possible socioeconomic impacts on different income groups.

[1] Note: The subsidies reached a peak in 2012, costing a total of MXN 244 billion (USD 13 billion), see Figure 1.

[2] G20 (2009) G-20 Pittsburgh Summit Leaders' Statement and Asia–Pacific Economic Cooperaiton (APEC) (2009) APEC Summit Leaders' Declaration: Sustaining growth, connecting the region.

[3] Friends of Fossil Fuel Subsidy Reform (FFFSR) (2015) Fossil-Fuel Subsidy Reform Communiqué.

[4] OECD (2017) Mexico's efforts to phase out and rationalise its fossil fuel subsidies.

[5] WTO (2017) Fossil Fuel Subsidies Reform Ministerial Statement.

[6] WB (2018a) GDP Data.

1. Defining energy subsidies

Internationally, the most broadly accepted definition of subsidy is the one proposed by the WTO in its Agreement for Subsidies and Countervailing Measures (ASCM), which was signed by the WTO's 164members (as of October 2018), including Mexico. Box 1 explains this definition.

The ASCM considers four types of subsidies:

- A direct transfer of funds or liabilities, such as the provision of grants.
- Revenue foregone or revenue that is not collected, including tax exemptions and reductions.
- Providing goods or services at below-market rates, such as the provision of land, services or inputs.
- Providing income or price support, for example through price regulation.

The Organization for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) proposed more simplified definitions specific to the energy sector, but both are covered by the WTO's more general one. There is no guidance from either the G20 or APEC on what FFS definition should be used. The Global Subsidies Initiative (GSI) and several other non-governmental organizations (NGOs) also use the ASCM definition.

Box 1: The WTO's definition of energy subsidies

The WTO's ASCM Article 1 provides a definition of subsidy that is binding for the 164 members of the organization. They read as follows:

Article 1: Definition of a Subsidy

1.1 For the purpose of this Agreement, a subsidy shall be deemed to exist if:

(a)(1) there is a financial contribution by a government or any public body within the territory of a Member (referred to in this Agreement as "government"), i.e. where:

i. A government practice involves a direct transfer of funds (e.g. grants, loans, and equity infusion), potential direct transfers of funds or liabilities (e.g. loan guarantees);

ii. Government revenue that is otherwise due is foregone or not collected (e.g. fiscal incentives such as tax credits); A government provides goods or services other than general infrastructure, or purchases goods;

iii. A government provides goods or services other than general infrastructure, or purchases goods;

iv. A government makes payments to a funding mechanism, or entrusts or directs a private body to carry out one or more of the type of functions illustrated in (i) to (iii) above which would normally be vested in the government and the practice, in no real sense, differs from practices normally followed by governments;

or

(a)(2) there is any form of income or price support in the sense of Article XVI of GATT 1994;

and

(b) a benefit is thereby conferred.

Source: WTO (n.d.) Agreement on Subsidies and Countervailing Measures.

Under the G20 and APEC agreements, countries and organizations have agreed to phase out subsidies that are "inefficient" and that encourage "wasteful consumption." There is not a well-established definition of the exact meaning of these two terms. In practice, both are determined by individual governments according to their country context. Box 2 explains which elements are typically used to consider those characteristics.

Box 2: Evaluating subsidies: Inefficiency and encouraging wasteful consumption.

Several organizations, such as the OECD and APEC, focus on the reform of subsidies that are "inefficient" and that "encourage wasteful consumption." The evaluation of these criteria is not clearly determined since it depends on country specifics, but it typically includes the following:

Inefficiency of energy subsidies is assessed against the following elements:

a. A broad analysis of a subsidy's fiscal, administrative, social and environmental costs.
b. Whether a subsidy delivers against its stated policy objectives.
c. Whether a subsidy can be replaced with more efficient policies that are more targeted, reduce the fiscal and administrative costs, and are less harmful to the environment.
d. Whether a subsidy is potentially obsolete.

Wasteful consumption refers to the use of energy that would not have occurred if no subsidies existed. Wasteful consumption can be evaluated by accounting for:

a. Possible unintended beneficiaries of subsidies.
b. Possible unintended and sub-optimal uses of energy resources.

Source: Gerasimchuk, Wooders, Merrill, Sanchez, and Kitson (2017) A guidebook to reviews of fossil fuel subsidies: From self-reports to peer learning.

In this report, the WTO definition presented in Box 1 is used. The extent to which subsidies are identified as inefficient or wasteful is based on the considerations set out in Box 2. Annex 1.1 explains the methodology used to identify inefficient energy subsidies in Mexico. The detailed inventory of energy subsidies identified in this report is presented in Annex 1.

2. History of energy subsidies and reform approaches in Mexico

Mexico has made considerable progress over the past few years, eliminating a substantial part of its subsidies for fossil fuels while transitioning toward open energy markets. The electricity sector has also gone through significant institutional reforms, notably following 2013's Energy Reform, a wide set of policy changes that affected the structure of the Mexican energy sector. Despite this, subsidies for the consumption of electricity are still considerable. This section looks at the recent history of Mexico's energy reforms, with a particular focus on reforms that impact subsidies for fossil fuels and electricity. The reforms and attempts are broken down into institutional, pricing and fiscal reforms.

2.1 Institutional Reforms

Reform of the energy sector has been on Mexico's political agenda for almost two decades. During this period, there have been several attempts with varying results. In 1999, President Ernesto Zedillo attempted a broad reform of the electricity sector that would have included the unbundling of the state-owned energy company CFE (Comisión Federal de Electricidad), the strengthening of the regulatory body and the creation of a wholesale electricity market.[7] In 2001, President Vicente Fox promoted a similar reform, but with less emphasis on privatization, which did not achieve consensus with the different parties and other stakeholders. President Felipe Calderón tried in 2008 to introduce several reforms related to the electricity and hydrocarbon sector. The final legislation allowed PEMEX (Petróleos Mexicanos, the national oil company) to enter into service contracts with third parties[8] and led to Mexico's first framework for the renewable energy industry and an increase in renewable energy production, particularly in wind power. [9]

In December 2013, legislation for the constitutional reform known as Reforma Energética (Energy Reform) was approved by Parliament and further secondary laws came into effect over the following months and years. The Energy Reform was a wide-reaching reform of the Mexican energy sector. Most of the changes introduced by the Energy Reform implied the unbundling of the historical national monopolies (PEMEX and CFE) and the opening of energy markets to private actors (see Table 1). The Energy Reform did not directly include a reform of energy subsidies, but one of its main goals was to improve the efficiency of the sector and reduce costs, which should result in the reduction of subsidies.

[7] Breceda (n.d.) Debate on the reform of the electricity sector in Mexico.

[8] Ribando Seelke, et al. (2015) Mexico's oil and gas sector: Background, reform efforts, and implications for the United States.

[9] Wood and Martin (2018) Mexico's new energy model of paradigm shifts and political conflict.

Table 1: Summary of changes introduced by Mexico's Energy Reform

Petróleos Mexicanos (PEMEX)	In 2015, Pemex was transformed into a Productive State-Owned Enterprise,[10] following a new tax regime, which maintained some support from the government and privileges versus open competition, such as the opportunity to choose the most attractive areas for itself (Round Zero) before concessions are auctioned openly (in Rounds 1, 2 and 3).[11] Upstream shared profit agreements can be signed between PEMEX and private companies. In addition, downstream permits (petrochemical refinement, distribution and storage of oil and gas) can be granted to private companies, ending state monopoly on upstream and downstream activities.[12]
Comisión Federal de Electricidad (CFE)	Secondary laws passed in August 2014 unbundled the CFE into about 10 different subsidiaries and outsourced some of its previous competences to new structures. In February 2015, the Ministry of Energy (SENER) recognized CFE as a Productive State-Owned Enterprise.[13] Electricity generation is carried out by both CFE and the private sector. Electricity transmission and distribution, however, remain solely under the CFE's responsibility. [14] The private sector is able to participate in the construction, operation, maintenance and infrastructure expansion of the electricity transmission and distribution networks.[15]
Hydrocarbons – Upstream	Though oil remains exclusively the property of the state with no concessions, upstream activities can be carried out by the private sector.[16] The related contracts include services, production sharing, shared utility and license. Contract procurement falls under the responsibility of the National Hydrocarbons Commission (Comisión Nacional de Hidrocarburos [CNH]).[17] The newly established Mexican Petroleum Fund for Stabilization and Development (Fondo Mexicano del Petróleo para la Estabilización y el Desarrollo [FMPED]), managed by Mexico's Central Bank, receives, manages and distributes the income derived from the licenses and contracts.[18]
Hydrocarbons – Mid- and Downstream	Private companies are allowed to enter the market for refining, processing, transportation, storage and distribution of oil and gas and their products, where permits can be granted up to 30 years.[19] The new National Natural Gas Control Center (Centro Nacional de Control del Gas Natural [CENAGAS]) opens competitive tenders for gas infrastructure projects.[20] Gasoline and diesel imports have been allowed since April 2016 but have not seen significant growth due to transport and storage constraints.[21]
Electricity Sector	The Electricity Industry Act (Ley de la Industria Eléctrica, LIE) , passed in 2014, provides the foundation for the gradual development of a wholesale electricity market through private participation and open competition in power generation, as well as greater generation of clean energy sources via the establishment of a Clean Energy Certificates (Certificados de Energías Limpias [CELs]) mechanism.[22] The new National Energy Control Centre (Centro Nacional de Control de Energía [CENACE]) is the body responsible for operating the wholesale electricity market. The LIE also links to particular programs and policies, such as the Program for the Development of the National Electricity System (Programa de Desarrollo del Sistema Eléctrico Nacional [PRODESEN]) and the Universal Electricity Service Fund (Fondo de Servicio Universal Eléctrico [FSUE]).[23] The Energy Transition Act (Ley de Transición Energética [LTE]), enacted in December 2015, provides legal certainty for clean energy investments by adding short-term targets for clean electricity generation of 25 per cent by 2018 and 30 per cent by 2021, considering also the previous target of 35 per cent by 2024. It also provides measures for distributed generation, smart grids and energy efficiency.[24]

[10] Note:Productive State-Owned Enterprises were created as a new category. These enterprises operate in a competitive market and have more independence in decision making from the government than parastatals. One of the purposes of creating them is to open the market to further participants.

[11] SENER (2015a) Ronda Cero y migración de contratos de PEMEX.

[12] BMWi and SENER (2018) Mexico's New Energy Era.

[13] See note 10 above.

[14] BMWi and SENER (2018) Mexico's New Energy Era.

[15] Idem.

[16] Note: Though private sector and SOEs do not have ownership of the oil reserves, they are able to exploit the reserves. Source: BMWi and SENER (2018) Mexico's New Energy Era.

[17] BMWi and SENER (2018) Mexico's New Energy Era.

[18] Alpizar-Castro and Rodriguez-Monroy (2016) Review of Mexico's energy reform in 2013: Background, analysis of the reform and reactions.

[19] Idem.

[20] Idem.

[21] Lastiri (2018) Importación privada de combustibles avanza primeros pasos.

[22] BMWi and SENER (2018) Mexico's New Energy Era.

[23] Note: The Universal Electric Service Fund's objective is to extend access to the electricity grid to rural communities and marginalized urban areas. Source: BMWi and SENER (2018) Mexico's New Energy Era.

[24] IEA (2017a) Energy policies beyond IEA countries: Mexico 2017.

2.2 Pricing Reforms

Electricity

Subsidies to electricity remain significant (MXN 130 billion in 2016) despite several reform attempts. In 2002, a reform was proposed to make the tariff structure less regressive, resulting in the special tariff for high-consuming households (Tarifa Doméstica de Alto Consumo —DAC in Spanish). However, several exemptions from the DAC tariff introduced in subsequent years, notably for higher electricity consumption in warmer parts of Mexico, reduced the impact of the reform. This is the case of the legislative initiatives by Senator Pérez de Alva[25] and Senator Oscar Luebbert.[26]

Some electricity tariffs (commercial, public services, industrial and DAC) are defined at a price higher than their supply cost. Residential and agricultural tariffs on the other hand have been consistently subsidized (see Annex 2: Summary of Residential and Agriculture Electricity Tariffs in Mexico). Some tariffs (industrial, commercial and DAC) are indexed on the price of fuels, presenting fluctuations that some years have resulted in net subsidies for the industrial and service tariffs.[27] However, no specific reform has been implemented.

In November 2017, the Energy Regulatory Commission (Comisión Reguladora de Energía [CRE]) proposed and implemented a new electricity tariff methodology that aimed at cost-recovery tariff levels and at the reflection of temporary costs and variations to make tariffs more competitive compared to international standards.[28] The new methodology was proposed for all tariff classes, although an official "Acuerdo" (agreement) by the Ministry of Finance set residential and agricultural tariffs back to the previous structure.[29,30]

Gasoline and Diesel

In 2012, subsidies to gasoline and diesel reached a peak of MXN 223 billion[31] (USD 17 billion) (see Figure 1). Over the last five years, pricing policy for transport fuels transitioned from a price smoothing mechanism (the Special Tax on Products and Services [IEPS], see below, Section 2.3 Excise Tax (IEPS) Reform) to a system with price bands and daily price adjustments, and then full liberalization by the end of 2017 (although the IEPS is still applied, see Section 2.3). In January 2015, the price band approach (minimum and maximum prices defined on a monthly basis) was introduced as a temporary measure to protect domestic consumers from price fluctuations at the international oil market—but, at the same time, allowing gasoline and diesel prices to follow international market prices more closely and thereby reduce the fiscal cost to the government.[32] As this approach could not deliver the intended fiscal sustainability, Mexico's government decided to accelerate the transition toward full liberalization of prices starting from January 2017, which was initially planned for 2018.[33] A schedule for price liberalization was established and implemented throughout 2017.[34]

LPG

LPG used to have a fixed price in Mexico that was lower than international market prices, resulting in an implicit subsidy for all users of this fuel. Figure 1 shows the level of these subsidies between 2007 and 2014. Since 2010, a stepwise increase in prices brought them closer to market level and in August 2014, a secondary law of the Energy Reform (Ley de Hidrocarburos) introduced the liberalization of the LPG market, which came into effect starting in 2017.

[25] Note: This initiative, approved in 2003, allowed low-income defaulting customers in warm areas to negotiate with CFE the modality of payment of due bills during the hottest months. Source: Hernandez (2006). La Reforma Cautiva. Inversión, trabajo y empresa en el sector eléctrico mexicano.

[26] Note: This initiative (known as Luebbert II Initiative, approved in 2003) proposed a new tariff schedule based on heat index and level of consumption, providing subsidies for low consumers in warmest areas, as well as for retired people. Source: Hernandez (2006). La Reforma Cautiva. Inversión, trabajo y empresa en el sector eléctrico mexicano.

[27] SENER (2016) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2015.

[28] CRE (2017) La CRE publica la metodología de cálculo y ajuste de las Tarifas Finales del Suministro Básico.

[29] DOF (2017a) Acuerdo por el que se autorizan las tarifas finales de energía eléctrica del suministro básico a usuarios domésticos.

[30] DOF (2017b) Acuerdo por el que se autorizan las tarifas finales del suministro básico de estímulo 9-CU y 9-N.

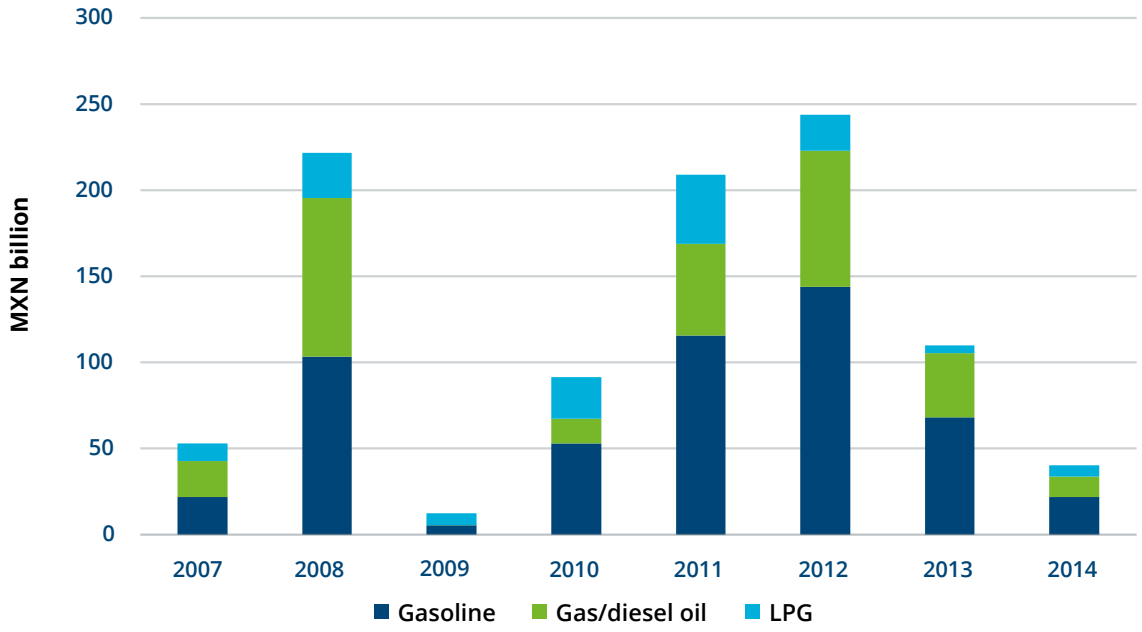
[31] OECD (2018) Fossil fuel support -MEX.

[32] CEFP (2017a) Evolución de los precios de las gasolinas en México, 2016–2017.

[33] IEA (2017a) Mexico energy outlook.

[34] CEFP (2017a) Evolución de los precios de las gasolinas en México, 2016–2017.

Figure 1: Subsidies to gasoline, diesel and LPG in Mexico before the reform, in MXN billion[35]



Source: IISD with information from OECD (2018).

2.3 Fiscal Reforms

Excise Tax (IEPS) Reform

Between 1994 and 2014, the IEPS was introduced on sales or imports of goods and delivery of services, including automotive fuels.[36] To this end, it was used as a de facto price smoothing mechanism for end-consumers of automotive fuels. The tax allowed the government to maintain relatively stable prices for end-consumers at times of high volatility of prices in the international market.[37] IEPS acted as a normal tax when prices at the international market were lower than fixed producer prices at the domestic market. When world market prices were greater than domestic ones, it became a "negative" tax (i.e., a subsidy). In 2008, when world market prices reached unprecedented heights, the negative IEPS rate resulted in a subsidy equivalent to 1.8 per cent of GDP[38] —that is MXN 222 billion[39] (USD 20 billion). In late 2014, Mexico eliminated this support measure for the consumption of transport fuels.[40] As of 2016, the IEPS on transportation fuels has been positive and still acts as a smoothing mechanism that limits price fluctuations and the high volatility of international oil markets.[41]

[35] Note: Lower subsidy values in 2009 reflect lower international oil prices after the oil price drop in December 2008.

[36] BMWi and SENER (2018) Mexico's New Energy Era.

[37] CEFP (2017a) Evolución de los precios de las gasolinas en México, 2016–2017.

[38] Hahn and Pitt (2014) Preparing for Liberalization of the Retail Gasoline Sector in Mexico: A household-level welfare analysis.

[39] OECD (2018) Fossil fuel support – MEX.

[40] OECD (2016a) Fossil fuel support country note: Mexico.

[41] CEFP (2017a) Evolución de los precios de las gasolinas en México, 2016–2017.

The Carbon Tax

The 2012 General Climate Change Law enabled Mexico to use a carbon tax as a fiscal instrument to reduce carbon emissions by putting a price on the environmental externalities of fossil fuels. It was legislated as a component of the IEPS in 2013 and came into full force in 2014. Under the IEPS, the carbon tax is applied to producers or importers of fossil fuels. In practice, much of the carbon tax is applied to the sale of gasoline, diesel and fuel oil.[42] Similar to other jurisdictions with a carbon tax, the tax is applied to fossil fuels based on their carbon emission content with a standard rate of MXN 43.77/ton of carbon dioxide equivalent (tCO_2e) (USD 2.31/tCO_2e).[43] However, there are several exemptions to the application of the tax.[44] There is no planned carbon tax increase, and its price is only adjusted based on the inflation. A total of MXN 17.3 billion (USD 950 million) was generated between 2014 and 2015, and all revenues are absorbed into the federal government's general budget.[45]

Box 3: Emissions Trading System

Similar to the carbon tax, the General Climate Change Law included a voluntary Emission Trading System (ETS) as part of its toolkit to reduce emissions. However, in 2017 a motion was put forward by the Chamber of Deputies to change the voluntary ETS and to require the design and implementation of a mandatory national ETS. The Senate passed the amendments in April 2018, and in July that same year, the General Climate Change Law was amended to include the carbon market as an instrument to support emission reductions in Mexico.[46]

As part of the reporting under the National Emissions Registry, (Registro National de Emisiones [RENE]), in 2017 a total of 926 companies registered their emissions.[47] Out of all the companies registered, the energy and industrial sectors were the highest emitting sectors, with over 13 billion tCO_2e and over 4 billion tCO_2e, respectively. This provided insights into the number of companies that could be significantly affected under the ETS system. To understand the mechanisms behind the upcoming ETS, a simulation was introduced in 2017 where an estimated 100 high-emitting companies participated, many of which fell below the top emitting companies under the RENE. The simulation ended in the second quarter of 2018. It is expected that, in 2019, the national ETS will be launched in a pilot phase of three years. It is scheduled to be fully up and running by 2022.[48]

[42] MexiCO2 (n.d.) Nota Técnica Impuesto al Carbono en México.

[43] Note: As a comparison, Canada will implement a CAD 20/tCO_2e (USD 15.45/tCO_2e) carbon tax in 2019; in the United Kingdom, high emitters are charged GBP 18.08 (USD 23.30) per tCO_2e they emit under the European Union ETS; and Colombia established a carbon tax of USD 5/tCO_2e.

[44] Note: The following fuels are de facto exempted of the carbon tax (as their price is zero): natural gas, fuels used in production processes other than for combustion, and all aviation kerosene and aviation fuels. In 2016 these exemptions had a total value of MXN 1.9 billion (USD 100.8 million) of revenues forgone. Source: OECD (2017) Mexico's efforts to phase out and rationalise its fossil fuel subsidies.

[45] SEMARNAT (n.d.) Recuadro: El impuesto al carbono en México.

[45] MexiCO2 (n.d.) Nota Técnica Impuesto al Carbono en México.

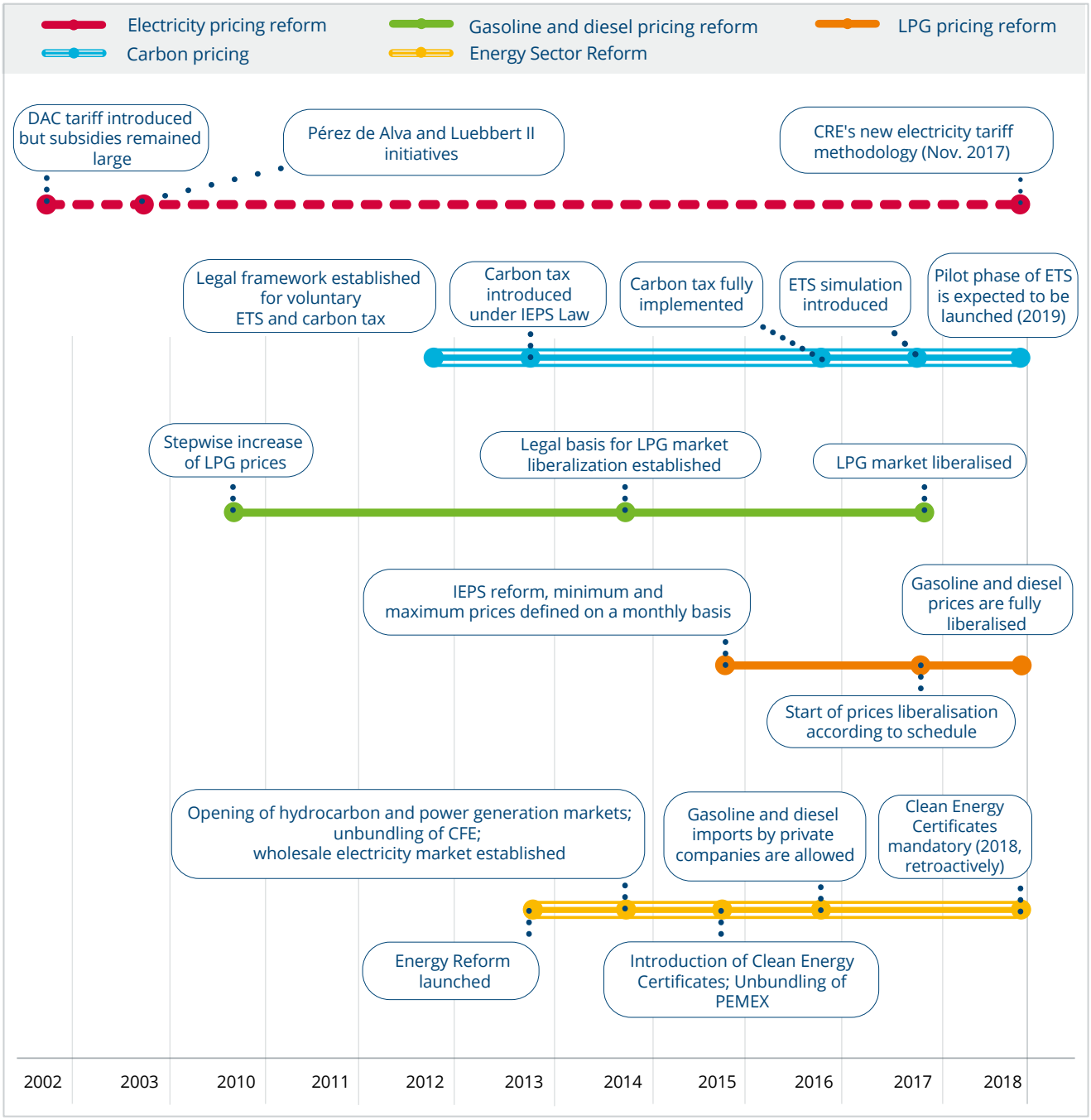
[46] SEGOB (2018) Decreto por el que se reforman y adicionan diversas disposiciones de la Ley General de Cambio Climático.

[47] SENER (2018) Avances en Desarrollo de mercado de carbono en México.

[48] Gobierno de la República (2018) México iniciará en 2019 fase piloto de Mercado de Carbono de las Américas.

Figure 2: Summary of energy reforms (institutional, pricing and fiscal) in Mexico since 2002

NOTE: The solid lines (gasoline, diesel and LPG) represent reforms that took place; the dashed line (electricity) represents attempted reforms; and the thicker lines represent implemented institutional reforms.



Source: BMWi and SENER (2018) Mexico's New Energy Era.

3. International best practices in reforming energy subsidies

This section presents three case studies and two text boxes that summarize lessons learned about energy subsidy reform from other countries that are relevant to Mexico. The cases focus on examples that demonstrate: how to efficiently use public economic resources, including on targeting and mitigation measures for vulnerable consumers; how to support transparency in energy prices; and how to avoid any discouragement to private sector participation in the electricity sector. A summary of the lessons is presented in Table 2.

Table 2: Summary of main learnings from international examples of energy subsidy reform

Country	Positive attribute	Challenging attributes
Turkey	• Simple tariff structure and a uniform national retail tariff is applied for all 21 retail companies, which eliminates differences between distribution regions. • Full cost recovery across all tariffs. • Privatization and security deposits arrangements have improved bill collection.	• Sudden "big bang" reforms can be politically challenging. • Despite models showing that large tariff increases were likely to have little impact on the poor, a lack of any dedicated mitigation measures or compensation for tariff increases could undermine support for reform.
Colombia	• Limited number of tariff lines (total of five dwelling categories, each divided into subsistence and over-subsistence consumption). • Subsidies offered only up to subsistence level of consumption for eligible households. • Targeting, while not perfect, is directed to low-income users and irrigation, not commercial or industrial users. • Subsidies are administered via a fund (FSSRI) and sent directly to all utilities so, in theory, there is no market access discrimination for private electricity suppliers. • Liberalization of the electricity sector led to significant efficiency and quality gains.	• Cross-subsidies have been increasingly unable to finance subsidies, leading to significant top-ups from the federal budget, which represents a cost to all taxpayers. • Whentransfers from FSSRI are insufficient to cover subsidy costs, the resulting under-recoveries reduce profitability of the distribution companies, which may be driving them to reduce service quality to subsidized neighborhoods. Chronic underfunding may lead to underinvestment in electricity infrastructure, undermining incentives for innovative electricity solutions for isolated regions. • Colombia's system exhibits common trends for long-standing subsidy schemes—over time, the number of consumers claiming subsidies increases and surcharged consumers declines—causing shortfalls in financing.
India	• Subsidy targeting, a key action for subsidy reform, was made easier after India switched to the Direct Benefits Transfer mechanism—a market price-based subsidy system that allowed for targeting mechanisms to be applicable. • A communication campaign, called GiveItUp, made an emotional appeal to richer households to give up their subsidy, establishing an ethical norm that access to LPG subsidies should be for the poor.	• Despite adopting the Direct Benefits Transfer system in which targeting is easier to introduce, little progress has been made in actually cutting out richer consumers. • Restricting consumption alone (like the introduction of quota caps) without a narrative of targeting subsidies to the poor attracted immense political and public pressure. • Better identification of poor households and restricting rich households through existing reforms remains a work in progress requiring constant adjustments.

Indonesia	• An existing social protection scheme is a major asset in subsidy reform. • Years of preparation and advocacy can change community attitudes. • Removing subsidies facilitated the reallocation of expenditure from supporting universal short-term consumption to strategic investments that will improve households' longer-term capacity and opportunities.	• Indonesia missed the opportunity to "swap" some of the savings into clean energy investments.
Iran	• Preparation, communication campaigns and cash transfers yield strong public support. • Reallocation from subsidies to cash transfers reduced poverty and inequality.	• Reforms will be vulnerable to inflation and exchange rate fluctuations if prices remain fixed rather than floating or market-determined. • Universal cash transfers can have inflationary effects. They should ideally be introduced when the inflation rate is low and decreasing, and not at the same time as investment and other inflationary government programs. • Transfers need to be targeted, time-limited and include a mechanism for review if subsidy savings fail to materialize. Budgeting transfers is key.

3.1 Reforming the Electricity Sector to Achieve Cost Recovery: The case of Turkey

Turkey introduced full cost-recovery pricing in the electricity sector from 2008, implying price increases to all consumers of over 50 per cent that year. No compensation to the low-income households was granted, although the price increases were staggered across three separate reforms over a nine-month period. Following reform, there is one tariff for all consumers, which is similar to that for the commercial sector, and which is kept uniform across the country despite differences in the cost of supply. Studies found that the impact on income, expenditure and consumer surplus for the bottom deciles were 2 per cent or less.[49] In Mexico, low-income households spend around 3 per cent of their income on subsidized electricity. Tariff increases to achieve cost-recovery could more than double current prices.[50] This means that they could have an impact on poorer households that might require some form of mitigation through social assistance programs.

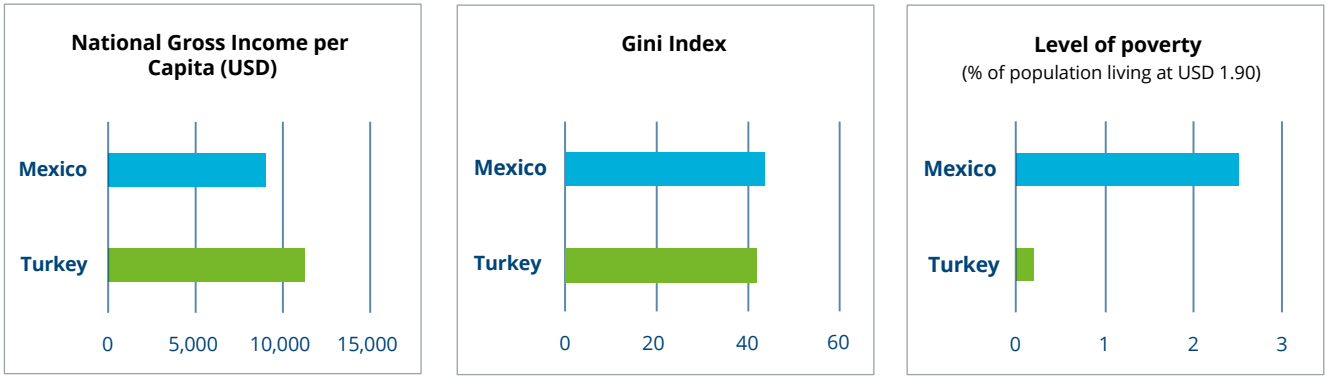
Turkey and Mexico have similar gross national income per capita (USD 11,230 and USD 9,010, respectively in 2016) and similar Gini coefficients (43.4 for Mexico and 41.9 for Turkey in 2016). [51] However, Mexico has higher levels of poverty (2.5 per cent of the population at USD 1.90 per day compared with 0.2 per cent in Turkey). The majority (67 per cent) of Turkey's electricity is supplied from gas and coal, making Turkey a net importer, especially of natural gas. The industrial sector is the largest user of electricity at 47 per cent, with households using less than half that at 22 per cent.

[49] Zang (2015) Energy price reform and household welfare: The case of Turkey, Bağdadioğlu, Başaran, Kalaycioğlu, and Pinar (2009) Integrating poverty in utilities governance.

[50] Note: Based on the cost estimates for 2015 by the IEA (2016a) Mexico energy outlook.

[51] WB (2018b) Indicators.

Figure 3: Comparison of national gross income per capita, Gini index and level of poverty of population between Turkey and Mexico (2016 figures)



Source: IISD with information from WB (2018b).

Reforms

Turkey began to reform its electricity sector in the 1980s as part of economy-wide reforms toward a market-oriented regime.[52] The electricity sector was dominated by vertically integrated SOEs. The performance of municipal distribution and retail was poor, resulting in unpaid bills to suppliers. Lack of financial viability in the sector limited investment and budgets for operation and maintenance budgets.[53] The aim of reforms was to:

- Better meet electricity demand through private investment and full cost recovery.
- Introduce competition, improve efficiency, and limit monopoly abuse in the sector.
- Meet the preconditions for Turkey's EU membership.[54]

Progress was slow until the introduction of the Energy Market Law in 2001. The Energy Market Law provided for unbundling of SOEs, third party access to the grid, an unregulated market for larger consumers and an independent regulatory body (the Energy Market Regulatory Authority—EPDK in Turkish). The law stated that: all regulated tariffs must be cost-reflective; the price of energy (excluding regulated end-user tariffs) should be set by competitive market forces; and any assistance to protect vulnerable consumers should be provided through a direct subsidy mechanism rather than tariffs (although this part of the law has not been pursued since).[55]

Consumers were separated into two categories: regulated consumers and "free consumers." Free consumers are able to choose their own retailer and negotiate prices.[56] Initially only the largest consumers were allowed to enter the free retail market, but the threshold declined over time: from 9 million kWh per month in 2002 to 2,000 kWh in 2018.[57] The persistence of low, regulated tariffs has discouraged eligible consumers from switching and they have remained captive consumers of the default retailer (and many that had switched returned).[58] Those who are not free consumers can only purchase electrical energy from the incumbent regional supplier and pay regulated prices.[59]

Cost recovery took some years to implement. From 2002 to 2007, regulated prices remained stable despite large increases in costs.[60] Low prices contributed to large increases in consumption, debts for generators and lack of investment in infrastructure. To address these issues, a move to cost-recovery pricing was made in 2008. Prices were increased 20 per cent in January, 24 per cent in July and 9 per cent in October.

Under the automatic pricing mechanism, EPDK adjusts the retail tariff for regulated consumers quarterly, based on pricing proposals submitted by distribution companies. The method ensures prices take into account input costs, inflation and the exchange rate. EPDK is authorized to challenge and revise the offered price.[61]

[52] IMF (2013) Case studies on energy subsidy reform: Lessons and implications

[53] WB (2015) Turkey's energy transition: Challenges and milestones.

[54] IMF (2013) Case studies on energy subsidy reform: Lessons and implications.

[55] WB (2015) Turkey's energy transition: challenges and milestones.

[56] Note: the Turkish Energy Market Law defines free consumers as those "whose yearly electricity consumption is over the free consumer limit or directly connected to the transmission system or organized industrial zones".

[57] IEA (2016) Energy policies of IEA countries: Turkey 2016 review, Ardiyok and Kıl (2018) Turkey: Recent restructuring of last resort electricity supply in Turkey.

[58] WB (2015) Turkey's energy transition: challenges and milestones.

[59] Ardiyok and Kıl (2018) Turkey: Recent restructuring of last resort electricity supply in Turkey.

[60] IMF (2013) Case studies on energy subsidy reform: Lessons and implications.

[61] IEA (2016c) Energy policies of IEA countries: Turkey 2016 review.

The energy authority determines electricity prices four times a year with different tariffs for domestic, commercial and industrial premises. Table 3 shows the average tariffs for different customers in Turkish lira (TRY), USD and MXN. As a comparison, in 2017 the average residential tariff in Mexico was MXN 1.09/kWh (including DAC)—that is, around a third of the corresponding tariff in Turkey in 2018 (MXN 3.39/kWh).

In addition, the current pricing structure in Turkey is relatively flat, and the same price applies to all consumption per consumer category. Households and agriculture (irrigation) pay similar prices to industry (Table 3). Consumers can choose to pay a single price or a variable price depending on time of day. In this last case, a smart meter is used to record the time of consumption.

Table 3: Retail electricity prices in Turkey in different currencies (TRY, USD and MXN), April 2018

	Average electricity price,[1] TRY/kWh	Average electricity price, USD[2]/kWh	Average electricity price, MXN[3]/kWh
Industry	0.78	0.13	2.39
Business	1.13	0.19	3.45
Residential	1.11	0.19	3.39
Irrigation	0.95	0.16	2.90
Lighting	1.07	0.18	3.28

Notes:

1: Prices based on the "day tariff"

2: 1 TRY = USD 0.17 on October 1, 2018

3: 1 TRY = MXN 3.13 on October 1, 2018

Source: IISD with information from Enerji Enstitüsü (2018) and Akilli Tarifa (n.d.).

A uniform national retail tariff is applied for all 21 retail companies, which eliminates differences between distribution regions. This effectively results in a cross-subsidy for remote regions, which have larger distribution losses and supply costs. Price equalization balances high- and low-cost regions between distribution companies.[62] Despite repeated promises by government to abolish the uniform national retail tariff, it was renewed in 2015 for another five years.

[62] International Energy Agency (2016) Energy policies of IEA countries: Turkey 2016 Review.

Subsidies to Assist Low-Income Households

Turkey has no electricity subsidies for low-income households. Despite electricity price increases of over 50 per cent in 2008, the Turkish government did not offer mitigating measures, although price increases were staggered across three separate reforms over a nine-month period. An economic model, developed and run independently of government, based on household survey data estimated that the impact on consumer surplus for a household in the bottom income quintile was on average about 2.16 per cent of household disposable income. For a household in the top quintile, the impact on consumer surplus was estimated to be 0.75 per cent of income. [63]

Another independent model forecasted lower impacts. Reductions in income and expenditures for the bottom two deciles was estimated to be less than 1 per cent.[64] However, the authors cautioned that missing data for the bottom deciles may have masked a greater impact of the reforms on poverty. Households in some districts were observed to spend over 10 per cent of their disposable income on electricity. In many countries, this is the formal threshold for energy poverty.

Turkey does not offer lifeline rates, block tariffs or geographically targeted electricity subsidies for low-income households. All regulated tariffs are cost-reflective. The possibility of social support in the form of direct cash to consumers (without affecting energy prices) was provided for in the 2001 laws but has never been pursued.[65] The International Monetary Fund (IMF) noted that Turkey relied primarily on its social safety net to address the adverse impacts of electricity subsidy reforms on low-income households.[66] These were not specifically increased in relation to the reforms but rather refer to the general support provided by the existing safety net programs. The World Bank (WB) noted the reliance on strong economic growth to compensate any short-term losses in welfare.[67]

Bill Collection

Before implementing reforms, Turkey's electricity sector experienced high levels of unpaid bills. Privatization of distribution companies led to dramatic improvement in bill collection and, consequently, payments of arrears to private generators. Bill payment by households improved even before privatization began, indicating that awareness about privatization led to a change in behavior. The four distribution companies privatized in 2008 had almost 100 per cent bill collection rates by 2009 and paid their bills in full to suppliers.[71]

Regulators allow distribution companies to collect security deposits, known as a subscription fee. Electricity is not provided unless the fee has been paid.[72] The fees are set by the energy regulator each year. In 2018, fees ranged from USD 22 to USD 33 for households and USD 50 to USD 88 for businesses, depending on the consumption level and installed capacity.[73,74] The tenant must choose the amount of electricity they are likely to consume based on the number of sockets and lights in the dwelling. The fee is refunded at the termination of the contract if all bills have been paid. The supplier can cut off electricity when customers use more than their allotment[75], and non-payment of bills results in disconnection in 50 days.[76]

[63] Zang (2015) Energy price reform and household welfare: The case of Turkey.

[64] Bağdadioğlu, Başaran, Kalaycioğlu, and Pinar (2009) Integrating poverty in utilities governance.

[65] WB (2015) Turkey's energy transition: challenges and milestones.

[66] IMF (2013) Case studies on energy subsidy reform: Lessons and implications.

[67] WB (2015) Turkey's energy transition: challenges and milestones.

[68] WB (2010) Second Programmatic Environmental Sustainability and Energy Sector Development Policy Loan.

[69] Vagliasindi (2013) Implementing energy subsidy reforms: Evidence from developing countries.

[70] WB (2010) Second Programmatic Environmental Sustainability and Energy Sector Development Policy Loan.

[71] Idem.

[72] Emlak Sayfasi (2018) How much is the tenant's subscrition fee in 2018?

[73] Idem.

[74] Note: Based on the exchange rate on August 26, 2018.

[75] Turkey Tribune (2018) House and home in Turkey.

[76] Njiddah, Bello, and Hassan (2015) Tariff regulatory design in the electricity distribution industry: A comparative analysis of Turkey and Nigeria.

Lessons from Reforms and Social Programs

Table 4 summarizes the attributes of the Turkish example that are likely to be both positive and challenging for Mexico.

Table 4: Lessons from Turkish subsidy reforms

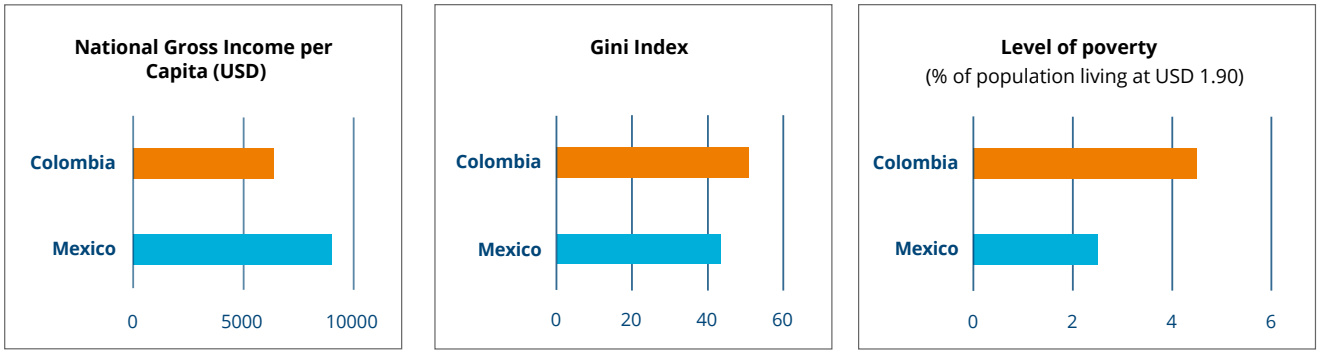
Positive attributes	Challenging attributes
• Simple tariff structure and a uniform national retail tariff is applied for all 21 retail companies, which eliminates differences between distribution regions (although it results in regional cross-subsidies). • Full cost recovery across all tariffs. • Privatization and security deposit arrangements have improved bill collection.	• Sudden "big bang" reforms can be politically challenging. • A lack of any dedicated mitigation measures or compensation for tariff increases could undermine support for reform.

3.2 Social Support Systems for Low-Income Households: The case of Colombia

Reforms introduced since 1994 have largely liberalized the electricity market and improved the sector's efficiency and reliability, although challenges remain in the quality of service delivery. Assistance for low-income households is delivered primarily through reductions in market tariffs based on geographic location, ranging from 15 per cent to 60 per cent. These tariff reductions are funded by cross-subsidies, fiscal transfers and under-recoveries by utilities (which have recently created significant debt).

Colombia and Mexico have similar gross national incomes per capita (USD 6,350 and USD 9,010, respectively, in 2016). Colombia has higher levels of poverty (4.5 per cent at USD 1.90 a day in Colombia compared with 2.5 per cent in Mexico). On the Gini index, in 2016 Colombia has a Gini coefficient of 50.8 compared to Mexico's 43.4.[77]

Figure 4: Comparison of national gross income per capita, Gini index and level of poverty of population between Colombia and Mexico (2016 figures)



Source: IISD with information from WB (2018b).

[77] WB (2018b) Indicators.

In the electricity sector, both countries have a partially deregulated industry, a large population living below the national poverty line that expects subsidies, and challenges in delivering reliable and affordable power to rural populations. The majority (65 per cent) of Colombia's electricity is supplied by hydropower, with thermal power (mainly gas, at 19 per cent of total supply) used in isolated regions and to meet shortfalls.[78] There is only one wind farm but significant potential. [79] The residential sector consumes the most electricity (47 per cent). In contrast, Mexico's residential sector consumes around 20 per cent of electricity, with the industrial sector consuming more than double this percentage.[80]

Reforms

Colombia was prompted to reform its electricity sector in 1994 following a drought that led to a shortage of hydropower, a major blackout and rationing.[81] The aim of the reforms was to create incentives for investment, efficiency and diversification by introducing market forces and deregulation to the sector. The reforms unbundled the government-owned utilities to establish competition and privatization in generation, distribution and commercialization.[82] Transmission was retained as a natural monopoly, but reforms allowed unrestricted access to the grid. A spot market for wholesale electricity was established.

The reform was successful in many of its goals. Real contract prices dropped by 42 per cent between 1994 and 2000. Twenty-one new thermal generation plants were installed between 1993 and 1998, 16 of which were privately owned.[83] Analysis of performance indicators in distribution companies and thermal generators found that efficiency and productivity were improved by the 1994 reforms for most operators.[84] There were also fewer blackouts.[85]

Consumers are separated into regulated and non-regulated users. The regulated sector includes most consumers such as residential, offices, small commercial or industrial users. These consumers are supplied by private distribution and marketing companies but subject to a general pricing structure determined by the Colombian Energy and Gas Regulation Commission (CREG). The price build-up is based on a formula that incorporates the costs of each of the stages (production, transmission, distribution, marketing and administration).[86] Unregulated consumers include large industry and businesses that consume more than 55 MWh per month.[87] These consumers can establish forward contracts with suppliers, which provide the benefit of certainty to both parties.[88]

Subsidies to Assist Low-Income Households

Colombia has several programs to make electricity affordable to low-income households. Subsidies for lower-income households for electricity, natural gas, telephone and water were established in 1994 at the time of energy sector reform. Special funds to improve services to non-connected areas, rural areas and low-income districts were created in later years.

The Social Energy Fund (FOES), created in 2003, provides up to COP 46 (USD 1.5 cents) per kilowatt hour for low-income households[89] in disadvantaged areas.[90] The fund is financed by the electricity trading system administrator (Administrador del Sistema de Intercambios Comerciales [ASIC]), electricity exports and, when these funds are insufficient, the federal budget. The total subsidies granted to companies under the Social Energy Fund in 2017 was COP 123,279 million (around USD 40 million).[91]

The Financial Support Fund for the Electrification of Non-interconnected Areas (FANZI), created in 2000, finances the construction and installation of new electrical infrastructure and replacement or repair

[78] IEA (2018a) Statistics, non-member countries.

[79] Ballesteros (2018) Wind power generation to strengthen Colombia's energy security.

[80] IEA (2017b) Statistic.

[81] OECD (2015) OECD review of the corporate governance of state owned enterprise.

[82] Pombo (2001) Regulatory reform in Colombia's electric utilities.

[83] Pombo and Taborda (2004) Performance and efficiency in Colombia's power utilities: An assessment of the 1994 reform.

[84] Pombo and Taborda (2006) Performance and efficiency in Colombia's power distribution system: Effects of the 1994 reform.

[85] Larsen, Dyner, Isaac, Bedoya , and Franco (2004) Lessons from deregulation in Colombia: successes, failures and the way ahead.

[86] CREG (n.d.) Tariff structure.

[87] ProColombia (2015) Electric power in Colombia: Power generation.

[88] CREG (n.d.) Structure of the sector.

[89] Note: Households in dwelling strata 1 or 2. See information in footnote below.

[90] Note: Defined as follows: Rural Areas of Less Development: (i) regions with an indicator of 54.4 or over in the official index of Unsatisfied Basic Needs and (ii) connected to public electric power. Subnormal Neighborhood: (i) does not have a public electric power utility or has an illegal connection,or (ii) where service has not been suspended or prohibited. Areas of Difficult Management: connected to the National Interconnected System with: (i) overdue loans resulting from 50 per cent or more of the consumers of strata 1 and 2 belonging to the zone, or (ii) unavoidable electricity distribution losses greater than 40 per cent. Source: Ministry of Mines and Energy (n.d.) Special Funds.

[91] Ministry of Mines and Energy (n.d.) Special Funds.

of existing equipment in non-interconnected areas. Areas with a high proportion of low socioeconomic neighborhoods are given priority.

By far the largest of the funds considered here, the FSSRI was created in 1994. The fund, administered by the Ministry of Mines and Energy, provides below-cost electricity and gas services to low-income users. Under the scheme, all residential dwellings are divided into six strata, from poor to rich based on a methodology provided by the National Planning Department.

Residents of the lower strata are eligible for electricity subsidies of 15 to 60 per cent, depending on their dwelling classification. Residents of wealthier dwellings and industry pay a surcharge of up to 20 per cent above the retail price. Utilities identify subsidy recipients based only upon their residential addresses.[92] Consumption up to the subsistence level[93] is charged at the discounted rate, and no subsidies are offered above that level.[94] Electricity for irrigation also has a subsidy of up to 50 per cent of the total cost applicable to the total consumption.

Table 5: Regulated electricity prices, subsidies and surcharges, 2018

Sector		Consumption level[1]	Tariff[2]			Subsidy or surcharge (%)
	Classification		COP/kWh	USD/kWh	MXN/kWh	
Residential	Stratum 1	0 to SC	205.17	0.068	1.29	-60
		>SC	503.33	0.166	3.17	0
	Stratum 2	0 to SC	256.47	0.085	1.62	-50
		> SC	503.33	0.166	3.17	0
	Stratum 3	0 to SC	427.83	0.141	2.70	-15
		> SC	503.33	0.166	3.17	0
	tratum 4	All	503.33	0.166	3.17	0
	Stratum 5	All	604.00	0.199	3.81	+20
	Stratum 6	All	604.00	0.199	3.81	+20
Commercial, factories and some industry[3]		All	605.01	0.199	3.81	+20

Notes:

1. SC is subsistence consumption: 130–184 kWh/month depending on household circumstances, as mentioned in the foot note above.
2. Prices are for Condesa residential customers. Condesa is the largest electricity distributor of customers (3.3 million). It has 22 per cent of the national market including all of Bogotá. Conversion rates to USD and MXN as of April 10, 2018.
3. Prices are for Condesa regulated industry and commercial customers with surcharge contribution, daytime rates.

Source: IISD with information from Condesa (2018).

[92] Li, Wang, and Yi (2018) Cross-subsidies and government transfers: Impacts on electricity service quality in Colombia.

[93] Note: Subsistence consumption is defined by CREG as the minimum amount of electricity used in a month by a typical user, to meet the basic needs that can only be satisfied by this form of final energy. The relevant law states that "The subsidies will not exceed, in any case, the value of the consumptions basic or subsistence". Source Castañeda (2017). It is revised once every few years. As of 2018, subsistence consumption for normal neighbourhoods located at less than 1,000 metres is 173 kWh/month and 130 kWh/month at less than 1,000 m. For "sub-normal" neighbourhoods, subsistence is 184 kWh/month at less than 1,000 m and 138 kWh/month above 1,000 m.

[94] Castañeda (2017) Las Conciliaciones de Subsidios por Menores Tarifas de Fondos Especiales (FSSRI y FOES), Según las Consideraciones Dadas por la Dirección de Energía Eléctrica del Ministerio de Minas y Energía, Por Medio de la Validación de Datos y Producción de Estadística.

In 2016, 88 per cent of households fell into the subsidized groups (65 per cent of which were in strata 1 and 2 with the highest subsidies), while only 5 per cent paid the surcharge.[95] Data on average electricity consumption suggests that most of the electricity use is subsidized for the eligible groups (Table 6), as strata 1 to 4 consume in average less than 130 kWh per month, the lower end of subsistence consumption.

Table 6: Average electricity consumption (kWh) for each dwelling stratum, 2017

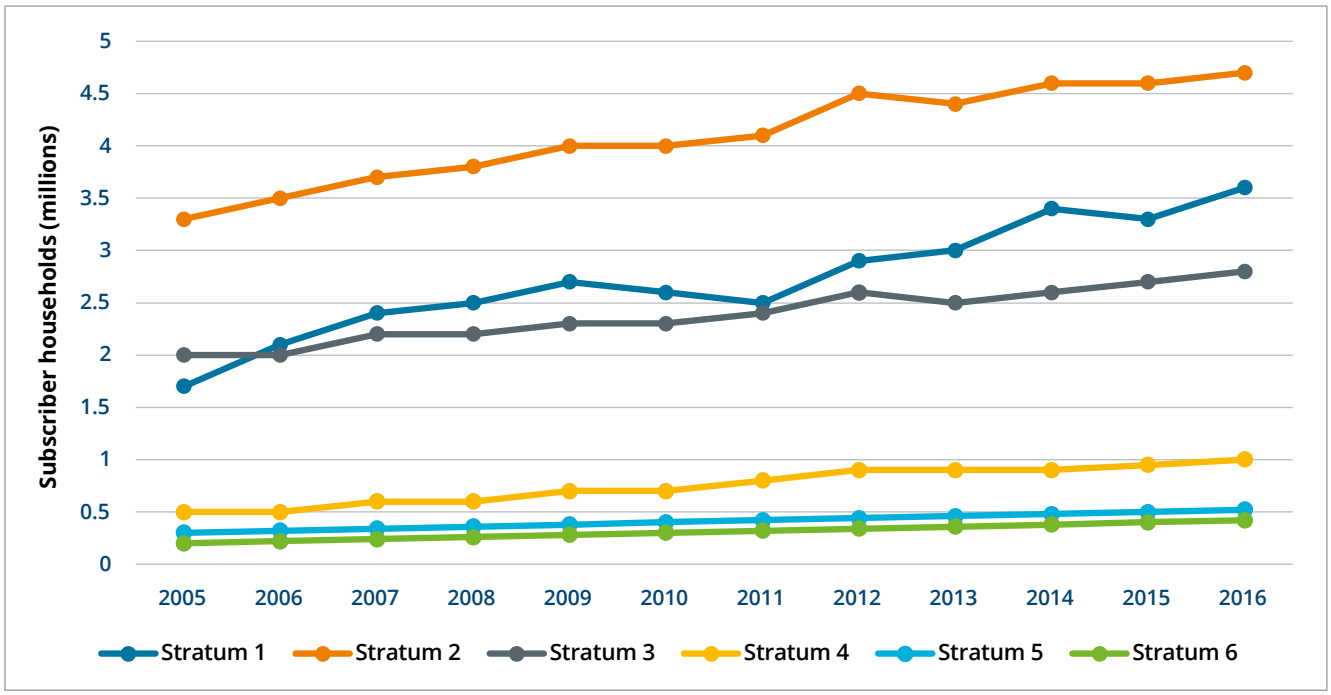
Stratum 1 (kWh)	Stratum 2 (kWh)	Stratum 3 (kWh)	Stratum 4 (kWh)	Stratum 5 (kWh)	Stratum 6 (kWh)
110	120	124	126	183	595

Note: 130 kWh per month is approximately sufficient to run a refrigerator, a television and lighting.[96]

Source: IISD with information from Condesa (2017).

As shown in Figure 5, the number of households in the subsidized strata have grown faster than those in the surcharged strata. This could imply that households are becoming poorer or that households in general (possibly including wealthier households) are finding a way to be classified in the lower strata and consume under the subsistence level.

Figure 5: Subscriber households in electricity subsidy classification strata, 2005–2016

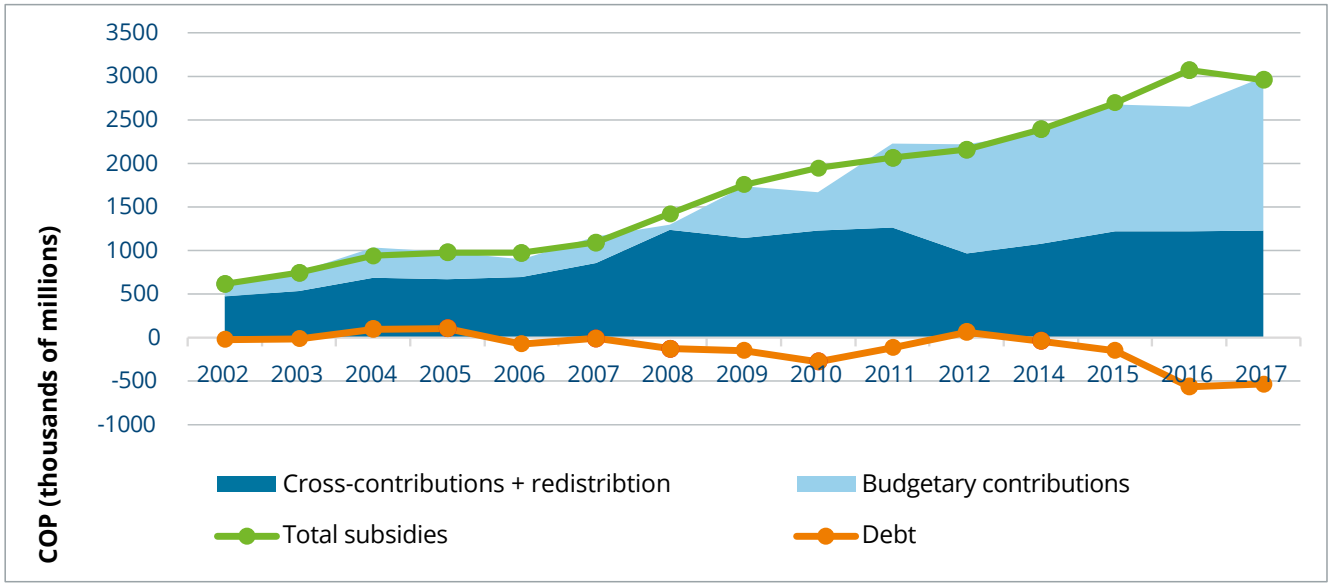


Source: IISD with information from Castañeda (2017).

[95] Unidad de Planeación Minero Energética (2016) Statistical bulletin
[96] EnColombia (n.d.) Household appliances that consume more energy.

The FSSRI administers the cross-subsidies in order to: reduce the administrative burden on utilities; balance subsidies and surcharges between different utilities and regions (i.e., if one utility has a higher proportion of wealthy citizens, it will collect more revenue through surcharges, which need to be redistributed by the fund); and top up the funds as necessary from the national budget. Each utility submits data to the local municipal government on subsidies granted and surcharges levied on a quarterly basis. Municipal governments register the subsidies and surcharges with the Ministry of Mines and Energy. If the cross-subsidies are not balanced, the utility pays or is paid funds from FSSRI quarterly. However, subsidies generally exceed levies, and reimbursements from FSSRI only cover part of the cost (Figure 6). The shortfall is borne as an under-recovery by utilities.[97]

Figure 6: Value of electricity subsidies, cross-subsidy contributions, fiscal contributions and accumulated FSSRI debt, 2002–2012 and 2014–2017



Note: Data unavailable for 2013.

Source: IISD with information from Contraloría General de la República (2018) and Ministry of Mines and Energy (2018).

Over time, the subsidy has become a major burden for the government. The number of subsidized households has increased while cross-subsidy revenue has decreased. A tax reform in 2010 allowed some industrial users to no longer pay the surcharge (other industry, factories and commercial enterprises still pay the surcharge).[98]

The government is considering ways to reform the subsidy, including: eliminating the subsidy for Stratum 3; reducing eligibility for Strata 1 and 2; or reducing the subsistence consumption threshold.[99] Modelling found that eliminating Stratum 3 and reducing the number of eligible households in Strata 1 and 2 by 10 per cent over three years would reduce fiscal transfers to FSSRI by around 30 per cent over that period. Reducing the subsistence consumption threshold over five years would reduce fiscal transfers by 33 per cent. And combined, these reforms could reduce fiscal transfers by 75 per cent.[100]

The system of targeting by residential dwellings also warrants review. Dwellings of the same stratum are generally grouped together, potentially allowing distributors to differentiate in service quality between subsidized and surcharge-paying areas. Perceptions of service quality (based on surveys) vary significantly between subsidized and non-subsidized consumers.[101] This implies that utilities might prioritize service quality to wealthier households and reduce service or maintenance to poorer neighborhoods, causing the utility financial losses.

[97] Li, Wang, and Yi (2018) Cross-subsidies and government transfers: Impacts on electricity service quality in Colombia.
[98] Note: Article 2 of Law 1430 of 2010 states that industrial users who meet certain criteria would not be subject to the collection of the surcharge from 2012. Source: Castañeda (2017).
[99] Castañeda (2017) Las Conciliaciones de Subsidios por Menores Tarifas de Fondos Especiales (FSSRI y FOES), Según las Consideraciones Dadas por la Dirección de Energía Eléctrica del Ministerio de Minas y Energía, Por Medio de la Validación de Datos y Producción de Estadística.
[100] Idem.
[101] Li et al. (2018) Cross-subsidies and government transfers: Impacts on electricity service quality in Colombia. Sustainability.

A targeting system that identifies subsidized households based on their socioeconomic circumstances would not allow utilities to provide a quality differential.[102] If the subsidies are applied through the social security system, the utility is unlikely to be able to identify the recipients. Under the current system where subsidies are offered through the utility, costs should be fully reimbursed by cross-subsidies or government to ensure that utilities do not try to claw back losses by reducing service quality.

Lessons Learned from the Colombian Reforms

Table 7 summarizes the attributes of the Colombian example that are likely to be positive and challenging for Mexico.

Table 7: Lessons from Colombian subsidy reforms

Positive attributes	Challenging attributes
• Limited number of tariff lines (total of five dwelling classification, each divided into subsistence and over-subsistence consumption). • Subsidies offered only up to subsistence level of consumption for eligible households. • Targeting, while not perfect, is directed to low-income users and irrigation, not commercial or industry users. • Subsidies are administered via a fund (FSSRI) and sent directly to all utilities so, in theory, there is no market access discrimination for private electricity suppliers. • Liberalization of the electricity sector led to significant efficiency and quality gains.	• Cross-subsidies have been increasingly unable to finance subsidies, leading to significant top-ups from the federal budget, which represents a cost to all taxpayers. • When transfers from FSSRI are insufficient to cover subsidy costs, the resulting under-recoveries reduce profitability of the distribution companies, which may be driving them to reduce service quality to subsidized neighborhoods. Chronic underfunding may lead to underinvestment in electricity infrastructure, undermining incentives for innovative electricity solutions for isolated regions. • Colombia's system exhibits common trends for long-standing subsidy schemes—over time, the number of consumers claiming subsidies increases and surcharged consumers declines—causing shortfalls in financing.

[102] Li et al. (2018) Cross-subsidies and government transfers: Impacts on electricity service quality in Colombia. Sustainability.

Box 4: Indonesia's reallocation of funds from fuels subsidies to development

In 2014, Indonesia reformed its long-standing subsidies for gasoline and diesel. Subsidies for these fuels were budgeted at USD 16.6 billion in 2013, representing over 10 per cent of government expenditure.[103] Gasoline prices were increased by 31 per cent and diesel by 36 per cent in November 2014. A month later, the government announced the complete removal of gasoline subsidies and the introduction of a "fixed price" subsidy on diesel, where the level of subsidization would remain fixed and prices allowed to fluctuate.

The revised national budget estimated savings of USD 15.6 billion from these reforms.[104] There was no formal reallocation of subsidies but analysis of the budget before and after reform showed an additional: (1) USD 1.6 billion to regional governments and villages; (2) USD 12 billion for ministries, including special programs in health insurance, housing for low-income groups and clean water access; and (3) USD 4.1 billion for SOEs for infrastructure.

The timing for the reforms was driven by several factors: international commitments in 2009 to eliminate inefficient FFSs, election promises by President Joko Widodo and the implementation of new social protection systems.[105] Indonesia's social protection system evolved alongside fuel subsidy reform. Cash transfers were used to accompany 2005 and 2009 fuel price rises. In 2014, a new smart card program was announced for delivery of social protection services including cash transfers.[106] The groundwork had been laid for reforms through years of campaigning and awareness-raising by government and non-government groups about the subsidy problem.

Lessons learned for Mexico:

- An existing social protection scheme is a major asset in subsidy reform.
- Years of preparation and advocacy can change community attitudes.
- Removing subsidies facilitated the reallocation of expenditure from supporting universal short-term consumption to strategic investments that will improve households' longer-term capacity and opportunities.
- There is also an opportunity to "swap" some of the savings into renewable energy investments, which Indonesia has not done yet.[107]

3.3 Targeting Energy Subsidies: The case of India's LPG subsidy reform

LPG subsidies in India were universal for residential use, with other usages having no subsidies. Beginning in 2012, the national government initiated a series of reforms that aimed at restricting consumption of LPG subsidies, seeking the reduction of subsidies to LPG and targeting low-income households. Since then, government expenditure on LPG subsidies has declined by 75 per cent from its peak, with market pricing and targeted benefits through direct payments being the most significant contributors.

LPG Subsidy Reform

Historically, India offered consumption subsidies on LPG sold in 14.2kg cylinders (or canisters). LPG subsidies are administered by the national government and were universal for households. However, with rising crude oil prices and an increasing consumer base, subsidy expenditure skyrocketed to over USD 9 billion in financial year (FY) 2013/14 .[108] This led to a series of reforms, with expenditure in FY 2017/18 at 75 per cent below the peak.

[103] Lontoh, Beaton, and Clarke (2015) Indonesia energy subsidy review: A biannual survey of energy subsidy policies.
[104] Pradiptyo, Susamto, Wiroto, Adisasmita, and Beaton (2016) Financing development with fossil fuel subsidies: The reallocation of Indonesia's gasoline and diesel subsidies in 2015.
[105] Beaton, Lontoh, and Wai-Poi (2017) Indonesia: Pricing reforms, social assistance and the importance of perceptions.
[106] Idem.
[107] Bridle, et al. (2018) Missing the 23 per cent target: Roadblocks to the development of renewable energy in Indonesia.
[108] In India, the government's financial year runs from 1 April to 31 March.

Table 8: India's expenditure on LPG subsidies

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
LPG Subsidies in USD (millions)	6,680	7,640	9,443.1	7,304.7	4,159.1	3,150.3	2,408.7

Note: For 2017/18, exchange rate is 1 USD = 65 INR.

Source: IISD with information from GSI (2014) and GSI (2017).

India imports 80 per cent of its crude oil demand and uses the refineries of the three public sector oil marketing companies (OMCs)[109] to process crude oil and obtain LPG. LPG cylinders are retailed by OMCs through a large national network of public–private distributors. Up to 2014, OMCs retailed LPG through a dual price mechanism, selling both subsidized (to households) and unsubsidized (for commercial and other users) LPG cylinders. Households could access subsidized LPG sold through OMCs if they were enrolled on a registry (or database) of any OMC. This mechanism encouraged illegal diversions of subsidized LPG cylinders into the commercial and open market.[110] Because it was untargeted, the subsidy also accrued to the rich.[111]

Description of Targeting of LPG Subsidies

This section describes measures introduced to restrict consumption of subsidized fuel and increase targeting to low-income households.

Quota Caps

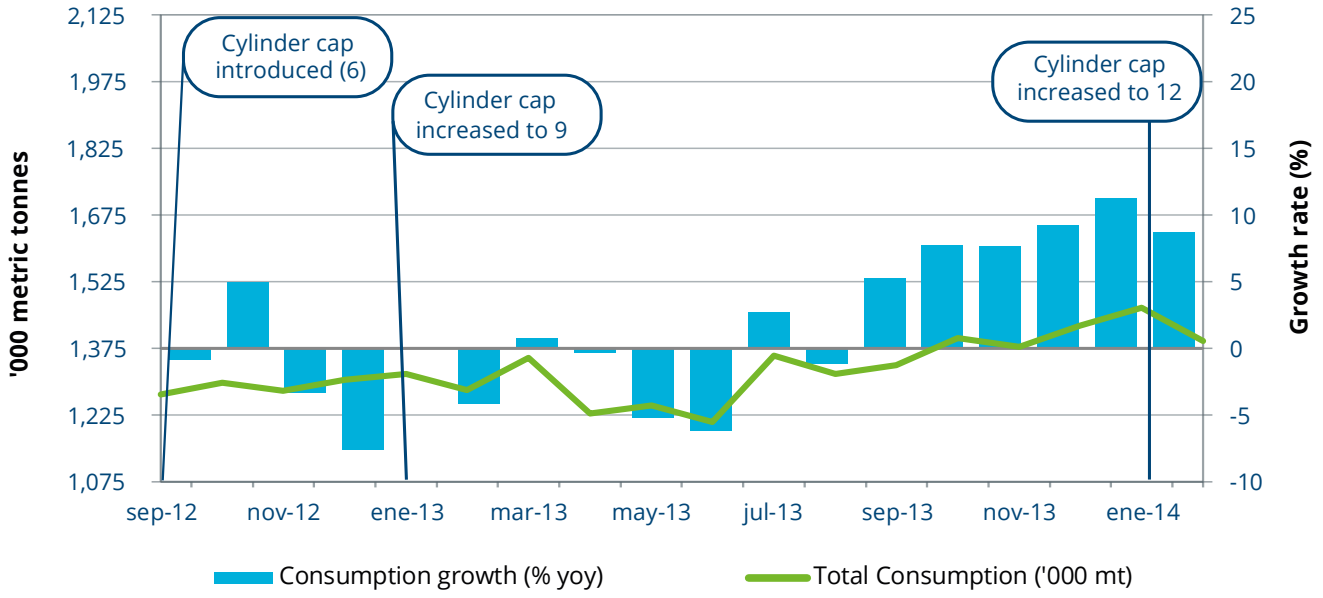
In a bid to contain rising LPG subsidy expenditure (see Table 8), in September 2012 the government announced restrictions on consumption of subsidized LPG. The policy, a quota cap, restricted the annual sale of subsidized LPG cylinders to 6 per household.[112] Following sustained political and public pressure, the government reviewed this announcement in January 2013, increasing the annual cap from 6 to 9 cylinders per household. A year later, in January 2014, the year the national elections were to be held, the government again increased the annual cap from 9 to 12 cylinders per household.[113] Figure 7 below displays the monthly LPG consumption and year on year growth rates from September 2012 to January 2014. It shows that, despite the annual caps that initially had positive effects on reducing the consumption of LPG, higher caps resulted in consumption growth.

Alongside the introduction of quota caps, another reform took place: connection de-duplication. An initiative of the OMCs, not a government policy, this exercise reviewed the database of LPG beneficiaries with the aim of blocking inactive or duplicate connections by verifying their information.

Though the volume of subsidized LPG consumption was restricted, it did not result in subsidy expenditure savings. LPG subsidy expenditure grew between FY 2011/12 and FY 2012/13 (see Table 8), prompting the government to use targeting mechanisms and restrict subsidy access to low-income households.

[109] The three main public sector OMCs are: Indian Oil Corporation Limited (IOCL), Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL).
[110] Mittal, Mukherjee, and Gelb (2017) Fuel subsidy reform in developing countries: Direct Benefit Transfer of LPG Cooking Gas Subsidy in India.
[111] GSI (2014) Subsidies to liquefied petroleum gas in India: An overview of recent reforms.
[112] Economic Times (2012) Government restricts supply of subsidised cooking gas to 6 cylinders per household.
[113] GSI (2014) Subsidies to liquefied petroleum gas in India: An overview of recent reforms.

Figure 7: Monthly consumption of LPG in 1,000 metric tons (mt)



Source: IISD with information from GSI (2014).

Direct Benefits Transfer Mechanism (DBTL)

Subsidy leakages and diversion of supply motivated a major reform in 2014, the introduction of a cash transfer mechanism (also called the Direct Benefits Transfer for LPG or the DBTL). Under this mechanism, OMCs stopped the dual price mechanism, retailing LPG cylinders only at market price. Households paid market price and the subsidy was then credited to their bank accounts through a direct cash transfer, reducing the net price paid per LPG cylinder.

The DBTL marked a change in the subsidy delivery mechanism and did not introduce any targeting. To receive a subsidy, an LPG consumer has to link three consumer identity points: the consumer's Aadhaar (a 12-digit unique identification number) must be linked to the LPG consumer number and the bank account. In 2016, GSI-supported research found that only 65 per cent of households had all three consumer identity points linked, restricting household access to LPG subsidy.[114]

The market price allowed OMCs to recover their costs and reduce net subsidy expenditure of the government. However not all subsidy savings were because of the DBTL's benefits. Administrative challenges in implementation and the initial design defects of the DBTL made several LPG consumers ineligible. This erroneous self-selection by the DBTL reduced LPG subsidy expenditure.[115] In total, the government estimated that the DBTL delivered fiscal savings of INR 127 billion (USD 1.98 billion) in FY 2014/15.[116]

Targeting Low-Income Households: Pradhan Mantri Ujwala Yojana Scheme

LPG subsidies have been subjected to more reforms recently, including the introduction of price reforms where subsidized prices are hiked nominally per month (i.e., where the refund given to eligible customers is progressively reduced). In 2015, the GiveItUp program was launched, a communication campaign inviting rich households to voluntary opt out of LPG subsidy, allowing the poor increased subsidy access. These actions saw some success in reducing the subsidy burden. The more significant reform, Pradhan Mantri Ujwala Yojana (PMUY), has helped in targeting subsidies to low-income households.

In 2016, in a bid to target LPG subsidies exclusively to low-income households, the government introduced PMUY, an LPG subsidy scheme that targeted women from low-income households. For most low-income households, the capital cost of acquiring an LPG connection remained the biggest barrier preventing households from switching from biomass to singular use of LPG.[117] PMUY addressed this affordability concern by assisting low-income households with the capital

[114] IRADe (2016) Providing clean cooking fuel in India: Challenges and solutions.

[115] Dhande (2014) Review of the Direct Benefit Transfer for LPG Scheme.

[116] IISD (2015) Ghost savings: Understanding the fiscal impacts of India's LPG subsidy.

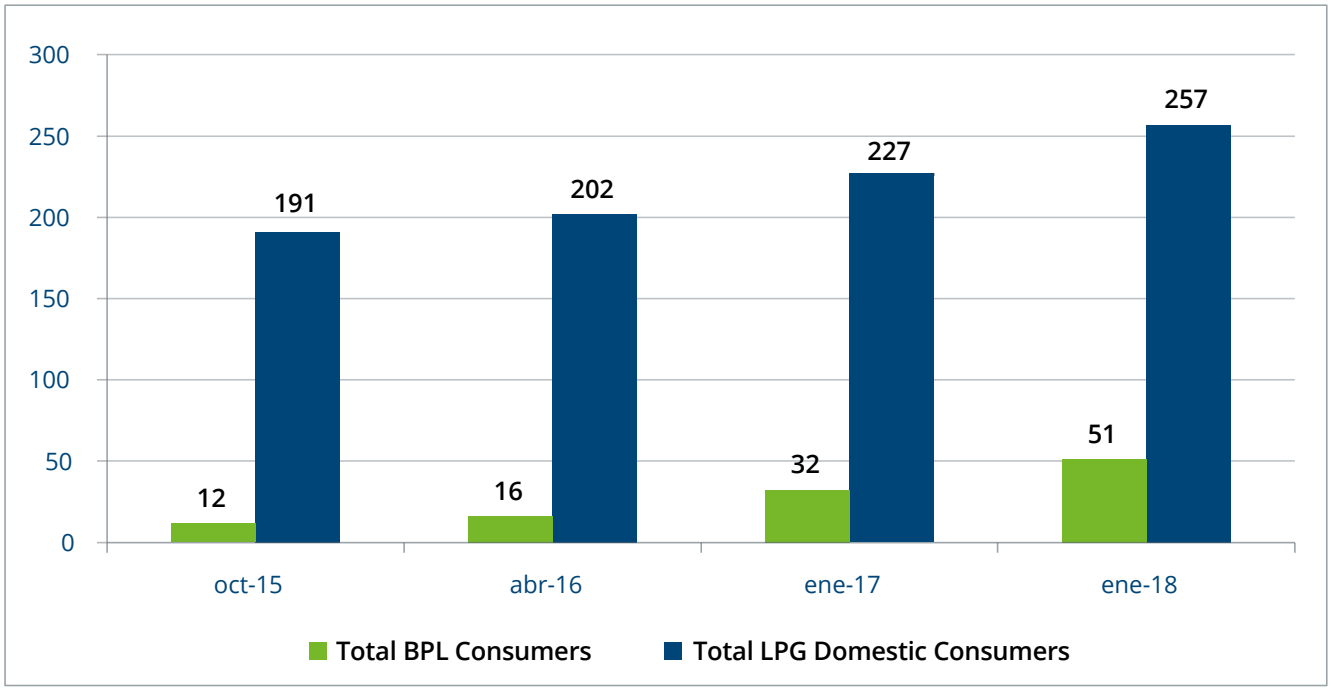
[117] CEEW (2015) Access to clean cooking energy and electricity: Survey of states.

cost of acquiring an LPG connection. Further, since cooking is a gendered responsibility, exposing women who cook using biomass to hardships,[118] PMUY targeted women. To be eligible, women from low-income households need a bank account, a poverty card[119] and a mobile phone. Once enrolled for the scheme with any OMC, the scheme functions similarly to the DBTL, where a subsidy is credited in their bank account against every LPG cylinder purchase.[120] Unlike DBTL, PMUY exclusively targets women from low-income households by identifying them through the poverty card.

Implementing PMUY introduced administrative challenges, as the national government had to resort to a dated poverty census conducted in 2011 to identify low-income households. Slower identification of low-income households delayed the pace of implementation until recently, when the government expanded the database and began identifying poor households based on other categories, like traditionally deprived communities.[121] By revising the targeting filters used in the scheme, the government has managed to complete its target of identifying 50 million poor households.[122] Affordability remains another challenge of the scheme, even though many more poor households are now able to access the LPG subsidy. The high price of each LPG cylinder, even after the subsidy, prevents low-income households from switching to singular use of LPG. As a result, they resort to fuel stacking using supplementary cheaper fuels like biomass, particularly in rural areas.[123]

Despite these challenges, PMUY succeeded in increasing access of households below the poverty line (BPL) to LPG subsidy. In October 2015 prior to the launch of PMUY, only 6 per cent of LPG consumers were BPL households, but by January 2018, the percentage of BPL households increased to 20 per cent. PMUY also affected subsidy expenditures since low-income households consumed far fewer LPG cylinders than the rich (no longer targeted thanks to the GiveItUp campaign) because of a lack of affordability. The reduced subsidy expenditure of FY 2017/18 should be taken into consideration along with low global oil prices and domestic pricing reforms. The latter began in July 2016 and hiked the price of subsidized LPG cylinders by INR 2 per month and later by INR 4 per month.[124]

Figure 8: BPL versus total domestic consumers (in millions)



Source: IISD with information from PPAC (2015, 2016, 2017, 2018).

[118] GSI (2016) Gender and fossil fuel subsidy reform: Current status of research.

[119] Note: Households in India are categorized as poor under the poverty census and given a below the poverty line (BPL) card. This card entitles them to several subsidized goods (like food grains, fuel, housing etc.) and services (scholarships and pensions etc.).

[120] Note: Up to a maximum of twelve 14.2 kg cylinders in a year.

[121] Times of India (2018) Govt looking beyond SECC to expand Ujjwala reach.

[122] PIB (2018) Pradhan Mantri Ujjwala Yojana achieves 5 core mark.

[123] Debroy (2018) The Ujjwala mission is a work in progress.

[124] GSI (2018) India energy subsidy.

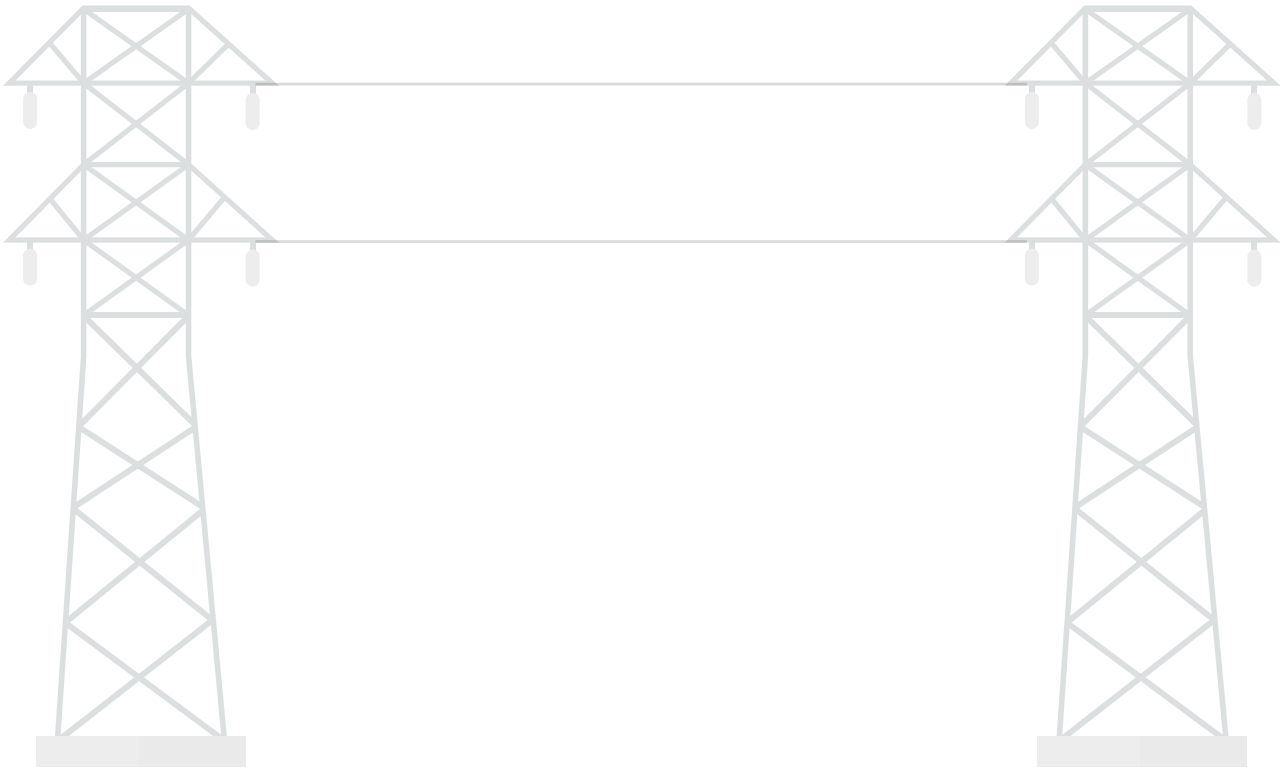
Along with targeting low-income households through PMUY, the government began restricting the access of the rich to LPG subsidies through income-based targeting. From January 2016 onwards, an announcement was made that only those households with annual income less than INR 1 million (approximately USD 15,000) would be eligible to receive LPG subsidies.[125] The new income-based targeting was applied to existing LPG consumers, their spouses and also to all new LPG enrolments.

Lessons from Targeting of LPG Subsidies

Table 9 summarizes the attributes of the Indian reforms which are likely to be positive and challenging for Mexico.

Table 9: Lessons from Indian subsidy reforms

Positive attributes	Challenging attributes
• Subsidy targeting, a key action for subsidy reform, was only possible after India switched to the DBTL, a market price-based subsidy delivery mechanism that allowed for targeting mechanisms to be applicable. • A communication campaign, GiveItUp, emotionally appealed to richer households to give up the LPG subsidy, creating a narrative that access to LPG subsidy should be for low-income households.	• Restricting consumption alone (like the introduction of quota caps) without a narrative of targeting subsidies to low-income households attracted immense political and public pressure. • Better identification of low-income households and restricting rich households through existing reforms remains a work in progress requiring constant adjustments.



[125] MoPNG (2015) Notification on Exclusion of Higher income from the LPG subsidy.

Box 5: Iran's subsidy reforms: Good intentions, unexpected results

In 2010, Iran passed a law that aimed to largely eliminate its subsidies on energy, water and staple foods. Subsidies had reached USD 66 billion in 2009.[126] The plan was to gradually remove subsidies over five years and reallocate 50 per cent of savings to targeted cash transfers and 30 per cent to industry to adopt more energy-efficient technologies.[127] The government prepared carefully for the reform including a long public relations campaign.[128]

Implementation was not according to plan. Price increases were large and sudden. Iran did not have a mechanism to target low-income households and opted for universal payments to households. Payments were made into a dedicated bank account for each household but frozen until the day of the price increases.[129] This won public support for the reforms. The permanent monthly transfers more than compensated for the removal of subsidies: USD 45 per person, representing 15 per cent of the average income of a median income family of four in 2011.[130] Proposed payments to industry were not made.

Cash transfers exceeded subsidy savings by 30 per cent.[131] To meet the shortfall, the government expanded monetary supply. Inflation spiked, exacerbated by undisciplined government spending, tightening of sanctions in 2011 and 2012 and devaluation of the Iranian Rial.[132] The second phase of reforms, postponed from 2012 to 2014, initiated some gradual price increases.[133] Despite multiple attempts to remove subsidies and target transfers, in 2018 most commodity prices remain below international market levels and transfers remain near universal.[134]

The reforms yielded some benefits. The poverty rate declined by five percentage points during the first three months of reform, mostly in rural areas.[135] An indicator of inequality, the Gini coefficient, decreased between 2009/2010 and 2011/2012. These are remarkable in the context of unfavorable economic conditions.

Lessons learned:

- Preparation, communication campaigns and cash transfers yield strong public support.
- Reallocation from subsidies to cash transfers reduced poverty and inequality.
- Reforms will be vulnerable to inflation and exchange rate fluctuations if prices remain fixed rather than floating or market-determined.
- Universal cash transfers can have inflationary effects. They should ideally be introduced when the inflation rate is low and decreasing, and not at the same time as investment and other inflationary government programs.
- Transfers need to be targeted, time-limited and include a mechanism for review if subsidy savings fail to materialize. Budgeting transfers is key.

[126] Gharibnavaza and Waschikb (2015) Food and energy subsidy reforms in Iran: A general equilibrium analysis.

[127] Hassanzadeh (2012) Recent developments in Iran's energy subsidy reforms.

[128] Demirkol, Blotevogel, Zytek, Zimand, and Liu (2014) Selected Issues Paper: Targeted subsidies in Iran.

[129] Guillaume, Zytek, and Rez (2011) Iran: The chronicles of the subsidy reform.

[130] Demirkol et al. (2014) Selected Issues Paper: Targeted subsidies in Iran.

[131] Salehi-Isfahani (2014) Iran's subsidy reform from promise to disappointment.

[132] Demirkol et al. (2014) Selected Issues Paper: Targeted subsidies in Iran.

[133] Nigeria Institute of Social and Economic Research (2016) Compensation subsidy mechanisms for fuel subsidy removal in Nigeria.

[134] Financial Tribune (2018) Iran: Monthly cash subsidies to coninue.

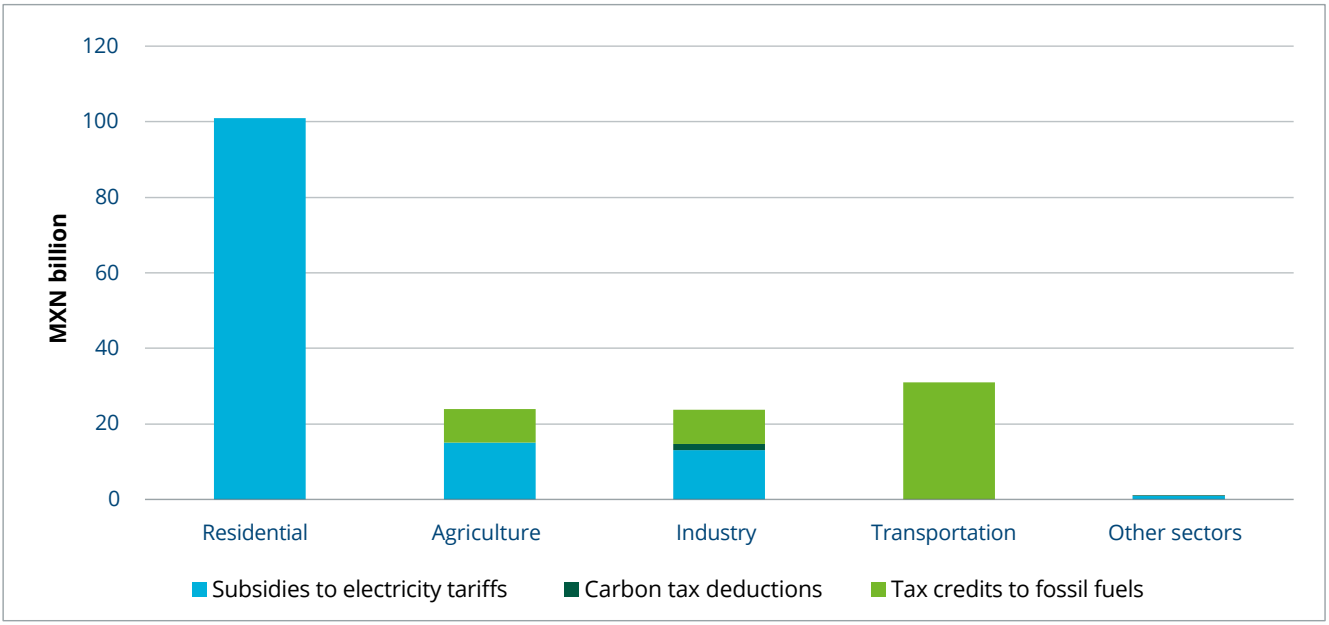
[135] Salehi-Isfahani (2014) Iran's subsidy reform from promise to disappointment.

4. Overview of Mexico's present energy subsidy policies

Mexico has made great progress in eliminating FFSs over the past years (see Section 2). However, some work remains to be done in the energy sector. In this section, we summarize existing subsidies based on estimates of the Secretaría de Hacienda y Crédito Público (SHCP, Mexican Ministry of Finance),[136] the Secretaría de Energía (SENER, Energy Ministry)[137] and the OECD,[138] as well as the G20 peer-review process.[139] The section will then focus on residential and agricultural electricity tariffs.

The Mexican energy sector provides several opportunities for improving fiscal performance while reaching environmental goals and—with smart reform design—furthering social justice. In Table 10, we summarize currently existing fossil fuel and electricity subsidies per sector, also represented in Figure 9. Further details for each measure mentioned as well as the methodology followed can be found in the overview table on remaining subsidies in Annex 1.

Figure 9: Total direct energy subsidies in Mexico in 2016, in MXN billion, per sector and type



Source: IISD with information from SENER (2017), OECD (2018) and SHCP (2018a) .

[136] SHCP (2015) Presupuesto de Gastos Fiscales 2015, SHCP (2016) Presupuesto de Gastos Fiscales 2016, SHCP (2017) Presupuesto de Gastos Fiscales 2017, SHCP (2018a) Presupuesto de Gastos Fiscales 2018.

[137] SENER (2016) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2015. SENER (2017) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2016.

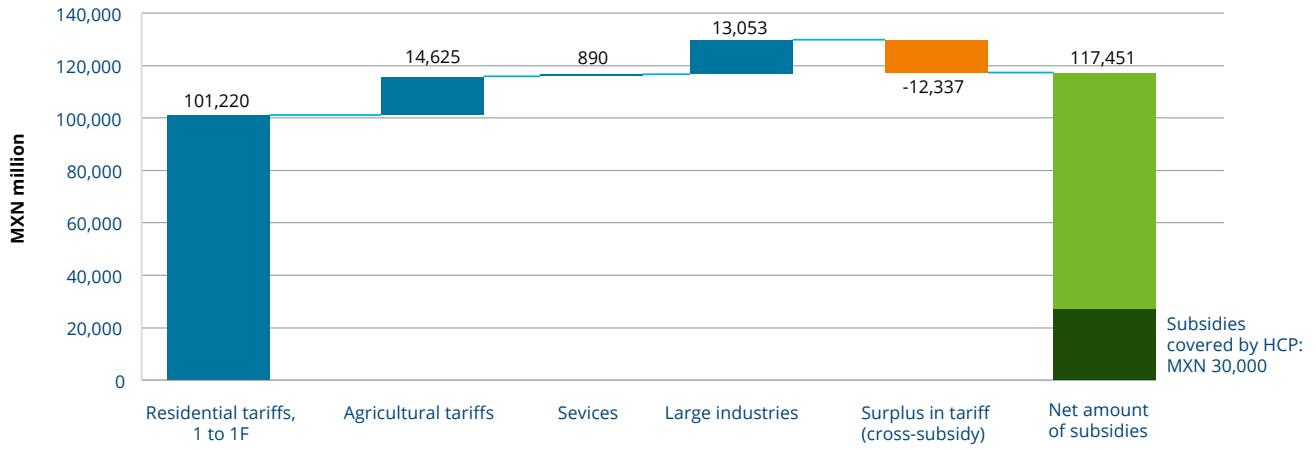
[138] OECD (2018) Fossil fuel support -MEX.

[139] OECD (2017) Mexico's efforts to phase out and rationalise its fossil fuel subsidies.

Subsidies to electricity tariffs were reported at MXN 130 billion (USD 6.8 billion) in 2016 for all electricity consumers.[140] This estimate considers the difference between the cost associated to each tariff class and the price paid by each consumer group. In 2016 households received 78 per cent of this subsidy, followed by the agricultural sector (11.3 per cent), industry (10 per cent) and services (0.7 per cent).

Several tariff types are above cost-recovery levels, creating a surplus that, in 2016, covered 9.5 per cent of the total subsidy. The remaining gap is covered by the public budget and CFE's assets.[141] However, the Ministry of Finance (SHCP) reported only a portion of that gap: MXN 30 billion (USD 1.6 billion) in 2016 in subsidies to electricity, which went up to MXN 67 billion (USD 3.6 billion) in 2017.[142] Figure 10 explains the structure of electricity subsidies in Mexico. As a comparison, the IEA estimated Mexican subsidies to electricity at USD 8.6 billion (MXN 166 billion) in 2016,[143] which is comparable with the subsidy reported by SENER.

Figure 10: Electricity tariff subsidies in Mexico in 2016 in MXN million, including surplus and state transfers



Source: IISD with information from SENER (2017).

Regarding government support to fossil fuels, there are still some subsidies to gasoline, diesel, natural gas and coal, notably in the form of tax rebates and exemptions for fuels used in agriculture, public transport and the industry. The carbon tax also presents a number of exemptions for coal and natural gas. Considering all the previous government support, our analysis estimates MXN 50.5 billion in subsidies to fossil fuels in 2016.[144]

[140] SENER (2017) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2016.

[141] Note: Before the legal framework was established by the Energy Reform, CFE covered the main part of the subsidies with the "aprovechamiento," a fiscal arrangement between CFE and the government that allowed to balance the cost of subsidies through writing down taxes and dividends owed to government. The new framework defines CFE as a "Productive State-Owned Enterprise," (Empresa Productiva del Estado) meaning that it has to pay taxes and report subsidies in a transparent way. This implies transferring part of the subsidy burden from CFE to the Treasury and introducing it as an item in the national budget. The public budget reports additional transfers to CFE and the electricity sector. Deeper analysis would be needed to determine how these relate to CFE's assets. Source: IEA (2017a). Energy policies beyond IEA countries: Mexico 2017 and Cámara de Diputados (2018). El Presupuesto Público Federal para la Función: Combustibles y Energía, 2017-2018.

[142] SHCP (2018b) Modelo Sintético de Información del Desempeño (MSD) Ejercicio Fiscal 2017.

[143] IEA (2018b) Energy subsidies.

[144] Note: The IEA provides only subsidies to oil consumption (estimated USD 706 million [MXN 13.6 billion] in 2016), but it cannot be compared to this report's estimate, due to the scope (we include also measures that affect natural gas and coal) and the methodology (see Annex 1).

Table 10: Summary of existing subsidies by sector in 2016, including both fossil fuel subsidies and electricity subsidies. The total value of direct subsidies by sector and type is represented in Figure 9.

Residential sector	Residential consumers receive direct subsidies in the form of electricity tariffs set up below supply cost. In 2016, 99 per cent of users benefited from a subsidized electricity tariff.[145] In 2016, these subsidies reached MXN 101 billion (USD 5.4 billion), were covered by the federal government and represented 78 per cent of the total subsidies to electricity tariffs.[146]
Agriculture and Fisheries	The agricultural sector received MXN 24 billion (USD 1.3 billion) of energy subsidies in 2016. The Agriculture Energy Law (Ley de Energía para el Campo) (2002) establishes support for electricity and fuel for farmers and fishers to stabilize food prices in the face of rising fuel prices.[147] Fuel tax credits for income tax for agriculture and fisheries in 2016 amounted to MXN 4 billion (USD 214 million), while excise tax exemptions had a value of MXN 5 billion (USD 268 million). The agricultural electricity tariff results in a subsidy for pumping water for irrigation, which amounted to MXN 15 billion (USD 804 million) in 2016.
Industry	The industrial sector benefited from MXN 23 billion in energy subsidies in 2016. These included MXN 13 billion in electricity subsidies, despite that, between 2011 and 2015, the tariffs for industry were set above cost and therefore received no subsidies. The sector also got MXN 11 billion in FFS in the same year in the form of: i) a tax credit for purchased diesel for machinery of MXN 9 billion in 2016 and ii) carbon tax reductions and exemptions for fuels amounting to MXN 1.7 billion in 2016, including for natural gas (MXN 1.4 billion) and coal (MXN 0.2 billion).
Transportation	The sector received MXN 31 billion of FFSs in 2016. A tax credit for diesel used in public transportation and cargo amounted to MXN 19.5 billion and for marine diesel an additional MXN 1.5 billion. In order to avoid economic arbitrage in gasoline consumption in the U.S.–Mexico border region, a tax benefit (reduced excise tax) for gasoline consumption in the northern border has been established by presidential decree. This subsidy reached MXN 10 billion in foregone tax revenues in 2016.[148] A carbon tax exemption for aviation fuel was MXN 2 million in 2016.

Source: IISD with information from sources detailed in Annex 1.3.

4.1 In Focus: Electricity Subsidies to the Residential Sector

Residential electricity subsidies are the largest energy subsidy in Mexico (see Figure 10). There are two main fiscal problems caused by electricity subsidies in Mexico: their regressive effects (they disproportionally benefit those that consume more) and the opportunity cost of these subsidies (subsidies could be directed to other development goals). The following sections will evaluate these two aspects.

Regressive Effects of Subsidies to Residential Tariffs

A regressive subsidy benefits the rich and those who consume more disproportionately compared to the poor. This is the case of residential electricity tariffs in Mexico. A study estimated that the two top deciles benefited almost three times more (in percentage terms) than the lowest decile of residential electricity subsidies (data are based on the National Survey on Household Income and Expenditure [Encuesta Nacional de Ingresos y Gastos en los Hogares, ENIGH], 2010).[149]

In addition to the regressivity linked to income groups, electricity tariffs in Mexico present a strong regional regressivity. Residential electricity tariffs are designed to subsidize more strongly areas that consume more due to higher use of air conditioning because of the warmer climate. Figure 11 shows that the regions that receive more subsidies are warm areas in the north, notably Sonora, Sinaloa and Chihuahua.

[145] SENER (n.d.) Sistema de información energética.

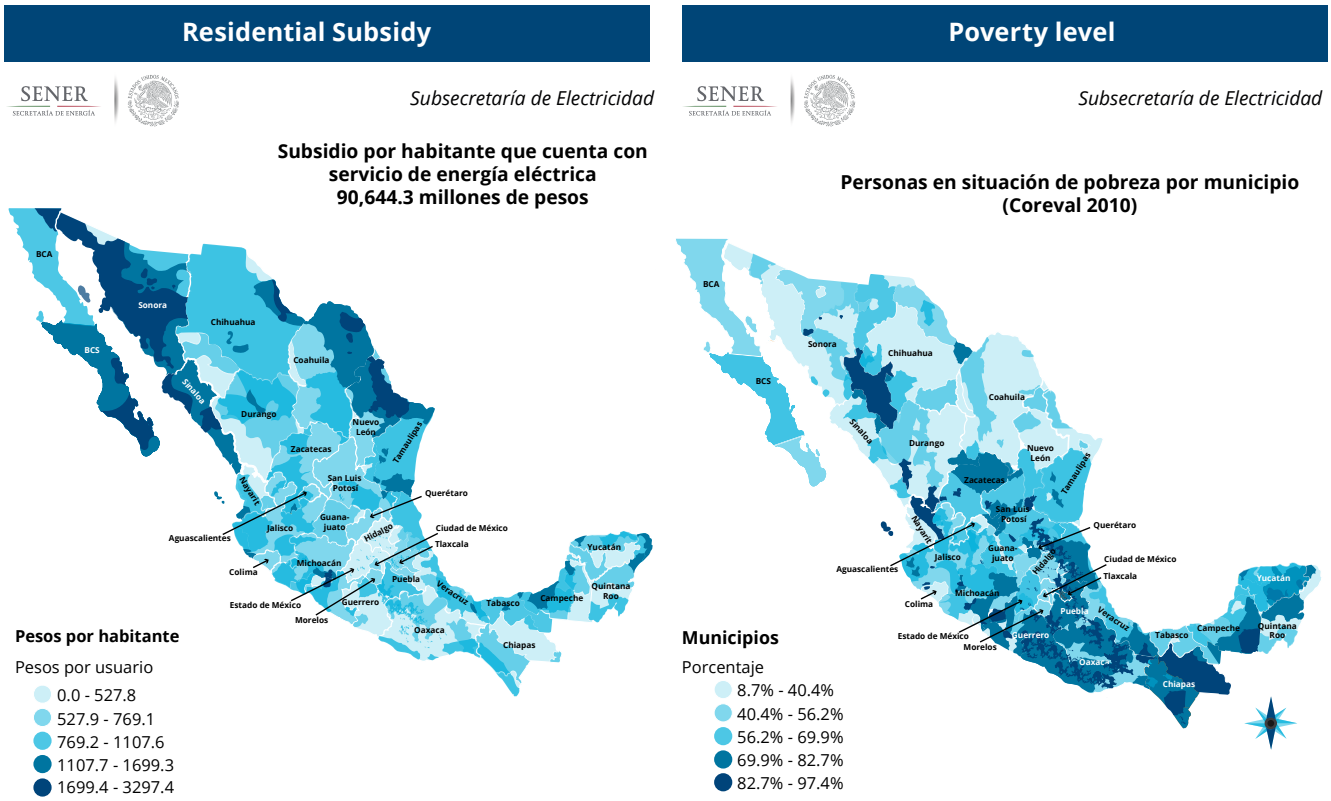
[146] SENER (2017) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2016.

[147] OECD (2017) Mexico's efforts to phase out and rationalize its fossil fuel subsidies.

[148] SHCP (2016) Presupuesto de Gastos Fiscales 2016, SHCP (2017) Presupuesto de Gastos Fiscales 2017, SHCP (2018a) Presupuesto de Gastos Fiscales 2018.

[149] Scott (2013) Subsidios regresivos.

Figure 11: Comparison of subsidies to residential tariffs (average subsidy per inhabitant) and poverty levels (in percentage of the population), per region.



Source: SENER (2015b).

In a country with 43.6 per cent of people living below the national poverty line in 2016 and high inequalities (Gini coefficient in Mexico was 43.4 in 2016),[150] reforming subsidies can unlock important funding to reduce poverty, improve access to education or expand health care coverage. Energy poverty is also a major issue in Mexico among the most vulnerable groups. An estimated 36.7 per cent of households in Mexico are considered to be energy poor (data are based on the ENIGH 2012).[151, 152]

One of the main reasons that these subsidies are regressive is due to the widespread eligibility for subsidized tariffs. Of the total electricity consumed by Mexican households, 96 per cent is sold at a price below the supply cost.[153]

[150] WB (2018b) Indicators.

[151] García-Ochoa and Graizbord (2016) Caracterización espacial de la pobreza energética en México. Un análisis a escala subnacional.

[152] Note: Energy poverty is defined there as lack of access to at least one of the economic goods related to energy use and is directly associated to life quality. The study highlights that there is a range in deprivation of energy, where the greatest deprivation identified was lack of thermal comfort (33 per cent), efficient refrigerator (21.1 per cent) and a gas or electric stove (16.6 per cent). The ones considered of a reduced deprivation level were in lack of water heating (8.7 per cent), entertainment (5.5 per cent) and lighting (2.2 per cent).

[153] SENER (n.d.) Sistema de información energética.

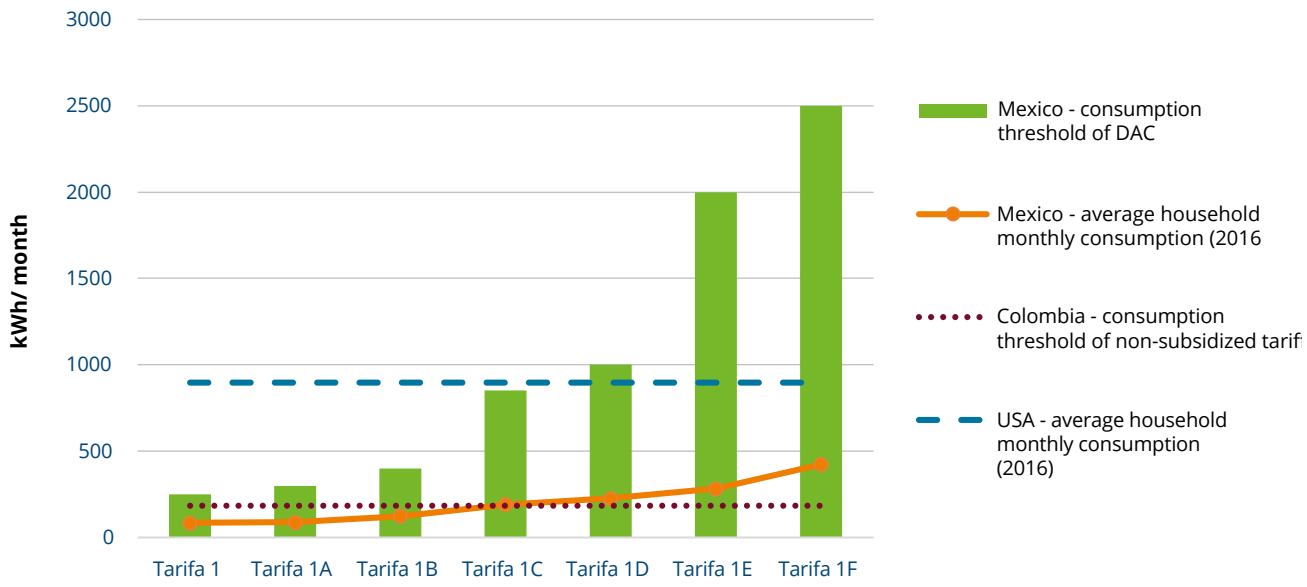
Tariff structure that benefits the rich more than the poor

Residential tariffs in Mexico are very complex. The block tariff system has 40 levels, depending on the level of consumption combined with seasonal and regional factors (see Annex 2)[154]. All residential electricity tariffs are below the cost of supply, except for the high consumption tariff, the DAC. The DAC tariff applies above a certain consumption threshold that varies significantly depending on the region (see Figure 12), and once the threshold is surpassed, the DAC price applies to the whole consumption, disregarding previous blocks. This creates a strong incentive for richer households to undertake measures to maintain consumption under the DAC threshold (such as implementing energy-efficiency measures or installing photovoltaic (PV) panels or multiple meters per household). As a result, DAC applies only to 1 per cent of households in Mexico,[155] a lower percentage than initially intended.[156]

A major issue with the current tariff structure is that the DAC threshold is very high. Figure 12 compares the average residential monthly consumption per tariff type with the threshold of the DAC tariff in Mexico.

The average residential monthly consumption of the United States and Colombia's higher threshold for non-subsidized tariffs (see Section 3.2) are also added as a reference. It shows that DAC limits are well above the Mexican average consumption for each type of tariff, especially in warmer regions (tariffs 1E and 1F). The electricity subsidy reform attempt in Mexico in 2002 estimated that eliminating the subsidy for all residential consumers who consumed more 140 kWh per month would still leave 75 per cent of consumers with a subsidy.[157]

Figure 12: Comparison of DAC tariff limit with the average monthly consumption per household, per tariff



Source: IISD with information from SENER (n.d.), Condesa. (2018), EIA (2018a).

There are also significant differences between the tariff types. Figure 13 compares the blocks of different tariff levels with the DAC, showing that, whereas the tariffs for temperate areas (tariff 1) can jump very quickly into DAC, the price of tariff 1F in the summer for consumptions above 2,500 kWh (the DAC threshold for tariff 1F) is MXN 2.8 per kWh, well below the price of DAC (MXN 4.5 per kWh).[158] The vertical bar represents the average residential monthly consumption of Mexico (135 kWh in 2016), showing again that the average household needs are well below the higher tariff blocks.

[154] CFE (n.d.) Portal web, tarifas.

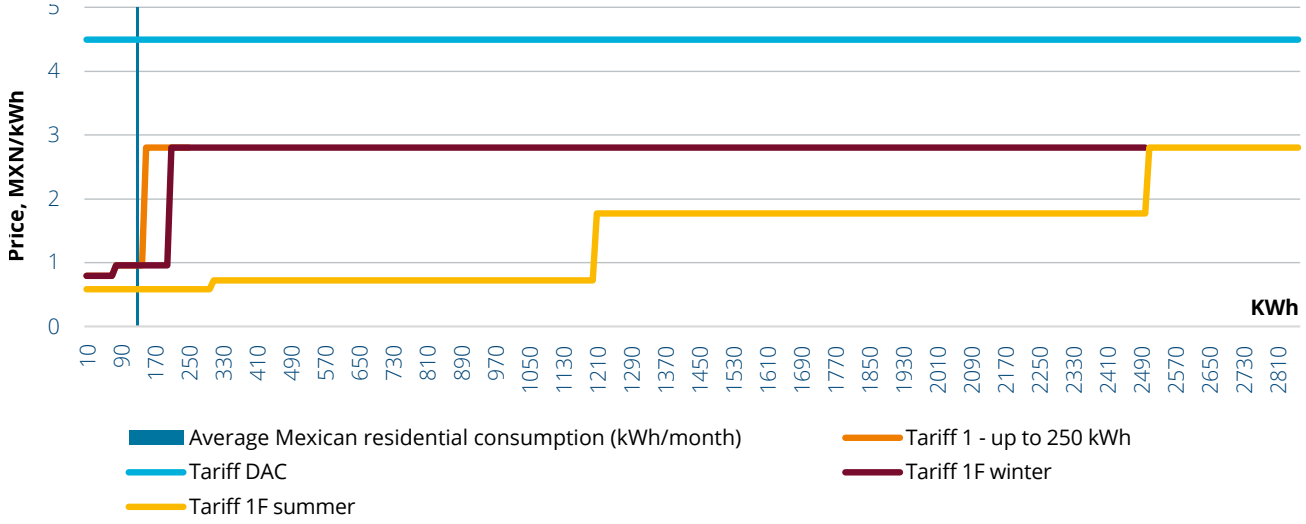
[155] SENER (n.d.) Sistema de información energética.

[156] Rosellón and Damerau (2018) Personal interview.

[157] IEA (2016b) Fossil fuel subsidy reform in Mexico and Indonesia.

[158] Note: DAC applies only if the threshold consumption has been surpassed during more than six consecutive months.

Figure 13: Comparison of residential tariffs 1, 1F winter, 1F summer and DAC in Mexico, 2018 prices



Note: The DAC tariff excludes fixed charges (which depend on the region and the season).

Source: IISD with information DOF (2017).

The DAC tariff was intended to reduce the regressivity of subsidies, but in its current form few households pay the DAC and instead qualify for subsidized electricity.

A lost opportunity to use public budget for other priorities

Electricity subsidies have a very high opportunity costs, and funding for electricity subsidies reduces fiscal space for other social priorities including education and health care. At MXN 130 billion in 2016, residential electricity subsidies in Mexico were 1.6 higher than the budget for the social program Prospera in the same year, including the program's support to social development, education and health for the poor.[159] Reforming subsidies and re-investing in development can bring positive results, as the case study of Indonesia shows (see Chapter 3). Reduced subsidies would also mean that CFE subsidiaries would have additional revenue to reinvest in improving efficiency, which would decrease the subsidies over time.

Electricity subsidies are defined in Mexico as the difference between the cost and price of electricity for each electricity tariff.[160] By offering tariffs below cost, CFE's capacity to recover costs decreases, eroding its capacity to invest. The Energy Reform indirectly attempted to reduce electricity subsidies by improving CFE's efficiency and decreasing generation costs. But there is still a long way to go. CFE's losses (transmission and distribution) have improved over the past few years, but at 13 per cent they are still very high compared to the 6 per cent average in OECD countries, Chile or Euro zone.[161] In 2015, CFE's losses had an estimated value of MXN 42 billion (USD 2.2 billion), that is, around a third of the total subsidy.[162] CFE estimates total investment needs of MXN 2,000 billion (USD 104 billion) in the period 2018-2032, of which MXN 174 billion is for transmission and MXN 138 billion is for distribution—values which compare with the residential electricity subsidies in one year. These investments could be partly financed by the subsidy savings and reflect sustainable cost gains to consumers. The same principle could apply to investments to renewable electricity sources, including distributed solutions.

Further Challenges

CFE has an additional challenge to overcome, which is the cross-subsidization between tariff categories, which represent 9.5 per cent of the tariff gap. Cross-subsidization between tariffs might not be a reliable source of coverage under the Energy Reform. The main tariffs providing this surplus are industrial and commercial categories. Under the new market rules, users whose demand exceeds 1 MW of electricity per year can opt out of the regulated market and be supplied by an alternative company or directly at the market.[163] If the cross-subsidies from these consumers decrease, the funding from the budget would have to increase.

[159] Presidencia de la República (2015) Presupuesto De Egresos de la Federación para el Ejercicio Fiscal 2016.

[160] SENER (2017) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2016.

[161] SENER (2016) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2015.

[162] Idem.

[163] BMWi and SENER (2018) Mexico's New Energy Era.

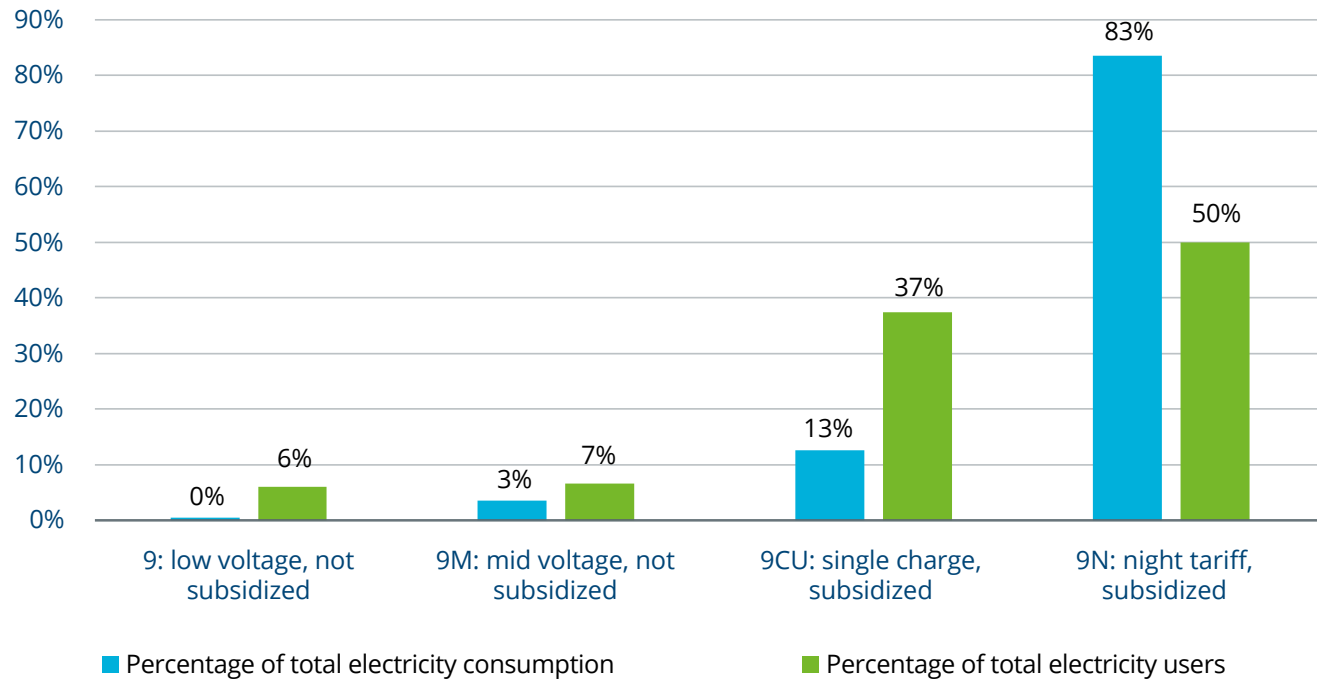
4.2 In Focus: Electricity subsidies to the agricultural sector

Subsidies to the agricultural sector are the second highest, representing around 11 per cent of the total subsidy to electricity tariffs in 2016[164], and are commonly associated to two main issues: high regressivity and the quick depletion of Mexican underground water resources, having significant negative environmental impacts.

Historically, CFE applied a low tariff to the agriculture sector to support Mexico's competitiveness against external markets, under the Acuerdo Nacional para el Campo (the National Farmers Agreement).[165] Specifically, electricity subsidies in the agriculture sector are applied on the use of water pumps and irrigation of crop lands. This subsidy is incorporated under tariffs 9CU and 9N (both applicable to low and mid voltage) (see Annex 2). All farmers that utilize electricity for water pumps and irrigation have access to this subsidy. The main requirements include to provide water and energy bills that prove consumption of water and electricity as well as proof of ownership of farming land irrigation and water pump systems. Requests to obtain the electricity subsidy are reviewed and approved by Ministry of Agriculture (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación [SAGARPA]). Once approved, farmers are shifted to subsidized tariffs.[166]

Figure 14 represents the share of consumption and users per agricultural tariff in 2016. It shows that, in 2016, 96 per cent of the electricity consumption by the agriculture sector and 87 per cent of agricultural users were subsidized.[167] SAGARPA is the entity that defines the electricity consumption quotas and SENER to apply the tariffs.[168] It is estimated that between 2009 and 2014, 53 per cent of the total agricultural consumption paid a tariff of MXN 0.59 per kWh, while the generation cost was MXN 4.00 per kWh.[169]

Figure 14: Percentage of total electricity consumption and of number of users in the agricultural sector in 2016 per tariff (subsidized and non-subsidized)



Source: IISD with information from SENER (n.d.).

[164] SENER (2017) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2016.

[165] Funes (2014) Tarifas eléctricas y agua: sobreexplotación.

[166] SAGARPA (2018) Programa especial de energía para el campo en materia de energía eléctrica de uso agrícola.

[167] SENER (n.d.) Sistema de información energética.

[168] SENER (2016) Informe pormenorizado sobre el desempeño y las tendencias de la industria eléctrica nacional 2015.

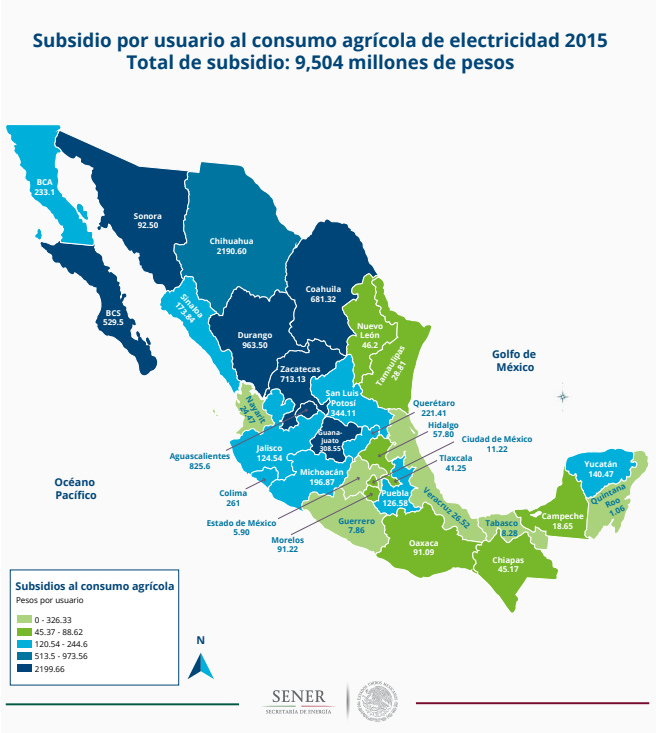
[169] Vargas, Acuna, Gomez, and Valenzuela (n.d.) Desacoplamiento del Subsidio Agricola para el Incremento de la Eficiencia Holistica del Riego.

Many studies have highlighted the high regressivity of agricultural subsidies.[170] Large commercial farmers with resources and high-tech irrigation systems are the ones that benefit most from it, and those in the highest income decile receive over 50 per cent of the subsidy.[171] On the other hand, family agriculture with links to market receive around 20 per cent of the subsidy, as they use less electricity and water intensive practices, such as drip irrigation or water channels, for their agricultural activities.[172] Lastly, the small-scale subsistence farmers do not have access to water pumps and therefore are not recipients of the subsidy.

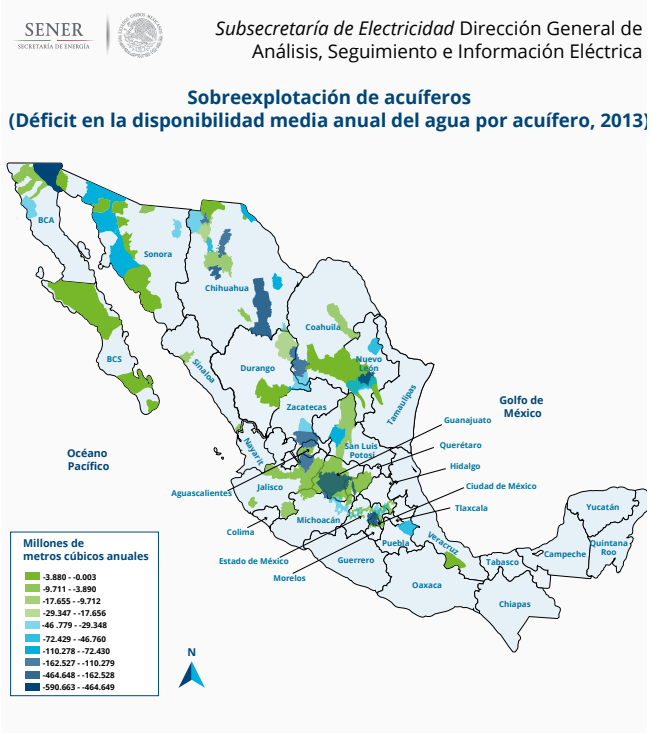
In addition, these subsidies lead to serious environmental consequences, notably the misuse of water and over-exploitation of ground water. In Mexico, there are over 98,000 wells that are designated for the use of agricultural activities, and within these, 70 per cent of them are attached to energy intensive water pumps.[173] As one of the major consumers of water, the agriculture sector has significantly contributed to the over-exploitation of aquifers. By 2014, 106 out of the 653 aquifers in the country were considered over-exploited,[174] and there is a significant correlation between the degree of exploitation of aquifers and the subsidy to electricity for agricultural irrigation. Agricultural irrigation is not the only cause of aquifer over-exploitation. However, as Figure 15 shows, most regions where aquifers are over-exploited correspond to regions where electricity subsidies for agricultural irrigation are highest (the north and the center of Mexico). In addition, it is estimated that the water pumps emit the equivalent to 5 million tons of carbon dioxide annually.[175] This electricity subsidy creates a disincentive to use more efficient systems that can reduce energy and water use.

Figure 15: Comparison of subsidies to tariffs for agricultural irrigation (average subsidy per user) and over-exploitation of aquifers (in terms of deficit of water availability, year average), per region

Electricity to agriculture for irrigation



Over-exploitation of aquifers



Source: SENER (2016).

[170] Avila, Munoz, Jaramillo, and Martinez (2005) Un análisis del subsidio a la tarifa 09, Scott (n.d.) Subsidios Agrícolas en Mexico, Vargas, Acuna, Gomez, and Valenzuela (n.d.), Centro Mario Molina (2016) Análisis de costos, beneficios y factibilidad de una estrategia de bajo carbono para el sector eléctrico hacia el mediano plazo.

[171] Centro Mario Molina (2016) Análisis de costos, beneficios y factibilidad de una estrategia de bajo carbono para el sector eléctrico hacia el mediano plazo.

[172] Idem.

[173] SAGARPA (2016) Eficiencia Energética en el Sector Agropecuario.

[174] Comisión Nacional del Agua (2014) Estadísticas del agua en México.

[175] Centro Mario Molina (n.d.) Reforma y desacoplamiento de subsidios electronicos que causan la sobreexplotacion de acuiferos.

5. Review and assessment of reform options

Many institutes in Mexico, including academia, think tanks and governmental organizations, have studied electricity subsidy reforms and proposed reform options, particularly for the residential sector. This section reviews four of such options to reform subsidies to residential electricity and assesses them according to a qualitative framework that considers several social, economic and environmental criteria.[176] Two reform options for the agricultural sector are also presented.

5.1 Household tariff reforms

Table 11 summarizes the reform options for the residential sector analyzed in this report. They have been grouped in two main categories:

- "Subsidy targeting," which implies that subsidies can still be provided through the tariff structure but in a more efficient manner.
- "Mitigation mechanisms and alternative social protection programs" includes short-term policies, such as assistance measures for vulnerable groups or compensation for powerful groups, which can help manage the social and political shock of price increases. It also includes long-term policies, such as social protection programs, which can be more effective and more efficient than energy subsidies at tackling poverty over the long term.

A third possible category would imply a simple reform of subsidies through, for example, tariff restructuring or direct tariff increases. No measure of this category has been analyzed in this report, which focuses on measures that imply some type of compensation mechanism. However, the IEA[177] has analyzed some related reform options (see Box 6).

Table 11: Summary of reform options for the residential sector proposed by Mexican experts

Reform Option	Definition
Subsidy Targeting	
Reduction of the DAC threshold	Decrease the consumption threshold of the DAC tariff for each tariff category (1 to 1F) to include a total of 20 per cent of the population under this tariff, reducing the total number of subsidized electricity users. By doing this, vulnerable households with lower consumption levels would still benefit from the electricity subsidy.
Mitigation Mechanisms and Alternative Social Protection Programs	
Subsidy reform and reinvestment in renewable energy at the household level	Transform residential electricity subsidies into financial support for rooftop solar PV installations, reducing subsidies, decreasing electricity bills and engaging electricity consumers by transforming them in renewable energy producers.
Subsidy reform and reinvestment in energy-efficiency measures at the household level	Transform residential electricity subsidies into financial support for energy-efficiency measures at households. The measures can range from the substitution of old household appliances by new and more energy-efficient ones, to the application of high insulation standards in the construction of new dwellings.
Subsidy reform and reinvestment in an expanded health care system	Remove all subsidies to electricity and dedicate the fiscal savings to financing a system of universal health care coverage. The example illustrates how fiscal savings from subsidy reform could be spent and estimates the mid- and long-term welfare impacts of such a reform.

The following sections will explain and analyze the previous options in detail.

[176] Note: Electricity subsidy reform can have impacts in many areas, including on household welfare and the economy, considering complex economic interrelationships. The evaluation has been done according to a qualitative framework that considers the following criteria: fiscal impacts, inflation impacts, macroeconomic impacts, distributional impacts by consumer group, distributional impacts by region, influence on market barriers for electricity suppliers, administrative simplicity, political acceptability, sustainability. The options have been tested on these criteria in a qualitative way, with information obtained through interviews with experts in the area and existing related literature. A detailed description of the framework and related criteria is presented in Annex 3.

[177] IEA (2016a) Fossil fuel subsidy reform in Mexico and Indonesia.

Box 6: IEA's analysis on the reform of residential electricity subsidies in Mexico

In 2016, the IEA[178] published a report on the reform of electricity subsidies in Mexico. The report assessed several reform options by modifying residential tariffs and their structures, and qualitatively evaluated the impacts on overall subsidy expenditure, the mean tariff and the population (low-, middle- and upper-income deciles). The following subsidy reform options were evaluated:

- Instant liberalization of electricity prices, that is, the total sudden elimination of subsidies.
- The introduction of a two-part tariff for the residential sector, made up of a variable and fixed charge, following the model of the industrial tariffs, with the fixed charge being set at either MXN 52 or MXN 20.
- Reduction of summer months (where cheaper summer tariffs exist) from six to four months.
- Simplification of the tariff schedule into three or four tariff groups by merging several tariffs (for example: tariffs 1A and 1B, tariffs 1C to 1F, etc.).
- Extending the coverage of the high DAC tariff to include the top 20 per cent or 50 per cent of consumers in each tariff category.
- Application of volume differentiated tariffs (VDTs) instead of the current block tariff, whereby consumers are charged one rate for the full volume of electricity they consume, and that rate is determined by their total volume of consumption.

Figure 16 summarizes the impacts of each option according to the IEA evaluation. Measures such as the change of summer months and the simplification of tariff groups would have insignificant impact on tariffs and on the population.

Figure 16: Summary of IEA's subsidy reform simulation results

	Impact				
Tariff reform option	**Aggregate Subsidy**	**Mean tariff**	**Tariffs for low deciles**	**Tariffs for middle deciles**	**Tariffs for upper deciles**
Instant liberalisation	↓↓↓↓	↑↑↑↑	+ / -	↑↑↑↑	↑↑↑
Two-part tariff for all (MXN 52)	↓↓	↑↑	+ / -	↑↑	↑
Two-part tariff for all (MXN 20)	↓	↑	+ / -	↑	↑
Two-part tariff – large consumers	↓	+ / -	+ / -	↑	↑
Summer month changes	↓	+ / -	+ / -	+ / -	↑
Simplified tariff groups	↓	+ / -	+ / -	+ / -	+ / -
VDT	↓↓↓↓	↑↑↑	↑↑↑	↑↑↑	↑↑↑
VDT with low consumption gratis	↓↓↓↓	↑↑	↓↓	↑↑↑	↑↑↑
DAC to top 20%	↓↓↓	↑	+ / -	+ / -	↑↑↑
DAC to top 50%	↓↓↓↓	↑↑	+ / -	↑↑↑	↑↑↑
Legend					
↑ to ↑↑↑↑	Slight increase (1) to very high increase (4)				
↓ to ↓↓↓↓	Slight reduction (1) to very high reduction (4)				
+ / -	Insignificant impact				

Source: IEA (2016a).

[178] IEA (2016a) Fossil fuel subsidy reform in Mexico and Indonesia.

Reduction of the DAC Threshold

This option proposes to reduce the consumption level that determines the application of the DAC tariff that is currently charged to high household consumers. This would increase the number of consumers that are billed according to that non-subsidized tariff. Today, the DAC tariff applies only to 1 per cent of total residential electricity users in Mexico,[179] whereas it was initially designed to cover 5 per cent of users.[180] DAC tariff is set at a cost higher than the supply cost, and the surplus is used to cross-subsidize other tariff categories.

This reform option would propose to lower the DAC consumption threshold (kWh) for each tariff category (1 to 1F) to include a higher share of the population—for example, the top 20 per cent consumers under each tariff category—thereby reducing the total number of subsidized electricity users.[181] An analysis by Centro Mario Molina[182] on charging the highest 20 per cent of consumers with the DAC tariff estimated that this would result in a 103 per cent increase in the electricity tariff 1 (from MXN 1.60 to MXN 3.24 per kWh) and reduce 14 per cent of the subsidies under this tariff . The biggest reduction would be for consumers under 1F with a 25 per cent reduction in subsidies in this category (1F is currently the most subsidized residential tariff category). The IEA[183] also evaluated the impacts of expanding the DAC to the top 20 per cent of consumers in each category (1 to 1F) (see Box 6). A related analysis suggested that this reform would result in a significant reduction of the total subsidy and an insignificant impact on the tariffs for low- and middle-income deciles of population.[184,185]

Several counter-arguments can be made to this proposal. The DAC tariff considers only consumption levels (different per region) and it does not include income criteria, so it is possible that poorer households with many members in temperate areas could fall under an expanded DAC tariff. In interviews, some Mexican experts raised the following concerns: i) the complexity of the tariff in terms of thresholds and application conditions[186]; ii) the application of DAC is based on consumption rather than on vulnerability assessment; and iii) richer households have more capacity to implement measures to reduce consumption while poorer households would probably not be able to invest in such measures.[187]

Table 12, below, summarizes an assessment of this option, based on interviews with Mexican energy experts. Although this measure has several fiscal advantages, the assessment suggests that it could create discontent among certain segments of the population. Implementation would require a detailed analysis of the affected population groups and their income levels, as well as an exploration of mechanisms that could identify vulnerable groups who are inadvertently affected by this measure. An optimal way for implementation would be to add criteria on household income to the definition of eligibility for the DAC tariff.

[179] SENER (n.d.) Sistema de Información Energética.

[180] Rosellón and Damerau (2018) Personal interview.

[181] del Valle Medina (2018) Personal interview.

[182] Centro Mario Molina (2016) Análisis de costos, beneficios y factibilidad de una estrategia de bajo carbono para el sector eléctrico hacia el mediano plazo.

[183] IEA (2016a) Fossil fuel subsidy reform in Mexico and Indonesia.

[184] Note: According to the study, the expansion of DAC would affect mostly deciles 8 to 10, which would see their tariff double. The study does not identify impacts for lower deciles (deciles 1 to 6 remain unchanged).

[185] Commander and Poupakis (2016) Electricity Tariffs in Mexico: Some options for reform.

[186] Note: Experts indicated that most users are not familiarized with DAC's consumption thresholds. Furthermore, its implementation can be confusing as it follows a "moving-average" approach, thus, creating additional uncertainty around billing: users that pay the DAC in one month may not qualify a few months later, or vice versa.

[187] del Valle Medina (2018) Personal interview and Rosellón and Damerau (2018) Personal interview.

Table 12: Summary of assessment of the reduction of the DAC threshold

Criteria	Experts' review:	
Fiscal impacts	In general, positive. The implementation of this measure would significantly reduce the subsidy in the short term. This reduction could decrease in the mid-term if households undertake measures to reduce their electricity consumption, but the results would still be positive. The definition of the DAC limit would strongly impact this criterion.	↑
Inflation impacts	Negative (higher inflation) or no impacts. The increases would only affect higher population deciles, although there is a risk that lower deciles also fall under this category, affecting the shares of household expenditures.	–
Macroeconomic impacts	No significant impacts identified.	–
Distributional impacts by income group	It is expected to affect negatively higher-income groups, although lower deciles could also be affected, given that DAC is defined only according to consumption. Higher deciles could eventually undertake measures to reduce their consumption to a subsidized level, which could result in households from middle and low deciles paying DAC rates.	– ↓
Distributional impacts by region	No major impact. DAC threshold is defined differently for each region according to temperature.	–
Influence on market barriers for electricity suppliers	Positive. DAC is the only residential profitable tariff. Increasing the number of users under the tariff could encourage new market entrants.	↑
Administrative simplicity	Positive. Very straightforward to implement, once the tariff is approved.	↑
Political acceptability	Negative. The important tariff increase would be expected to cause discontent among the population, notably among the groups identified as most affected by the potential measure, and other lower-income groups that would feel they could fall under the expensive DAC.	–
Sustainability	Positive. A higher tariff would act as a price signal for energy efficiency and other measures to reduce electricity consumption.	↑

Legend

Score	Description
↑↑	Very positive effect
↑	Positive effect

Score	Description
–	Neutral or no effect

Score	Description
↓	Negative effect
↓↓	Very negative effect

Subsidy Reform and Reinvestment in Renewable Energy

This option proposes to transform residential electricity subsidies into a financial support for rooftop solar PV installations. This would result in an overall reduction of subsidies (the beneficiary households would not receive the tariff subsidy and the costs of installation would be paid back after a few years), lower electricity bills and higher engagement from electricity consumers, who would become renewable energy producers.

Renewable energy technologies have proved to be very price competitive in Mexico, at least in large-scale auctions. Small-scale renewable energy installations are more expensive than utility-scale plants, but the potential in Mexico is significant and it is part of the new government's plans.[188] In addition, renewable energy supports Mexico's international target to unconditionally reduce its greenhouse gas emissions by 22 percent by 2030 versus the business-as-usual scenario[189] and the national clean energy target established by the General Climate Change Law of 35 per cent by 2024.[190, 191]

Iniciativa Climática de Mexico[192] has proposed an implementation strategy for this option, including a financing scheme that implies the payment of the solar PV rooftop installation by the consumer via the basic service supplier[193] in the form of regular fixed payments. The measure proposes to initially install over 1.4 million solar rooftops to subsidized residential consumers across all regions, which it estimates would reduce subsidies by MXN 10,587 million (USD 557 million) in the first 15 years, targeting mostly low- and middle-income households. The measure can be scaled up further if the adequate funding and PV market mechanisms are defined.

A simulation by Hancevic, Núñez, and Rosellón concludes that under a subsidized tariff, Mexican households could save an average of USD 48 (MXN 910) per year on electricity expenditures if distributed PV panels were installed, which would be paid back in 16 years.[194] The payback time would be reduced to 12 years if the electricity subsidy was removed. Further public support would improve the attractiveness to invest in distributed solar PV.

Table 13 summarizes the assessment of this option. Overall, interviews with Mexican experts showed broad support for this policy option. Most experts commented that the measure could incentivize households to consume less and invest in energy-efficiency options.[195] An expert further recommended small pilots in all climatic zones to identify and address any administrative or technological challenges before widening coverage.[196]

[188] Morena (2017) Proyecto de nación 2018-2024. It includes a program to install 1 million small renewable energy plants for the residential and services sectors.

[189] Gobierno de la República (2015) Estrategia Nacional de Transición Energética y Aprovechamiento Sustentable de la Energía.

[190] In addition to that target, the Energy Transition Law introduced shorter term targets of 25 per cent by 2018 and 30 per cent by 2021 and the Electricity Industrial Law added long-term clean energy targets of 40 per cent by 2035 and 50 per cent by 2050.

[191] Gobierno de la República (2012) Ley General de Cambio Climático and Gobierno de la República (2016) Removing barriers: Boosting clean energy.

[192] Iniciativa Climática de México (2017) Análisis de Costo Beneficio del Programa Bono Solar Fase 1.

[193] Note: The LIE established "basic service suppliers" as the new entities (companies) responsible for supplying electricity to end users that do not participate in the open market ("basic users") BMWi and SENER (2018).

[194] Hancevic, Núñez, and Rosellón (n.d.) The Impacts of Massive Adoption of Distributed Photovoltaic System in Mexican Households. Note: The model used in the study is the January 17, 2017 version of the System Advisor Model (SAM) provided by the National Renewable Energy Laboratory (NREL). Using this model, the authors simulated the performance of residential PV systems across the various regions and tariff categories under Mexico's residential electricity sector.

[195] del Valle Medina (2018) Personal interview, Muñoz (2018) Personal interview, Chacon (2018) Personal interview, Belausteguigoitia (2018) Personal interview and Rosellón and Damerau (2018) Personal interview.

[196] Muñoz (2018) Personal interview.

Table 13: Summary of assessment of the subsidy reform and reinvestment in renewable energy

Criteria	Experts' review:	
Fiscal impacts	Positive. The measure would result in a reduction of subsidies to electricity tariffs, as less subsidized electricity from the grid would be consumed. The overall impact on the budget would depend on the price conditions and financing scheme for the solar PV installations (government or international funding).	↑
Inflation impacts	Neutral or positive (lower inflation). The measure should lead to reduced electricity costs, which would represent a smaller share of household expenditure.	↑
Macroeconomic impacts	Positive. The measure is expected to support the development of a distributed renewable energy services industry, creating jobs.	↑
Distributional impacts by income group and by region	Positive across the entire population with the capacity for an individual solar rooftop. The measure could have a higher potential in warmer areas and among higher-income households (higher consumption), although it would be easy to target to poorer households.	↑ ↑↑
Influence on market barriers for electricity suppliers	Neutral or positive. The impact will depend on the implementation mechanism. The measure could open opportunities for private players if it is not bound to CFE or governmental institutions.	—
Administrative simplicity	Will depend on the implementation mechanism and the institutions involved. Would need to solve some challenges, for example, the transferability of the contract for a rooftop installation if the dwelling is sold.	—
Political acceptability	Positive. The measure can be designed to be revenue neutral or achieve household savings, gaining the support of the population.	↑
Sustainability	Positive. Supports Mexican climate and renewable energy targets. The option also involves the implementation of energy-saving measures.	↑

Legend

Score	Description
↑↑	Very positive effect
↑	Positive effect

Score	Description
—	Neutral or no effect

Score	Description
↓	Negative effect
↓↓	Very negative effect

Subsidy Reform and Reinvestment in Energy Efficiency

Energy efficiency is a powerful tool to compensate the negative impacts of electricity price increases, and fiscal savings from subsidy reform can be redirected to fund energy-efficiency measures in households.

Energy efficiency in Mexico has a high potential, including through building insulation and replacing of old inefficient appliances. CONUEE and SENER estimated that a reduction of 41 per cent and 35 per cent in energy consumption can be achieved in the industry and buildings, respectively, by 2050.[197]

In Mexico, the Fideicomiso para el Ahorro de Energía Eléctrica (FIDE, the Energy Savings Trust Fund)[198] has a significant history of supporting the implementation of energy-efficiency measures, giving loans to low-income households to invest in efficient and green technologies. One example is the household appliances phase-out scheme that ran between 2008 and 2017, replacing around 1.6 million refrigerators. The program estimated USD 22.4 million (MXN 420 million) in subsidy savings annually, which represents around 0.4 per cent of the total electricity subsidy to residential consumers in 2016. In addition to the fiscal savings, the measure also had environmental and social side benefits, avoiding 287,000 tCO_2e annually, and creating around 1,660 permanent and 10,650 indirect jobs.[199]

Energy-efficiency measures can also be applied more holistically to buildings, including energy-efficient heating systems, solar powered water heaters and thermal insulation. FIDE's new program (Eficiencia Energética en Vivienda Usada, energy efficiency in existing homes)[200] started in 2017 with this aim, providing a subsidy to low-income households. Participating households contribute 60 per cent of the cost of the measures, with the rest being covered by the National Housing Commission (Comisión Nacional de Vivienda [CONAVI]) and SENER.

Transforming electricity subsidies in energy efficiency can result in very positive outcomes. The measures should target the most vulnerable households to compensate for the negative impacts of eventual electricity price increases. At the same time, it reduces electricity consumption, consequently reducing the total subsidy. Table 14 summarizes the evaluation of this measure by Mexican experts.

[197] CONUEE and SENER (2017) Hoja de Ruta en Materia de Eficiencia Energética.

[198] Note: FIDE is a not-for-profit established in 1990 as a private trust fund, whose mandate is to guarantee an equitable coverage and support on energy efficiency across the various Mexican sectors. Among its trustees are the Nacional Financiera (NAFIN, Mexico's Development Bank), CFE and electricity consumers.

[199] FIDE and IEA (2018) Removing barriers: Boosting clean energy.

[200] FIDE (n.d.) Politicas de otrogamiento de subsidios a la energia electrica para usuarios domesticos.

Table 14: Summary of assessment of the subsidy reform and reinvestment in energy efficiency

Criteria	Experts' review:	
Fiscal impacts	Positive. Subsidy savings are obtained through reduced energy consumption, freeing fiscal space in the long term.	↑
Inflation impacts	No specific impacts were identified.	—
Macroeconomic impacts	Positive. There is indirect job creation through goods and services of the appliances and other green technologies and increased disposable income through reduced energy consumptions and costs. Concerns exist about the access of credit for low-income households.	↑
Distributional impacts by income group	Positive for low- and middle-income groups, at whom the previous Mexican programs have been directed.	↑ —
Distributional impacts by region	Positive for hot climates as there is higher use of appliances (e.g., air conditioning) in these zones, and greater energy savings would be observed. More neutral in temperate climates.	↑ —
Influence on market barriers for electricity suppliers	No major impacts identified. Scaling energy efficiency at households could create a market of electricity service suppliers. This would depend, however, on how the implementation schemes are defined and which actors are involved.	↑
Administrative simplicity	Positive. The fund for efficient refrigerators has been running for over a decade and has had successful project implementation, although the specifics of the expanded program should be studied.	↑
Political acceptability	Positive. Being targeted to poorer households is a plus for its acceptance.	↑
Sustainability	**Experts' review:** Positive. The measure has demonstrated significant carbon dioxide and other emission reductions. A reduction in the use of energy is linked also to a decrease of air pollution.	↑

Legend

Score	Description
↑↑	Very positive effect
↑	Positive effect

Score	Description
—	Neutral or no effect

Score	Description
↓	Negative effect
↓↓	Very negative effect

Subsidy Reform and Reinvestment in an Expanded Healthcare System

Previous sections of this report have discussed the opportunity cost of regressive electricity subsidies, meaning that fiscal resources could be more efficiently invested in programs to reduce poverty and improve health care or education. This option evaluates the reform of the subsidy and the reinvestment in universal health care coverage that would include all workers, including those in the informal system.[201]

A study completed by the Ibero-American University of Puebla[202] evaluates the impacts of removing energy subsidies and expanding the value-added tax (VAT) to exempted goods, to readdress the savings and the additional public budget to expand health care coverage. The study models the economic, distributional and environmental impacts of that reform, finding positive impacts on welfare, economic activity and environment, in comparison to a "no reform" scenario. The proposed expanded health care coverage consists of removing two thirds of the current social security employee–employer contributions, which would be compensated by universal coverage.

The study demonstrates the regressive aspect of energy subsidies and the broad economic, social and environmental benefits of reform combined with the investment of subsidy savings to social programs, such as the expansion of a health care coverage. A universal health care system would also support moving labor from the informal sector to the more efficient formal sector, since it would not imply a significant additional cost to employers to officially register their employees in the health care system. However, in Mexico, subsidies are not earmarked, meaning that savings from one area cannot be readdressed to another one in a simple way. Exceptional and specific measures would need to be taken to directly reallocate the funds. In addition, the cost of universal health coverage is much higher than the savings that could be delivered by the reform of electricity subsidies.[203] Therefore, this measure would require either the allocation of additional funding (such as the expansion of the VAT) or the targeting of specific population groups, such as the poor.

Further analysis should be done to evaluate and specify the administrative implications of implementing this measure. The sudden removal of subsidies to residential electricity consumers is very likely to cause social unrest. In addition, the study was done at the time when hydrocarbon products were still subsidized. The current level of electricity subsidies would only cover a portion of the cost to provide universal health care, so that other revenue sources should be found. Therefore, a detailed analysis of the overall impacts should be undertaken, and a targeted communication campaign would be required to explain the reasons and benefits of reform to the affected population. Efforts might also be required to map health care infrastructure and plan expansions in under-served areas, to ensure that low-income households can access facilities and benefit under the scheme. Table 15 summarizes the evaluation and impacts of the option, assessed by Mexican experts.

[201] Note: In Mexico there is a significant percentage of workers in the informal labor system, which means that they do not contribute to the public social security system, and therefore, are excluded from it and its benefits.

[202] Ibarrarán, Boyd and Elizondo (2015) Mexico: Reducing energy subsidies and analysing alternative compensation mechanisms. Note: This was first commissioned by the Sustainable Development Department of the Latin America and the Caribbean Region, Colombia and Mexico Country Management Unit, World Bank and was later published in the journal Sobre México. Temas en Economía.

[203] The cost of universal health care coverage in Mexico is estimated at MXN 560 billion a year (2012 estimate) more than 5 times higher than the subsidy to electricity tariffs in 2016.

Table 15: Summary of assessment of the subsidy reform and reinvestment in health care

Criteria	Experts' review:	
Fiscal impacts	Neutral. Savings on subsidies would be reoriented into the health care system.	—
Inflation impacts	Neutral. The theoretical model[204] identified positive impacts on inflation in the mid and long term. However, experts highlight that, in the short term, the removal of the subsidy will outweigh the positive impacts of the expanded health care coverage. This could be mitigated by reforming the subsidy gradually.	↓
Macroeconomic impacts	Neutral.The theoretical model[205] identified positive macroeconomic impacts. However, experts highlight that, in the short term, the removal of the subsidy will outweigh the positive impacts of the expanded health care coverage.	—
Distributional impacts by income group and region	Negative. In the short term, consumers would mostly notice only higher electricity prices. Some experts interviewed indicated a limited access to government health care centers in poorer and rural areas, meaning that these groups would have double negative impacts—unless part of the savings would be addressed to improving this access.	↓ ↓↓
Distributional impacts by region	No major impacts have been identified. Research studies, however, suggest that the geographical distribution of doctors in Mexico is unequal, with one third the number of physicians per capita in Chiapas and Puebla in comparison to Mexico City.[206] This suggests that the distribution of health care infrastructure by region could lead to varying distributional impacts unless access to facilities is also addressed.	—
Influence on market barriers for electricity suppliers	Positive. A full removal of the subsidy would contribute to create a level playing field for new and private electricity suppliers.	↑
Administrative simplicity	Negative. The reform option involves very different ministries, and exceptional measures should be taken to ensure the reinvestment of the subsidy savings into the compensation measure. It would also involve reforming the health sector in Mexico.	↓
Political acceptability	Negative. Several experts noted that there would be social unrest on subsidy removal, as the energy costs would rise.	↓
Sustainability	Positive. The sudden increase of prices is expected to incentivize energy efficiency and a more sustainable consumption.	↑

Legend

Score	Description
↑↑	Very positive effect
↑	Positive effect

Score	Description
—	Neutral or no effect

Score	Description
↓	Negative effect
↓↓	Very negative effect

[204] Ibarrarán, Boyd and Elizondo (2015) Mexico: Reducing energy subsidies and analysing alternative compensation mechanisms.

[205] Idem.

[206] OECD (2016b) Health policy in Mexico.

Overall assessment and conclusions for reform of residential sector subsidies

The previous options have been evaluated through a total of 21 interviews with experts in the Mexican energy sector, according to the methodology and analytical framework presented in Annex 3. Table 16 summarizes the results of this evaluation. Against each criterion, reform options are given a score between -1 and 1, representing more negative or more positive outcomes, respectively.[207] These scores have been assigned based on interview responses.

Table 16: Evaluation framework results, comparison between the different reform options for the residential sector

Evaluation criteria													
Reform Option	Fiscal impacts	Inflation	Macroeconomic impacts	Household welfare						Impact on market access	Administrative simplicity	Political acceptability	Sustainability
				Low income		Middle income		High income					
				Moderate climate	Hot climate	Moderate climate	Hot climate	Moderate climate	Hot climate				
DAC expansion	↑	—	—	—	—	↓	↓	↓	↓	↑	↑	—	↑
Subsidy reform to renewable energy	↑	↑	↑	↑	↑	↑	↑↑	↑↑	↑↑	—	—	↑	↑
Subsidy reform to energy efficiency	↑	—	↑	↑	↑	—	—	—	—	↑	↑	↑	↑
Subsidy reform to universal health care coverage	—	↓	—	↓	↓↓	↓	↓	↓	↓	↑	↓	↓	↑

Source: IISD with the inputs from interviews to Mexican energy experts.

Legend

Score	Description
↑↑	Very positive effect
↑	Positive effect

Score	Description
—	Neutral or no effect

Score	Description
↓	Negative effect
↓↓	Very negative effect

[207] Note: In the case of impacts to household welfare, however, the ranking varies between -3 and +3, in order to be able to well differentiate the impacts on each group class.

The evaluation framework shows that all measures have positive and negative impacts. For the first three options (DAC expansion, renewable energy and energy efficiency), it is possible to pursue a combination of them, taking into account the impacts on specific household groups, reflecting the complexity and diversity of the Mexican population. Section 6 proposes a combination of these options with a possible implementation pathway.

The measures proposing subsidy reform to renewable energy and to energy efficiency score best in economic impacts (fiscal, inflation and macroeconomic). This is because the changes would affect only residential tariffs and the two options imply some kind of compensation measure, mitigating the effects of a price reform. Nevertheless, the evaluation of the fiscal impacts is limited to the effects on the public budget driven by a reduction in subsidies. The support to renewable energy, energy efficiency and universal health care coverage would require additional public funding to support the measures, at least initially (in the case of renewable energy and energy efficiency). Furthermore, all measures that imply the reduction of the electricity consumption would result in reduced income from the VAT to which electricity tariffs are subject. This could result in negative fiscal impacts (less income from VAT). The case of universal health care coverage would require special attention, as electricity subsidy reform would only cover a fraction of the total health care cost. The DAC expansion and the reform to health care are considered to have no or negative economic impacts, as both of them would imply significant tariff increases.

Two important aspects to consider are administrative simplicity and political acceptability. The four options analyzed have ranked very differently in these criteria, which are key for a smooth and easy implementation. Some scores on administrative simplicity can be improved by creating supporting policies (reform to renewable energy) or by allowing the earmarking of the subsidy[208] (reform to universal health coverage). Political acceptability could be improved with carefully designed communication campaigns from the government to the affected population, as it is the case with other government initiatives (for example, for social protection programs or raising awareness of how to act in crisis situations).

Last but not least, all measures have been considered to result in positive sustainability impacts and to have positive effects on the market access of new electricity suppliers. The subsidy swap to energy efficiency and renewable energy options can also support the creation of companies on energy savings and distributed renewables, favoring economic growth in those sectors.

5.2 Agricultural tariff reform options

Subsidies to agricultural electricity tariffs are also significant and are associated to high regressivity and important negative environmental impacts (see Section 4.2). Mexican experts have also investigated how to reduce these subsidies in an efficient way, including compensation measures. Table 17 summarizes some of the options proposed.

[208] Note: In Mexico, budgetary savings are not earmarked, meaning that fiscal savings from a specific reform get dissolved in the general budget, and it is not possible to re-assign them to another case. There are however exceptions, such as the "Ramo 23" of public accounts, that can designate public resources for social and environmental programs but can risk transparency. Source: Moreno (2018) Personal interview.

Table 17: Reform options for agricultural electricity subsidies in Mexico

Reform Option	Definition
Agriculture	
Decoupling subsidy and use of energy-efficient technologies	Decoupling agricultural support means reforming a policy so that "it has no or only very small effects on production and trade."[209] In the case of electricity subsidies, this means breaking the link between subsidy benefits and volumetric consumption. Decoupling in Mexico has been proposed in three forms, where subsidy payments would be determined according to: • Historic amounts received: It is recommended to complement this option with transfers toward technologies to use water efficiently. This would, however, maintain inequality in subsidies among farmers, and farmers might question the longevity of the subsidy payments following the transition. • Number of cultivated hectares: This option would result in a more equitable distribution of the subsidy that reflects the number of irrigated hectares. The assumption is that farmers would make the best economic choice on the type of crops grown on their lands. • Staggered payments: This option would scale subsidy payments so that high electricity consumers receive a lower subsidy, favoring support to small-scale farmers. Small producers are a main target group for the implementation of this decoupling, notably through measures that encourage a transition to more energy-efficient solutions.[210]
Energy efficiency in the agriculture sector	SAGARPA put forward a mitigation measure to replace inefficient water pumps with more efficient ones. The new technologies are acquired under a funding scheme where SAGARPA pays 50 per cent of the cost, the recipient pays a 10 per cent upfront cost, and the remaining 40 per cent is paid to CFE through a monthly payment. The subsidy is not removed, as the same tariff applies, but since the farmer would consume less energy, production costs would decrease, also freeing up fiscal space in the long term.[211] However, experts highlight that this measure would incentivize the over-exploitation of aquifers, as energy efficiency in pumps could result in more water extracted for the same amount of electricity.

In addition to the previous options, a program was proposed to encourage farmers to voluntarily give up a percentage of their electricity subsidy, as well as their water concessions from the National Water Commission (Comisión Nacional del Agua [CONAGUA]). The refused electricity subsidy was then matched with funding to invest in energy-efficiency technologies. This program did not prove to be successful, however, and it is currently under review to understand why. [212]

[209] OECD (2001) Decoupling: A conceptual overview.

[210] FIRA (2018) Respuestas para entrevista sobre opciones de reforma a los subsidios a la electricidad en México.

[211] SAGARPA (2016) Eficiencia Energetica en el Sector Agropecuario.

[212] FIRA (2018) Respuestas para entrevista sobre opciones de reforma a los subsidios a la electricidad en México.

6. Key reform recommendations

6.1 Implementation plan

This report has shown that electricity subsidies lead to a range of undesirable outcomes, including reducing fiscal space in Mexico's public budget (and therefore reducing the opportunity to invest in social programs and development) and limiting CFE's ability to invest in the electricity system and electricity provision. Furthermore, electricity subsidies increase health and other external costs due to over-consumption of fossil fuels for power generation and make alternative energy services (notably, energy efficiency and renewable energy) less attractive to new companies and investors.

Several options to reduce electricity subsidies for the residential sector have been explored, which can be grouped in two main concepts:

1. Reducing the demand for subsidized electricity through energy-efficiency measures and increasing the supply of distributed renewable energy, notably from self-consuming households.
2. Increasing tariffs to the supply cost level (at least) for those who are able to pay[213] or to the whole population, introducing compensation measures for those that would be most affected by the reforms.

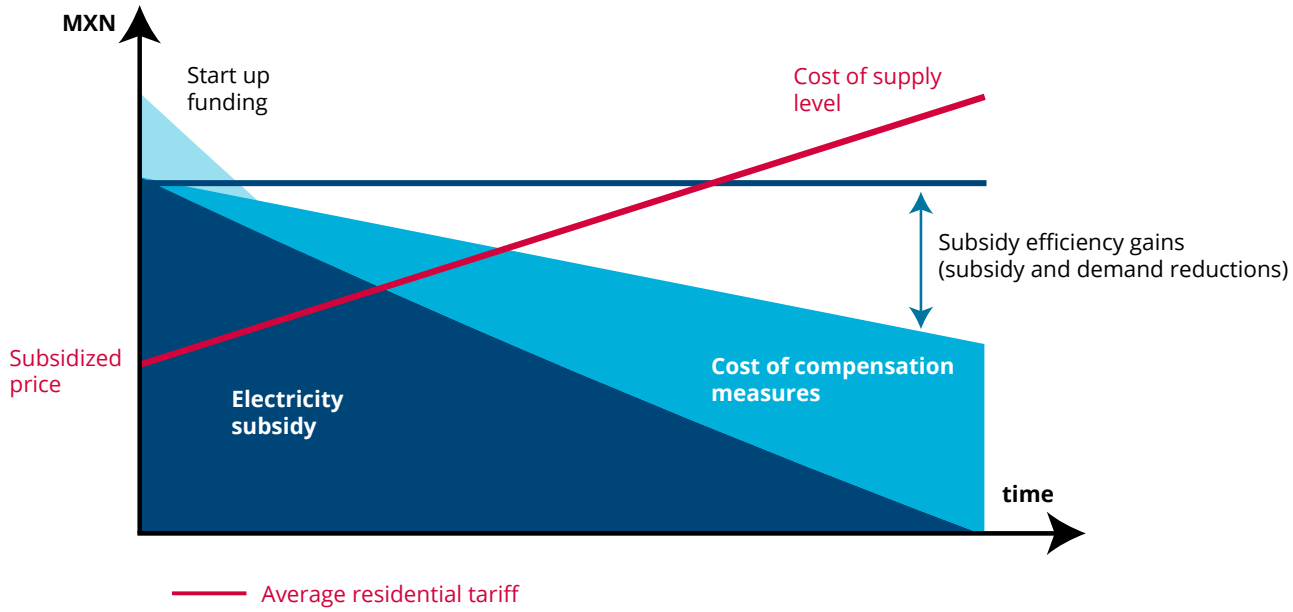
Considering Mexico's complexity and the comments from the Mexican experts interviewed, the reform of electricity subsidies would require a combination of the different options. This would imply defining specific measures and implementation schemes for different population groups depending on their socioeconomic conditions. To achieve this, we recommend that a reform strategy should be founded on the following general principles:

- Vulnerable population groups should not be affected, meaning that the share of their household expenditure that goes to electricity should not increase.
- Energy efficiency and distributed renewable energy are powerful tools to compensate price increases, especially for low- and middle-income population groups. Mexico can use, expand and build upon recent and ongoing financing schemes supported by the government (such as FIDE or the Energy Transition and Sustainable Use of Energy Fund (Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía [FOTEASE]).
- A further reduction in electricity subsidies will be achieved if consumers with the ability to pay are effectively moved to non-subsidized tariffs.
- Applied compensatory schemes should result in acceptable social welfare benefits and should be designed so that their financial cost is less to government than the cost of subsidies. The government is in effect making a swap from providing electricity subsidies to providing a lower level of alternative compensation measures that are more effective.

Figure 17 illustrates the financial cost from the perspective of government, with electricity tariffs progressively moving to reflect the cost of supply over the long term.

[213] Note: For the population "that are able to pay", the tariff could be defined at a surplus cost, as it is the case of the DAC expansion option. It is recommended that the number of people that would pay a tariff at supply cost level increases as measures to reduce the demand for subsidized electricity are implemented, so that the effect on the consumer bill is neutral (consumption is lower, but the kWh is more expensive).

Figure 17: Change in average tariffs,[214] electricity subsidy and compensation measure costs over time



Source: IISD.

6.2 Reducing Electricity Subsidies—to Whom, What level and at What Time?

A key element of subsidy reform is to identify the main affected groups to define adequate compensating measures that mitigate the impact of price increases. Considering that, this study recommends the segmentation of the population into three groups. Table 18 describes the proposed tariffs and the relationship to compensatory measures for each of these three groups.[215] We propose to expand the DAC to be applicable to higher-income deciles, adding the criterion of income to the application of the tariff, and to reform subsidies gradually for the rest of the population. We recommend that the removal of subsidies for groups B and C be conditional on the implementation of compensatory measures, and, more concretely, on energy efficiency (as a first step) and distributed solar PV for users that have already implemented basic energy-efficiency standards.[216] Therefore, the measures would be at least partly financed by the electricity savings. Other supportive measures could be also defined for most vulnerable households to compensate for tariff changes, such as tax reductions or exemptions (for example of the property tax, the "Predial").

[214] Note: In Figure 17, we assume that the initial target of tariff reform is to achieve cost-of-supply or cost-recovery level.

[215] Note: This report proposes only a segmentation according to the income level of electricity users. Regional differences in electricity tariffs can remain, although a larger potential for energy efficiency and renewable energy compensatory measures is expected in warmer areas. Furthermore, the initial classification according to the "ability to pay increased electricity tariffs" is very basic, and further investigation should be done to refine it and identify the criteria and the data bases that could be used to support the classification. The specific financing mechanisms related to the compensation measures also have to be further evaluated.

[216] Note: These standards could be defined by existing Mexican institutions, such as the National Commission on Efficient Energy Use (Comisión Nacional para el Uso Eficiente de la Energía [CONUEE]).

Table 18: Proposed segmentation of electricity consumers and corresponding compensation measures

Group	Ability to pay increased electricity tariffs	To what level could tariffs be increased	When could tariffs be increased	Type of compensation measure
A	Can pay.	Maintain and expand the DAC to a higher share of population (for example, 20 per cent). Use income in addition to consumption criteria to apply the DAC.	DAC tariff not changed but expanded to a broader part of the population at one point in time.	No specific measure defined, but opt-in access to government programs on energy efficiency and renewable energy.
B	Can pay, but would lead to a significant impact on household expenditure.	Up to cost of supply, conditional on the implementation of compensation measures.	Gradually, in parallel to the implementation of compensation measures, reaching a zero-net impact in electricity bills.	Energy efficiency and distributed renewable energy linked to energy-efficiency measures.
C	Cannot pay without significant impact on household expenditure.	Up to cost of supply, conditional on the implementation of compensation measures.	Gradually, in parallel to the implementation of compensation measures, reaching a zero-net impact in electricity bills.	Focus on energy efficiency and building insulation. Distributed renewable energy conditioned to the implementation of energy-efficiency measures, especially for social housing provided by the state.

Source: IISD.

6.3 Implementation plan

A detailed implementation plan needs to start by identifying and defining different elements, including: the population segments, a plan to scale up and implement compensation measures, a communication plan, and the main public actors that will intervene in the reform. The following sections outline possible ways to move forward.

Identifying the population segments

Under the scheme proposed, the key need is to identify those who are in group A, as all of those outside group A would then automatically be targeted for compensation measures, and only targeted for tariff rises once in receipt of compensation measures. Electricity consumption volume and income criteria (for example, from tax returns) should be used together to identify these users, as well as household information (such as area of living space).

To differentiate groups B and C, data from the National Council for the Evaluation of Social Development Policy (Consejo Nacional de Evaluación de la Política de Desarrollo Social [CONEVAL]), Prospera program or the Ministry of Social Development (Secretaría de Desarrollo Social [SEDESOL]) could be used to determine those in poverty level.[217] Applying reform measures to new social housing projects or new social protection programs would automatically address the identification of these groups.

[217] Note: Despite the many different institutions working in Mexico to address poverty, the task of obtaining an exact and updated database of most vulnerable families can be challenging. A more detailed analysis is required to properly target those that would need it the most. Nevertheless, it is important to note that, under the current proposal, subsidies would be maintained to those in groups B and C that do not benefit from mitigation measures.

Scaling up and implementing compensation measures

There is a very good set of experiences from Mexico's schemes to support energy-efficiency and renewable energy: for example, the FIDE-managed schemes incentivizing energy-efficient household appliances and the proposed "bono solar" scheme for solar PV for households. To this could be added some further ideas, such as community solar projects for poorer households that are not suitable for solar rooftops, which would provide equal benefits to all households.

There is a need to further specify schemes and how they may be rolled out at an increased scale. Importantly, this includes how they could be financed, noting:

- Schemes should focus on being pro-poor as far as possible.
- Initial capital costs must be met and ideally supported by government or international finance institutions in a rolling funding arrangement, as indicated by some of the proposals.
- The cost to government of providing subsidized credit must be less than the savings in electricity subsidies.
- Integration of best sustainable energy standards (such as energy-efficiency standards defined by CONUEE) within the compensation mechanisms should be made mandatory, to optimize the implementation and results of these mechanisms.

It is recommended that energy-efficiency measures are prioritized in time over renewable energy measures, in order to maximize the impact of renewables. Furthermore, more comprehensive and stringent standards are needed, and norms and standards can already be worked upon in preparation for improved standards in the medium term. A special focus should be given to social housing projects.

Communicating and adapting

It is strongly recommended that a formal communications and consultation strategy be adopted, which can react and adapt as new information and views become apparent. Communications should be adapted to each population group and region and should emphasize how compensation measures can be accessed and their benefits.

Scaling up compensation measures will necessarily be gradual over time, and there will be opportunities to learn from experience and to adapt. The use of pilot schemes is strongly recommended.

Impacts and roles of Mexico's electricity sector

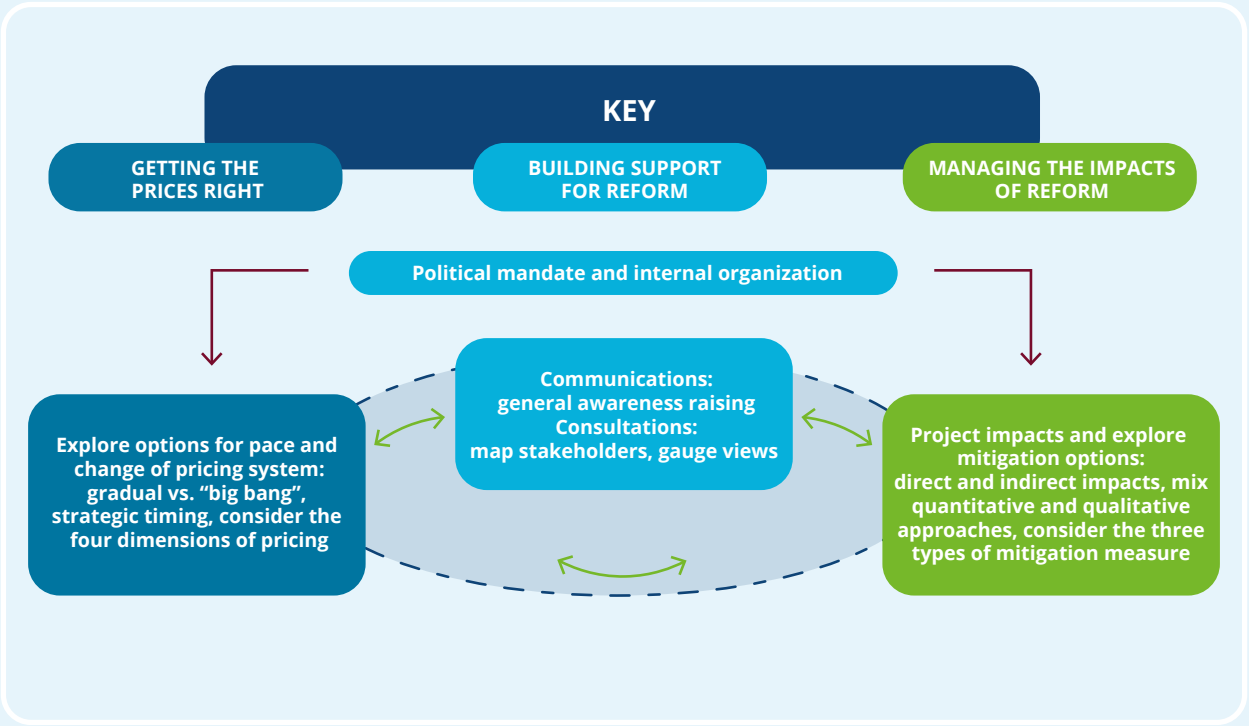
A successful implementation of the reform will see the electricity subsidy burden decrease over time (see Figure 17), which will result in a lower level of support needed for CFE from the government. However, a decrease in demand would also result in less revenue for CFE. There is also a significant investment backlog in CFE's ability to maintain and improve electricity supply across the country, so that subsidies to CFE should be expected to continue in the short and medium term. In the long term, the "cost of supply" should include the investment needs of CFE.

It is recommended that the independent regulator (Comisión Reguladora de Energía [CRE]) should play a central role in the definition and validation of what constitutes the "cost of supply," whether this is calculated with reference to a provision for investment or not.

Box 7: International best practice in the implementation of energy subsidy reform

Since 2005, the GSI conducted research and analysis on the implementation of subsidy reforms and assisted governments with reform implementation. Experience shows that careful preparation matters in three key areas (see Figure 18): i) the design of a new pricing system; ii) estimating the impacts of reform and preparing compensation; and iii) building support for reform internally and externally. All three elements must be pursued in parallel.

Figure 18: Key areas to consider for subsidy reforms



Source: Beaton et al. (2013).

Getting the prices right refers to the process of establishing a new pricing system and determining the schedule for moving to that system. Determining an appropriate pace for price changes is typically informed by research on impacts and political attitudes to change.

Managing the impacts of reform refers to (i) the process of estimating who will be affected and how to help inform the pace of change and appropriate mitigation measures and (ii) the process of preparing mitigation measures, if necessary. Impact assessments are typically based on economic models, which may range from simple calculations based on household survey data and economic databases with very few assumptions to more complex macroeconomic models, which will typically try to project impacts over a longer-term scale and take into account a complex interplay of interrelationships. If the desired mitigation measures are already known, appropriate coordination with relevant ministries will be required. Early engagement is particularly important in cases where entirely new policies are to be created or existing policies are to be adapted or updated in some way.

Building support for reform refers to the process of: i) ensuring good internal coordination and agreement within government as well as researching the opinions of external stakeholders and ii) engaging with stakeholders in a strategic fashion to create political space and improve the likelihood of effective implementation of mitigation measures. Internally, this typically means the creation of the right coordinating bodies with executive representation to ensure that the issue is adequately prioritized and that internal sensitivities are carefully managed. Externally, it typically means the use of research tools to help identify public opinion and to engage in dialogue with key stakeholders. Ultimately, these planning processes ought to result in some kind of strategic communications campaign. Communications will usually be more effective if organized early and carried out over a medium timeline.

Source: Beaton et al. (2013) A guidebook to fossil fuel subsidy reform for Southeast Asian policymakers.

Annex 1. Inventory of existing energy subsidies in Mexico

Annex 1.1 Methodology

1.) The price-gap approach is used by the International Energy Agency (IEA) and the International Monetary Fund (IMF). It is based on a comparison of domestic and international reference prices (i.e., estimation of the price gap). When domestic prices are lower than international prices, this means that there is a subsidy, which is estimated as the price gap multiplied by the amount of energy consumed.

2.) The inventory approach is used by the Organization for Economic Co-operation and Development (OECD) and the Global Subsidies Initiative (GSI), wherein an inventory of government policies and programs that constitute subsidies is elaborated and their total value is added up.

The FFS inventory presented in this report uses the second approach, specifically looking at measures that were reformed or implemented after the Energy Reform. The list of measures is based on the OECD database of support to fossil fuels.[218] We have also reviewed the Mexican self-report on inefficient FFSs submitted to the G20,[219] which mentions 10 measures, regrouping some of the measures contained in the OECD database. Four additional measures were identified through a review of press reports (using key words "subsidies", "México", "Energy Reform" in Spanish) on energy reform in the past three years. For some of these measures, information on values is not available.

For electricity subsidies, the report uses estimates provided by the Ministry of Energy (SENER). These subsidies are calculated as the difference between the price that the consumer pays (the tariff) and the supply cost corresponding to that tariff, estimated by SENER.

Finally, the inventory includes other subsidies based on figures published by the Mexican Ministry of Finance (SHCP).[220] We also mention measures without published estimates. Other potential subsidies specific to coal or fuels for the generation of electricity were not considered.

[218] OECD (2018) Fossil fuel support -MEX.

[219] OECD (2016c) Mexican self-report on the phasing -out of inefficient fossil fuel subsidies.

[220] SHCP (2015) Presupuesto de Gastos Fiscales 2015, SHCP (2016) Presupuesto de Gastos Fiscales 2016, SHCP (2017) Presupuesto de Gastos Fiscales 2017, SHCP (2018a) Presupuesto de Gastos Fiscales 2018.

Annex 1.2 Description of energysubsidies

Name of Subsidy	Type of Fuel	Sector	Subsidy Description	Type of Subsidy	Exists Since	Legal Basis
Subsidy for electricity tariffs	Electricity	Residential	The federal budget formally declares a line to electricity subsidies. It is a payment from the Finance Ministry to CFE to cover part of the gap between tariffs and supply cost. The figure for 2018 is the value approved in the Federal Expenditures Budget (Presupuesto de Egresos de la Federación [PEF]).	Direct transfer	n/a	Presupuesto de Egresos de la Federación.
Electricity tariffs for households, types 1 to 1F	Electricity	Residential	Mexico maintains subsidies to the electricity sector via tariffs. Electricity prices for households and for the agriculture sector are set well below cost, with the price-cost difference being covered by government transfers and by cross-subsidies from other types of tariffs. Tariffs for industry and services vary over time, and some years have been set at a price lower than their cost, creating a subsidy.	Direct transfer	n/a	Constitución, Artículo 73, Fracción XXIX; Ley Orgánica de la Administración Pública, Artículo 31, Fracción X.
Electricity tariffs for agriculture	Electricity	Agriculture		Direct transfer	2002	Ley de Energía para el Campo.
Electricity tariffs for industry	Electricity	Industry		Direct transfer	n/a	Constitución, Artículo 73, Fracción XXIX; Ley Orgánica de la Administración Pública, Artículo 31, Fracción X.
Electricity tariffs for services	Electricity	Services		Direct transfer	n/a	Constitución, Artículo 73, Fracción XXIX; Ley Orgánica de la Administración Pública, Artículo 31, Fracción X.
Carbon tax exemption for fuels used in production processes for something different to combustion	Coal tar	Industry	Fossil fuels destined as input into the production of plastics and other products are exempted from the carbon tax. However, processing also results in significant carbon emissions, so that the exemption is considered as a subsidy.	Revenue foregone	2014	Ley del Impuesto Especial a la Producción y Servicios, Presidential decree, January 2014.
	Ethane					
	LPG					
	Naphtha					
	Lubricants					
	Bitumen					
	Paraffin waxes					
	Natural gas					

Name of Subsidy	Type of Fuel	Sector	Subsidy Description	Type of Subsidy	Exists Since	Legal Basis
Carbon tax reduction and exemptions for fuels	Anthracite	Industry	Fossil fuels in Mexico are subject to a carbon tax, defined according to the fuel's carbon content. A lower carbon tax rate was negotiated for coal and coal products, in order to limit the price increase that would have resulted from applying a tax calculated based on coal's carbon dioxide content (a full application of the carbon tax would have made coal prices increase by up to a quarter; the reduced tax had a total price increase of 12.5 per cent).	Revenue foregone	2014	Ley del Impuesto Especial a la Producción y Servicios, Presidential decree, January 2014.
	Coking coal					
	Sub-bitumi-nous coal					
	Lignite					
	Coke oven coke					
	Coal tar					
	Aviation gasoline	Transportation	Aviation fuels are exempted from the carbon tax. The International Civil Aviation Organization's (ICAO's) Chicago Convention precludes taxing fuels for international flights, but not domestic flights. Legal hurdles are in the way of establishing the carbon tax for domestic flights.			IICAO Chicago Convention, Presidential decree, Ley del Impuesto Especial a la Producción y Servicios.
	Coke oven gas	Industry	Fossil fuels in Mexico are subject to a carbon tax, defined according to the fuel's carbon content. A lower carbon tax rate was negotiated for coal and coal products, in order to limit the price increase that would have resulted from applying a tax calculated based on coal's carbon dioxide content.			Ley del Impuesto Especial a la Producción y Servicios, Presidential decree, January 2014.
	Natural gas	Industry	Natural gas, as the industrial fossil fuel with the lowest carbon emissions per unit of energy, and the one with lowest local air pollutants, is exempted from the carbon tax as its value is zero.			Ley del Impuesto Especial a la Producción y Servicios, Presidential decree, January 2014.
Diesel tax credit for passenger and cargo transportation	Gas/diesel oil excl. biofuels	Transportation	Taxpayers in this sector can reduce their income tax by the amount of excise tax paid.	Revenue foregone	2015	Ley de Ingresos de la Federación.
Tax credit for purchased diesel for machinery	Gas/diesel oil excl. biofuels	Industry	Taxpayers in this sector can reduce their income tax by the amount of excise tax paid.	Revenue foregone	2015	Ley de Ingresos de la Federación.
Tax credit for marine diesel	Gas/diesel oil excl. biofuels	Transportation	Taxpayers in this sector can reduce their income tax by the amount of excise tax paid.	Revenue foregone	2015	Ley de Ingresos de la Federación.
Tax benefit for gasoline consumption in the northern border	Motor gasoline excl. biofuels	Transportation	Exemption of the excise tax of gasoline purchased within 45 km from the border with the United States.	Revenue foregone	2016	Presidential decree published each year.
Fuel tax credit for agriculture and fisheries	Gas/diesel oil excl. biofuels	Agriculture	Taxpayers in this sector can reduce their income tax by the amount of excise tax paid.	Revenue foregone	2000	Ley de Ingresos de la Federación.
Excise tax exemption for fishers and farmers	Gas/diesel oil excl. biofuels	Agriculture	Fishers and farmers registered with SAGARPA can get a certain amount of cheaper fuel without excise tax.	Revenue foregone	2002	Ley de Energía para el Campo.
Provisions for producers of hydrocarbons	Various	Industry	This measure provides favorable taxation rules specific to hydrocarbon exploration and production (E&P) companies, including: 1) They are allowed to consolidate results across contracts for corporate income tax purposes; 2) They enjoy accelerated depreciation rates for exploration investments (100 per cent) and wells (25 per cent); 3) Contractors are allowed to carry forward losses for deep-water projects for 15 years, instead of 10 years.	Revenue foregone	2013	Ley de Ingresos sobre Hidrocarburos.

Name of Subsidy	Type of Fuel	Sector	Subsidy Description	Type of Subsidy	Exists Since	Legal Basis
Royalty exemption for shale gas	Gas	Various	The Hydrocarbon Income Law establishes an exemption from royalties (derecho de extracción de hidrocarburos) for gas when gas prices are below 5 USD/million BTU. This price situation that triggers the exemption has been the standard in the shale gas industry for the last years (the average monthly reference price of natural gas at the Henry Hub has only briefly risen above USD 5 twice since 2009).	Revenue foregone	2016	Ley de Ingresos sobre Hidrocarburos.
Clean Energy Certificates for natural gas	Natural gas	Various	The Energy Transition Law classified natural gas as "clean energy," allowing "efficient co-generation" to get clean energy certificates (CELs), providing an additional source of income for gas-based power generators Value is not available since the CEL market starts early 2019 (to cover 2018 electricity consumption).	Direct transfer	2018	Ley de Transición Energética, Artículo 16, Fracción IV.
Fideicomisos de inversión en energía e infraestructura (FIBRA E)	Various	Various	FIBRA-Es establish tax benefits for trusts that invest in treatment, refineries, commercialization, transport and storage of oil, gas and petrochemicals, with the aim to compensate for the reduction in public resources provided to PEMEX and CFE.	Revenue foregone	2015	RESOLUCIÓN que modifica las disposiciones de carácter general aplicables a las emisoras de valores y a otros participantes del mercado de valores. de la Secretaría de Hacienda y Crédito Público y Comisión Nacional Bancaria y de Valores, 20/10/2015.
Absorption by federal budget of CFE pension liabilities	Electricity	Various	One-time payment in the process of turning CFE into a state-owned productive enterprise.	Direct transfer	2016	Ley Federal de Presupuesto y Responsabilidad Hacendaria, Acuerdo 85-2016 SHCP.
Absorption by federal budget of PEMEX pen-sion liabilities	Various	Various	One-time payment in the process of turning PEMEX into a state-owned productive enterprise.	Direct transfer	2016	Ley Federal de Presupuesto y Responsabilidad Hacendaria.

Annex 1.3 Estimates of energy subsidies and sources

Name of subsidy	Value (MXN million)									Source of Estimates
	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Subsidy for residential electricity tariffs	0	0	0	0	0	0	30,000	66,678	50,179	SHCP (2016, 2017, 2018a)
Electricity tariffs for households, types 1 to 1F	83,697	86,646	89,821	96,644	101,565	81,609	101,220	n/a	n/a	SENER (2016, 2017)
Electricity tariffs for agriculture	10,279	12,656	12,787	12,987	13,427	9,504	14,625	n/a	n/a	SENER (2016, 2017)
Electricity tariffs for industry	5,560	0	0	0	0	318	13,053	n/a	n/a	SENER (2016, 2017)
Electricity tariffs for services	2,582	2,220	1,699	2,152	1,508	2	890	n/a	n/a	SENER (2016, 2017)
Carbon tax exemption for fuels used in production processes for something different to combustion	0	0	0	0	0	0	0	n/a	n/a	OECD (2018)
	0	0	0	0	6	7	7	n/a	n/a	OECD (2018)
	0	0	0	0	0	0	0	n/a	n/a	OECD (2018)
	0	0	0	0	2	3	3	n/a	n/a	OECD (2018)
	0	0	0	0	0	0	0	n/a	n/a	OECD (2018)
	0	0	0	0	3	3	3	n/a	n/a	OECD (2018)
	0	0	0	0	0	0	0	n/a	n/a	OECD (2018)
	0	0	0	0	1	2	2	n/a	n/a	OECD (2018)
Carbon tax reduction and exemptions for fuels	0	0	0	0	13	10	6	n/a	n/a	OECD (2018)
	0	0	0	0	57	41	27	n/a	n/a	OECD (2018)
	0	0	0	0	248	179	120	n/a	n/a	OECD (2018)
	0	0	0	0	34	25	17	n/a	n/a	OECD (2018)
	0	0	0	0	102	73	49	n/a	n/a	OECD (2018)
	0	0	0	0	30	22	15	n/a	n/a	OECD (2018)
	0	0	0	0	3	2	2	n/a	n/a	OECD (2018)
	0	0	0	0	75	54	36	n/a	n/a	OECD (2018)
	0	0	0	0	2,998	2,164	1,446	n/a	n/a	OECD (2018)
TOTAL of carbon tax reduction and exemptions for fuels	**0**	**0**	**0**	**0**	**3,560**	**2,570**	**1,718**	**n/a**	**n/a**	
Diesel tax credit for passenger and cargo transportation	0	0	0	0	0	12,863	19,496	24,718	18,469	SHCP (2015, 2016, 2017, 2018a)
Tax credit for purchased diesel for machinery	0	0	0	0	0	5,967	9,044	10,048	8,654	SHCP (2015, 2016, 2017, 2018a)
Tax credit for marine diesel	0	0	0	0	0	1,028	1,557	1,587	1,516	SHCP (2015, 2016, 2017, 2018a)

Name of subsidy	Value (MXN million)									Source of Estimates
	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Tax benefit for gasoline consumption in the northern border	0	0	0	0	0	0	9,556	8,981	9,587	OECD (2018), SHCP (2015, 2016, 2017, 2018a)
Fuel tax credit for agriculture and fisheries	52	135	174	0	0	2,770	4,080	4,829	9,477	OECD (2018), SHCP (2015, 2016, 2017, 2018a)
Excise tax exemption for fishers and farmers	0	0	0	0	0	0	5,038	3,108	3,089	SHCP (2016, 2017, 2018a)
Provisions for producers of hydrocarbons	n/a	n/a	n/a	0	0	0	0	n/a	n/a	OECD (2016a)
Royalty exemption for shale gas	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	OECD (2018)
Clean energy certificates for natural gas	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Ley de la Industria Eléctrica, DOF (2014)
FIBRA E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	DOF (2015)
Absorption by federal budget of CFE pension liabilities	n/a	n/a	n/a	n/a	n/a	n/a	161,080	n/a	n/a	CEFP (2017b)
Absorption by federal budget of PEMEX pension liabilities	n/a	n/a	n/a	n/a	n/a	n/a	160,731	n/a	n/a	CEFP (2017b)

Annex 2. Summary of residential and agriculture electricity tariffs in Mexico

Residential			
Tariff	**Temperature**	**Consumption Limit per Month (kWh/month)**	**Tariff Structure and Subsidies**
1	Temperate climates	250	Each electricity tariff is structured in three consumption blocks: • Basic block: very low consumption and high subsidy. • Intermediate block: low consumption with lower subsidy than basic range. • Surplus block: the price is close to the supply cost. The block limits are defined per tariff.
1A	Summer lowest average temperature of 25° C	300	
1B	Summer lowest average temperature of 28° C	400	
1C	Summer lowest average temperature of 30° C	850	
1D	Summer lowest average temperature of 31° C	1,000	
1E	Summer lowest average temperature of 32° C	2,000	
1F	Summer lowest average temperature of 33° C	2,500	
DAC	High electricity consumption > 2,500		Same price applies to all the consumption (no block structure applies).

Agriculture		
Tariff	**Use**	**Associated subsidies**
9	Pumping water for irrigation, low voltage	Tariff set by SHCP and not subject to the agriculture stimulation rates (i.e., no subsidies applied).
9CU	Pumping water for irrigation with a single charge, low and mid voltage	Tariff subject to the agriculture stimulation rates (i.e., subsidized) defined by the Rural Energy Law (Ley de Energía para el Campo). The electricity consumption under this tariff is defined by a quote determined by SAGARPA.
9M	Pumping water for irrigation, medium voltage	Tariff set by SHCP and not subject to the agriculture stimulation rates (i.e., no subsidies applied).
9N	Pumping water for irrigation at night, low and mid voltage	Tariff subject to the agriculture stimulation rates (i.e., subsidized) defined by the Rural Energy Law (Ley de Energía para el Campo). The electricity consumption under this tariff is defined by a quote determined by SAGARPA.

Source: IISD with information from SENER (2017).

Annex 3: Evaluation framework

In order to assess reform options, it is important to review against multiple criteria, because electricity subsidy reform can have impacts in many areas. Typically, evaluation includes both qualitative and quantitative analysis, with economic modelling seeking to identify the rough order of magnitude of impacts on households and the economy, taking into account complex economic interrelationships.

For the purposes of this study, IISD has developed an evaluation framework for qualitative analysis only. Each criterion in the framework is designed so that a score can be assigned, ranging from a negative value (-1) to neutral (-) and to a positive value (+1). In the case of impacts to the population, the scoring goes from (-3) to (+3) in order to be able to differentiate the impacts to each group. Negative values are associated with a negative outcome for any given criterion: for example, higher fiscal expenditure, lower household welfare or low political acceptability. Positive values are associated with a positive outcome: for example, fiscal savings, improved household welfare or high politically acceptability. Color codes are assigned to ease interpretation.

This framework is designed to work as a screening tool for identifying preferred options. If desired, these options could then be made subject to a detailed quantitative analysis. The following sections explain the different evaluation criteria, as well as the methodology followed to determine the population groups. The framework is applied to residential options, but it could also be used to assess options to reform electricity subsidies to the agriculture sector.

Annex 3.1 Framework definition

The framework considers the following criteria:

- Fiscal impacts: Typically, energy subsidy reform will result in fiscal savings, but the exact scale of savings will differ if subsidy targeting is adopted. Mitigation measures and compensation policies take up fiscal resources.
- Inflation impacts: This will be higher or lower according to the scale and breadth of the price increases, and the extent to which they are clustered in groups that play a more important role in consumer demand or agricultural production.
- Macroeconomic impacts: This will consider relative impacts on GDP and any strategic sectors outside households and agriculture.
- Distributional impacts by consumer group: This will focus on the consumers who will face higher prices: either households or agriculture sector.
- Distributional impacts by region: This will focus on the extent to which price increases affect consumers in a particular geographic region of Mexico more than another. This reflects the extent to which the current tariff regime is disaggregated by region.
- Influence on market barriers for electricity suppliers: Under the current subsidy regime, the gap between cost and price of electricity supplied to households creates a de facto market entry barrier to private basic service suppliers that cannot directly access the government subsidies. If subsidies go directly to the national electricity distribution company (CFE), then only electricity supplied by CFE can be sold at a price below cost. Depending on how subsidies are disbursed, this could improve or worsen incentives for private supply.
- Administrative simplicity: This considers aspects such as legislative complexity, the need for ongoing government staff management of the new pricing regime, and whether the reform will require the use of any existing or new complementary policies.
- Political acceptability: This considers how acceptable a given reform plan may be politically, taking into account knowledge about stakeholder views, linkages with the political agenda and core constituencies of the new government, and the level of anticipated opposition from other political parties.
- Sustainability: This accounts for whether the reform will have any notable impacts in areas such as energy efficiency, renewable energy, and the reduction of local air pollution and global greenhouse gas emissions.

The framework has been populated with two main sources of information:

- Existing analysis: Existing analysis may have explored the anticipated impacts of any given option across a range of areas. This information will be used to contribute toward the accuracy of any of the given scores across all criteria.
- Interviews: Interviews will be conducted with a wide range of stakeholders. These interviews will be used to identify reform options and to identify sources of existing analysis on those reform options. The interviews will also be used to collect data on a specific sub-set of the evaluation categories, including: macroeconomic impacts, household welfare, farmer welfare and political acceptability.

Annex 3.2 Definition of household segments

Considering the characteristics of Mexican residential electricity tariffs and the impacts that their reform can have on households, we identified two main criteria to segment the population: income level and region.

Residential electricity tariffs in Mexico are already differentiated according to the level of consumption and to the regional climate (see Annex 2). Income criteria do not intervene in the assignation of the tariff type, but it is an important parameter to consider for subsidy reform. According to the National Survey on Household Income and Expenditure (Encuesta Nacional de Ingresos y Gastos en los Hogares [ENIGH]) , the share of electricity cost in a household total budget was very similar for different income groups, representing around 3 per cent of the total household expenditure.[221] However, the impacts of a subsidy reform would be expected to differ per income group, especially considering that 53.4 million of Mexicans (43.6 percent of total population) are considered as poor according to national standards (2016 figures).[222] Furthermore, differences in levels of electricity consumption between rural and urban areas have been observed.[223] However, this evaluation will not consider this differentiation, since the tariffs do not include any specific element for rural or urban areas, and the income and consumption levels would reflect specific differences.

A more detailed analysis is needed to understand all the previous impacts and do a finer segmentation of the groups. For the purpose of this study and the qualitative analysis carried out, we will consider the following simplified six groups for the residential sector:

Income level	Climate
Low income	Temperate
	Warm
Middle income	Temperate
	Warm
High income	Temperate
	Warm

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