



Whitepaper Mexico Cleantech

Center for Business in the Americas

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Executive Summary

Environmental protection is a new and increasingly important concept in Mexican policy making. In addition, the country needs to improve its insufficient and ageing infrastructure. New policies, laws and regulations support a new mindset to tackle these important issues.

With economic growth the need for energy is increasing.

The Mexican energy reform, which is currently being implemented, will end the state monopoly and liberalize the market. Diversification of energy sources, growth of renewable energy and reduction of carbon dioxide and greenhouse gases are among the government's long-term goals for the coming 20 years. Auctions for contracts in wind, solar and geothermal energy started in March 2016, initializing the wholesale market and attracting large international energy companies into Mexico.

In line with the Mexican government's initiatives, the three leaders of the NAFTA countries presented in June 2016 the North American Climate, Clean Energy and Environment Partnership Action Plan, to align their policies regarding clean energy, energy efficiency and emission goals. The three NAFTA countries joined the Paris Agreement on climate change, a reduction of emissions and promotion of a clean economy. Mexico ratified the agreement in September 2016¹. In March 2016 the countries of the Pacific Alliance (Mexico, Colombia, Peru and Chile) signed a green economy declaration, committing to a green development plan and discussing a possible carbon emissions market.

The Low Carbon Business Action (LCBA) supports the government's future goals for Mexico. The LCBA aims to reduce CO₂ emissions in Mexico by mapping the needs and fitting these with the best solutions of European companies in the areas of energy efficiency (buildings and industry), waste and waste water management.

Access for the Mexican population to clean drinking water is another leading policy objective. Mexico's water services are not fulfilling the requirements, which could be expected from an OECD country. Even in the capital, less than half of the population has access to a constant stream of drinking water, leading to tensions within the society.

This Whitepaper is the result of a thorough analysis of 11 different Cleantech sectors in Mexico, including current policy changes.

The Whitepaper evaluates national and international incentive programs of these sectors and concludes that six sectors in Mexico should be of special interest for Swiss internationally oriented Cleantech companies, namely: drinking water, waste water treatment, solar energy, energy efficiency, sustainable buildings and pollution control.

Table 1: Key Cleantech Figures

| Key Cleantech Figures | |
|----------------------------------------------------|--------------------------------------|
| Investments in clean energy 2016-2030 | USD 72 bn |
| Added capacity clean energy 2016-2030 | MW 35.534 |
| Annual CO₂ reduction 2015 - 2040 | 64 M-tons |
| Water consumption per capita annually | 690 m ³ (77% agriculture) |
| Drinking water distribution loss | 30-40% |
| Population without running water | 9 m |

¹ United Nations Framework Convention on Climate Change, 2016

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List of Abbreviations

| | |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| ACE | Air Climate Energy |
| AMEXCID | Agencia Mexicana de Cooperación Internacional para el Desarrollo (Mexican Agency for International Development Cooperation) |
| ATVM | Aguas Tratadas del Valle de México (Mexico Valley Sewage System) |
| BANCOMEXT | Banco Nacional de Comercio Exterior, S.N.C. (Mexican National Bank of Foreign Trade) |
| BANOBRAS | Banco Nacional de Obras y Servicios Públicos, S.N.C. (National Works and Public Services Bank) |
| BBC | British Broadcasting Corporation |
| BEEC | Building Energy Efficiency Certificate |
| BID | Banco Interamericano de Desarrollo (Inter-American Development Bank) |
| BNEF | Bloomberg New Energy Finance |
| BOT | Build Operate and Transfer |
| B-USD | Billion Dollars |
| C.P. | Postal Code |
| CDMX | Ciudad de México (Mexico City) |
| CEL | Clean Energy Certificates |
| CEMIE | Centros Mexicanos de Innovación de Energía (Mexican Energy Innovation Centers) |
| CENACE | Centro Nacional de Control de Energía (The National Energy Control Center) |
| CFE | Comisión Federal de Electricidad (Federal Electricity Commission) |
| CHF | Swiss Francs |
| CIA | Central Intelligence Agency |
| CIF | Climate Investment Fund |
| CNH | Comisión Nacional de Hidrocarburos (National Hydrocarbons Commission) |
| CNN | Cable News Network |
| CONABIO | Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (National Commission for Knowledge and Use of Biodiversity) |
| CONAGUA | Comisión Nacional del Agua (National Water Commission) |
| CONACYT | Consejo Nacional de Ciencia y Tecnología (National Council for Science and Technology) |
| CONAVI | Comisión Nacional de Vivienda (National Housing Commission) |
| CONUEE | Comisión Nacional para el Uso Eficiente de la Energía (National Commission for Efficient Energy Use) |
| COP | Conference of Parties (under the United Nations Framework on Climate Change) |
| COP21 | United Nations Framework Convention on Climate Change, 21st Conference of the Parties |
| CRE | Comisión Reguladora De Energía (Energy Regulation Commission) |
| CTF | Climate Technology Fund |
| DAP | Derecho de Alumbrado Publico (Public Utility Tax) |
| DGGIMAR | Dirección General de Gestión Integral de Materiales y Actividades Riesgosas (General Department of Management of Dangerous Material and Activities) |
| DGIRA | Dirección General de Impacto y Riesgo Ambiental (Department of Environmental Risk and Impact) |
| EDGE | Excellence in Design for Greater Efficiencies, a green building certification system for emerging markets |
| EFTA | European Free Trade Association |
| ESCOs | Energy Service Companies |
| EU | European Union |
| FIDE | Fideicomiso para el Ahorro de Energía Eléctrica (Energy Savings Trust) |

| | |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| FIRA | Fideicomisos Instituidos en Relación con la Agricultura (Trust Funds for Rural Development) |
| FIRCO | Fideicomiso de Riesgo Compartido (Shared Risk Trust) |
| FONADIN | Fondo Nacional de Infraestructura (National Infrastructure Trust) |
| FOTEASE | Fondo para la Transición Energética y el Aprovechamiento Sostenible de la Energía (Fund for Energy Transition and Sustainable Use of Energy) |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility (Co-funding programs by international institutions) |
| GHG | Greenhouse Gases |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (German Agency for International Cooperation) |
| GW | Gigawatt |
| HFC | Hydrofluorocarbons |
| IADB/ IDB/ BID | Inter-American Development Bank |
| IBRD | International Bank of Reconstruction and Development (World Bank) |
| IDTP | Instituto de Políticas para el Transporte y el Desarrollo (Institute for Transportation and Development Policy) |
| IEA | International Energy Agency |
| IEPS | Impuesto Especial sobre Producción y Servicios (Special Production and Sales Tax) |
| IFC | International Finance Corporation |
| IIC | Inter-American Investment Corporation |
| IMF | International Monetary Fund |
| INECC | Instituto Nacional De Ecología Y Cambio Climático (National Institute of Ecology and Climate Change) |
| ISO | International Organization for Standardization |
| KW | Kilowatt |
| KWp | Kilowatt-Peak (rated output) |
| LCBA | Low Carbon Business Action |
| LEED | Leadership in Energy and Environmental Design |
| LFIs | Local Financial Intermediaries |
| LGPGR | Ley General para la Prevención y Gestión Integral de los Residuos (General Law for the Prevention and Integral Management of Wastes) |
| LIE | Ley de Inversión Extranjera (Foreign Investment Law) |
| MDD | Milliones de Dolares (Million Dollars) |
| MDL | Mecanismo de Desarrollo Limpio (Clean Development Mechanism – Kyoto Protocol) |
| MRV | Monitoring, Reporting and Verification |
| MW | Megawatt |
| MWh | Megawatt hour |
| MXN | Mexican Peso |
| NADB | North American Development Bank |
| NAFIN | Nacional Financiera (a Development Banking Institution by the Mexican Government) |
| NAFTA | North American Free Trade Agreement |
| NAMA | National Appropriate Mitigation Action |
| NDP | The National Development Plan |
| NL | Nuevo Leon State |
| NMT | Non-Motorized Transport |
| NRDC | National Resources Defense Council |
| NSSH | National Strategy of Sustainable Housing |
| OECD | Organization for Economic Co-operation and Development |
| PNDU | Programa Nacional de Desarrollo Urbano (National Urban Development Program) |
| PNI | Programa Nacional de Infraestructura (National Infrastructure Program) |
| PPP | Public Private Partnerships |

| | |
|----------|-------------------------------------------------------------------------------------------------------------------|
| PRODESEN | Programa de Desarrollo del Sistema Eléctrico Nacional (National Electric System Development Program) |
| PRODI | Grupo Promotor de Desarrollo e Infraestructura S.A. de CV (Private Company) |
| PROFEPA | Procuraduría Federal de Protección al Ambiente (Federal Attorney for Environmental Protection) |
| PRONASE | Programa Nacional para el Aprovechamiento Sustentable de la Energía (National Program for Sustainable Energy Use) |
| PSHCVM | Programa de Sustentabilidad Hídrica de la Cuenca del Valle de México (Mexico Valley Water Sustainability Program) |
| PTAR | Planta de Tratamiento de Aguas Residuales (Sewage Plant) |
| PV | Photovoltaic |
| PwC | Pricewaterhouse Coopers |
| REMSA | Recicla Electrónicos México (Private Company) |
| S.A. | Sociedad Anonima (Public Limited Company) |
| S.N.C. | Sociedad Nacional de Crédito (National Banking Corporation) |
| SCCP | Special Climate Change Program |
| SCT | Secretaría de Comunicaciones y Transportes (Communication and Transport Ministry) |
| SDC | Swiss Agency for Development and Cooperation |
| SECO | State Secretariat for Economic Affairs of Switzerland |
| SEMARNAT | Secretaría de Medio Ambiente y Recursos Naturales (Ministry of Environment and Natural Resources) |
| SEN | Sistema Eléctrico Nacional (National Electric System) |
| SENER | Secretaría de Energía (Mexican Ministry of Energy) |
| SHCP | Secretaría de Hacienda y Crédito Público (Ministry of Finance) |
| SHF | Sociedad Hipotecaria Federal (Federal Mortgage Society) |
| SIA | Schweizerischer Ingenieur und Architektenverein (Swiss Society of Engineers and Architects) |
| SiSeViVe | Sistema de Evaluación de la Vivienda Verde (The Green Housing Evaluation System) |
| SMEs | Small and Mid-sized Enterprises |
| SVUT | Schweizerischer Verband für Umweltechnik (Swiss Association of Environment Technology) |
| TV | Television |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |
| US | United States of America |
| USD | United States of America Dollar |
| UTTP | The Urban Transport Transformation Project |
| VAT | Value Added Tax |
| VSA | Verband Schweizer Abwasser- und Gewässerschutzfachleute (Swiss Water Association) |
| WRAP | Water Resources Management in Mexico: The Role of the Water Rights Adjustment Program |

1. Overview

1.1. Why This Whitepaper?

Mexico is a country of significant economic importance, measured both globally and within Latin America. The country is one of two Latin American members of the OECD (Chile being the other), with an economic size of Italy (GDP in USD 2015), and only slightly behind France and the United Kingdom².

Despite the present uncertainties in the bilateral US-Mexican relationship, Mexico is moving rapidly towards becoming a significant economic power with a clear objective to continue on its path of global economic integration.

Thus, with its economic growth and the position Mexico is assuming among the other OECD countries, the need for more and cleaner energy, clean water and reduction of the overall environmental impact is growing. In 2016 Mexico invested almost USD 15 billion in environmental measures.

With the recent visit by the President of the Swiss Federation in November 2016 the bilateral relationship between Switzerland and Mexico continues to be strengthened.

This Whitepaper aims to support Swiss Cleantech companies in their decision-making process for a possible market entry into Mexico.

Please notice, throughout the Whitepaper the separation of thousand (**1,000**) and decimals (**1.0**) is according to the American nomenclature.

1.2. Growing Environmental Awareness Leads to Policy Shifts

During the last two decades, Mexico has shown leadership towards implementing sustainable development measures. Climate change and water scarcity are among Mexico's major environmental challenges³. The country has therefore signed international agreements within the UN Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol, ratified in 1998. In 2015, before the COP21 conference in Paris, Mexico had pledged to substantially reduce greenhouse emissions by 50% between 2000 and 2050⁴, increase the clean energy share of total production to 35% by 2024, reduce methane releases, reach zero deforestation and guarantee urban and industrial water treatment for all cities larger than 500,000 inhabitants. The country was among the first countries to ratify the Paris Agreement, which came into force in November 2016⁵. The Federal Government subsequently outlined its "Climate Change Mid-Century Strategy"⁶. Additionally, Mexico will sell only ultra-low sulphate gasoline and diesel, recover methane from waste water plants and landfills and introduce bio digesters in agricultural production⁷.

These environmental policy changes will result in large future investment commitments. In 2015 alone, Mexico invested some USD 4 billion in clean energy⁸. Over the last decade the environmental investments have increased at an annual rate of 6%, amounting to USD 14.7 billion in 2016, as indicated in figure 1 below. Consequently, Mexico has established itself as a global leader in remedying climate change in recent years⁹.

² OECD, 2016

³ Téllez Martínez, Villarreal Ugarte, Menchaca, Porsen Oveergard, and Bremer, 2014

⁴ Climate Investment Fund [CIF], 2011

⁵ United Nations Framework Convention on Climate Change, 2016

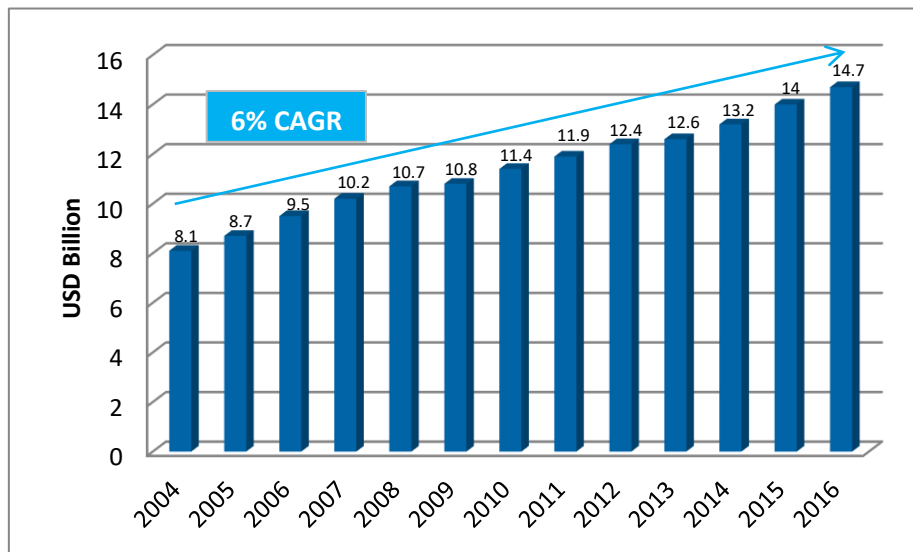
⁶ SEMARNAT-INECC, 2016

⁷ Expansión en Alianza con CNN, 2015

⁸ MacDonald, 2016a

⁹ NRDC, 2016

Overview

Figure 1: Mexico Environmental Investments¹⁰

Between 2001 and 2011 the energy consumption per capita grew more than 2% annually, while the energy production fell by 0.3% per year¹¹. The Ministry of Energy forecasts an annual increase in energy demand of 3.5% for the coming decade¹². Mexico's pledged goals on clean energy are leading to a shift in its energy production towards renewable energy. Costs of environmental degradation were estimated at approximately 5% of GDP in 2011, primarily triggered by the health impact of air pollution, while over-exploitation of natural resources – such as water – is threatening sustainability¹³.

The National Development Plan (NDP) 2007-2012 already introduced a National Climate Change Strategy, which included sustainability¹⁴. It has been followed by the national climate law with clear goals regarding GHG emission reductions with specific plans to reach these goals. One of several planning instruments of this law is the Special Climate Change Program SCCP 2014-2018 (PECC 2014-2018 in Spanish)¹⁵.

The EU project “Low Carbon Business Action in Mexico” was launched in December 2015¹⁶. The project will detect industries and entities interested in establishing cooperation partnerships. Furthermore, it supports the detection of “needs, existing technology gaps, possible funding in Mexico and creating a pool of potential consumers of green technologies with suppliers from the EU”¹⁷. Additionally, the project “identifies EU's best offer and technical state of the art solutions to cover the identified needs.” “The project will provide business opportunities between the European Union and Mexico in the following specific sectors: energy efficiency; construction industry; waste management; and waste water management”¹⁸. Accordingly, matchmaking events are being organized to bring some 200 European entrepreneurs together with Mexican stakeholders.

In June 2016, the three NAFTA countries announced their energy plan, as the three leaders committed to have 50% of their energy generated by green sources by 2025, prohibit HFC (hydrofluorocarbons) and significantly reduce greenhouse gas emissions, including methane from the oil and gas (40-45%

¹⁰ Hinman & Kreps, 2016

¹¹ Banco Interamericano de Desarrollo [BID], 2014

¹² PricewaterhouseCoopers [PwC], 2014

¹³ Valdivia de Richter, 2013

¹⁴ Téllez Martínez et al., 2014

¹⁵ SEMARNAT-INECC, 2016

¹⁶ Setuain, 2015

¹⁷ Low Carbon Business Action in Mexico, 2015

¹⁸ Low Carbon Business Action in Mexico, 2015

Overview

reduction by 2025), agriculture and landfills industry. Subsidies for fossil fuels will be phased out by 2025¹⁹. The plan also foresees measures to advance energy efficiency and promote zero/low emission vehicles.

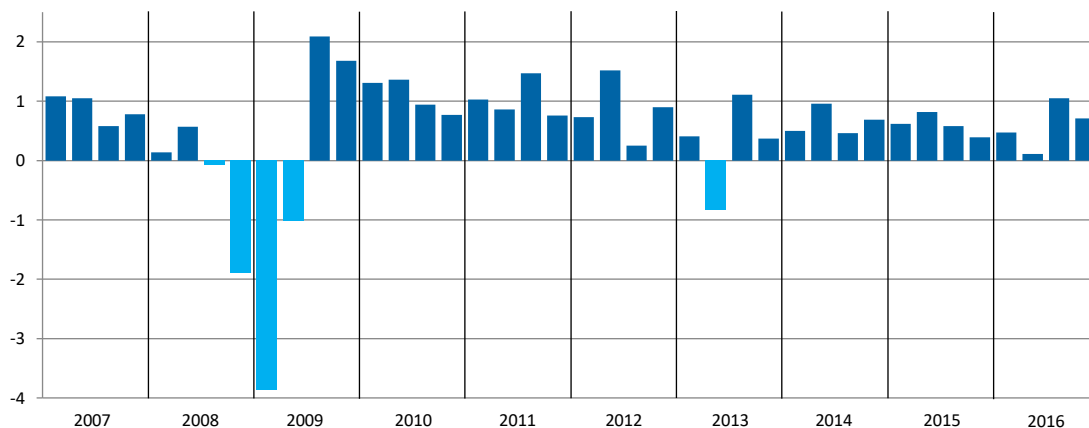
In March 2016, the Pacific Alliance's Ministers of Environment signed their Green Growth Platform²⁰ with the aim, among others, to strengthen sustainable consumption and production methods and promoting investments in environmental goods and services.

The economic impact of the Mexican initiative is significant. In a recent report, the International Finance Corporation (IFC) estimates the investment potential in renewable energy to USD 75 billion and more than USD 3 billion in energy efficiency measures²¹.

1.3. Mexico a Large Market and Great Opportunity for Swiss Companies

The Mexican population, (with its app. 128 million inhabitants) is growing around 1.6 million (or 1.4%) per year²². The economy has in recent years also been growing steadily at over 2% per year²³.

Figure 2: Quarterly GDP Percentage Change to Previous Period of Mexico²⁴



Among all the Latin American countries, Mexico keeps the first position in the 2017 “Ease of Doing Business” ranking issued yearly by the World Bank (47th overall), on par with EU countries like Italy (50) or Belgium (42)²⁵. Less positive is Mexico's 123rd position in the 2017 Corruption Perception Index by Transparency International²⁶.

Despite Mexico's economic growth in recent years, Switzerland's exports of goods to the country (without gold) dropped 17% in 2015 compared to 2014, reaching CHF 1,444 million – the same level as the annual exports to Sweden or the Czech Republic²⁷. In 2014, machines and electronics amounted to CHF 318 million²⁸.

¹⁹ The White House, 2016a

²⁰ The Pacific Alliance, 2016

²¹ International Finance Corporation [IFC], 2016

²² Worldometers, 2017

²³ TradingEconomics, 2017

²⁴ OECD, 2016b

²⁵ The World Bank Group, 2016a

²⁶ Transparency International, 2016

²⁷ Federal Department of Finance & Federal Customs Administration, 2016

²⁸ Federal Department of Economic Affairs, Education and Research & State Secretariat for Economic Affairs, 2016

Overview

A negative correlation between the currency exchange development (see chart on next page) and the drop in exports could be one of several explanations.

Switzerland's imports from Mexico have been rising in the last years, surpassing its corresponding exports²⁹.

Top Swiss imports from Mexico are pharmaceuticals, vitamins and diagnostics, accounting for 46% of all Swiss imports. The same industries reach number one status in Swiss exports, followed by machines and electronics, precision instruments and watches.

Since July 2001, Switzerland, as a member of the European Free Trade Association (EFTA), has benefited from the free trade agreement signed with Mexico, allowing practically all of EFTA's exports to enter Mexico tax-free. The Mexican government recently implemented different reforms in order to reduce entry barriers such as expenditures for company registration for foreign investors and needed time to start a new business. It is expected that these reforms will further increase foreign direct investment in Mexico^{30/31}.

Being an OECD country, Mexico is not a focus country of Swiss Agency for Development and Cooperation (SDC), or the State Secretariat for Economic Affairs (SECO).

Figure 3 shows the steady depreciation of the Mexican peso against the Swiss Franc, resulting in very attractive investment opportunities in Mexico for Swiss companies. By 2013, the total Swiss direct investment in Mexico amounted to CHF 12.8 billion³². Swiss companies employ approximately 52,000 people in Mexico and are the 9th biggest direct investors in Mexico³³.

Figure 3: MXN – CHF Chart (01.2007 – 01.2017)³⁴



²⁹ Federal Department of Finance & Federal Customs Administration, 2016

³⁰ The World Bank Group, 2016b

³¹ Speyside Corporate Relations, 2016

³² State Secretariat for Economic Affairs [SECO], 2016

³³ Secretaría de Economía, 2015

³⁴ XE, 2017

1.4. Whitepaper Purpose and Methodology

Due to the above-mentioned shifts in its environmental policy and economic growth, Mexico needs new technologies in many sectors.

This Whitepaper will principally focus on the Cleantech areas, where Swiss companies are known to be strong (international) players. Thus, areas such as wind power, to be widely installed in Mexico, will not be discussed in detail.

As the Mexican Cleantech market appears not to have gained much attention yet by Swiss firms, this Whitepaper serves as a first comprehensive collection of the market conditions of the Cleantech sectors in Mexico. The paper is providing insights into sectors where Swiss companies are believed to have significant market opportunities, as well as highlighting sectors where it is recommended to refrain from entering.

The Whitepaper provides an overview over the general market conditions, regulations, growth prospects and political initiatives. Also financing aspects by international bodies, government programs and tax incentives specifically for the Cleantech/Energy sector are covered in the report. Moreover, other socioeconomic features that might lead to policy changes are included, such as social groups impaired by environmental change or insufficient infrastructure.

The Whitepaper is divided into the different Cleantech sectors and prioritized according to growth perspectives, domestic (Mexican) regulations and to the authors' estimations of the potential for Swiss Cleantech companies.

For each sector there is a description of the issues, the relevant investment programs of the below mentioned organizations regarding duration, conditions and amounts followed by a set of recommendations.

The paper takes into account the initiatives of:

- Mexico's Government agencies, ministries and governmental organizations
- Climate Investment Fund (CIF)
- Climate Technology Fund (CTF)
- International Monetary Fund (IMF)
- Inter-American Development Bank (IADB)
- International Energy Agency (IEA)
- International Finance Corporation (IFC)
- North American Development Bank
- OECD
- World Bank (IBRD)

2. Renewable Energy

2.1. Issues

Liberalization of Energy Production: The Mexican Energy Reform

The Mexican Energy Reform packages from 2015, the Electric Industry Law (LIE), the CFE Law terminating the status of Mexico's state power utility - Comisión Federal de Electricidad (CFE) - and the amendments of the articles 25, 27 and 28 in the Mexican constitution have ended 75 years of state monopoly.

The reform establishes a call for long-term procurement of (electric) power. The CFE (Federal Energy Commission) manages 75% of the installed generating capacity and has until 2015 been the only provider of electricity transmission and distribution services. The implementation of the electric reform is expected to be completed by 2018³⁵.

The Mexican Ministry of Energy (SENER) forecasts an annual increase in energy demand of 3.5%³⁶, while the total energy demand for the next 25 years is estimated to increase by approximately 72%, from currently 305 TWh to 512 TWh in 2040³⁷. By 2028 an additional total of 55-66 GW of capacity will be needed to meet the demand and to compensate for 11.8 GW of retirements^{38/39}.

The liberalization and privatization of the energy sector aim to increase the energy supply and hence lower prices. According to a recent IMF Working Paper, "reductions in electricity tariffs derived from the energy reform could increase manufacturing output annually by up to 3.6%, and overall real GDP by 0.6%"⁴⁰, due to improved competitiveness.

The vast majority of Mexico's energy is derived from fossil fuels, mainly natural gas. Mexico has 63.6 GW of installed capacity (2015)⁴¹, of which 48.0 GW from fossil fuels, 11.7 GW from hydropower, 1.4 GW from nuclear and 1.6 GW from wind energy. Co-generation facilities (e.g. gas energy plants which are also used for heating) and self-supplied energy production installations combine another 8 GW⁴². Natural gas production is growing too, but does not yet meet the country's needs. "Clean energy" includes nuclear energy and co-generation plants, according to the Mexican definition⁴³.

Mexico is the 7th largest oil producer in the world, but production has recently been declining due to ageing oil fields. In 2013 Mexico exported half of the oil, which accounted for 32% of total government revenues⁴⁴.

Renewables

According to a recent study by the IFC, the potential for renewable energy investments could reach up to USD 75 billion by 2030⁴⁵. In 2015, Mexico already invested USD 4 billion in renewable energy, reaching the 9th place in the Climatescope ranking on renewable energy⁴⁶.

³⁵ Noticias MVS, 2016

³⁶ PwC, 2014

³⁷ Noticias MVS, 2016

³⁸ Apricum, n.d.

³⁹ Sopinka, 2015

⁴⁰ Alvarez & Valencia, 2015

⁴¹ Secretaría de Energía [SENER], 2016

⁴² Sopinka, 2015

⁴³ Hering, 2015

⁴⁴ Sopinka, 2015

⁴⁵ International Finance Corporation [IFC], 2016

⁴⁶ García, 2016a

Renewable Energy

To meet the needs for more energy, Mexico is, as mentioned, planning to add another 57 GW installed capacity by 2030⁴⁷, hereof app. 35 GW in clean energy, attracting an estimated USD 120 billion in total energy investments, including distribution and transmission. This program will cost the Mexican government around USD 14 billion⁴⁸.

In addition to gas co-generation, Mexico will be looking into three areas of renewable energy generation, namely wind, solar and geothermal energy.

According to the national development program PRODESEN (Programa de Desarrollo del Sistema Eléctrico Nacional), Mexico will add the following clean and conventional energy capacities by 2030:

Table 2: Mexican Energy Capacity Forecast 2015 - 2030

| Technology ⁴⁹ | 2015 | 2016-2030 | | 2015-2030 | |
|---------------------------|---------------|---------------|---------------------|----------------|---------------|
| | MW | New MV | M-USD ⁵⁰ | Total MW | |
| Wind | 1,600 | 12,000 | 21,248 | 13,600 | 11.3% |
| Co-Generation | | 7,045 | 6,704 | 7,045 | 5.8% |
| Hydro | 11,700 | 4,493 | 6,129 | 16,193 | 13.4% |
| Nuclear | 1,400 | 4,191 | 18,411 | 5,591 | 4.6% |
| Solar | 100 | 6,849 | 18,411 | 6,949 | 5.8% |
| Geothermic | 800 | 895 | 1,362 | 1,695 | 1.4% |
| Bio Energy | | 61 | 59 | 61 | |
| Cleant Total | 15,600 | 35,534 | 72,324 | 51,134 | 42.4% |
| Fossil Fuels | 48,000 | 20,454 | 17,836 | 68,454 | 56.7% |
| Other Conventional | | 1,136 | 1,308 | 1,136 | 0.9% |
| Conventional Total | 48,000 | 21,590 | 19,144 | 69,590 | 57.6% |
| Energy Total | 63,600 | 57,124 | 91,468 | 120,724 | 100.0% |

As the numbers in table 2 indicate, the interest in non-hydro renewables is still new in Mexico.

Another 21.5 GW will be added through conventional energy sources, principally oil and gas amounting to approximately USD 19.1 billion.

Most of the new capacity will be for (grid) distribution. The investments in distribution and transmission will amount to approximately USD 30.5 billion during the same period.

However, Mexico also plans to expand the so-called own use capacity. Currently, 293 MW of hydro power is installed for own use.

⁴⁷ PwC, 2016

⁴⁸ Bierzwinsky et. al., 2016

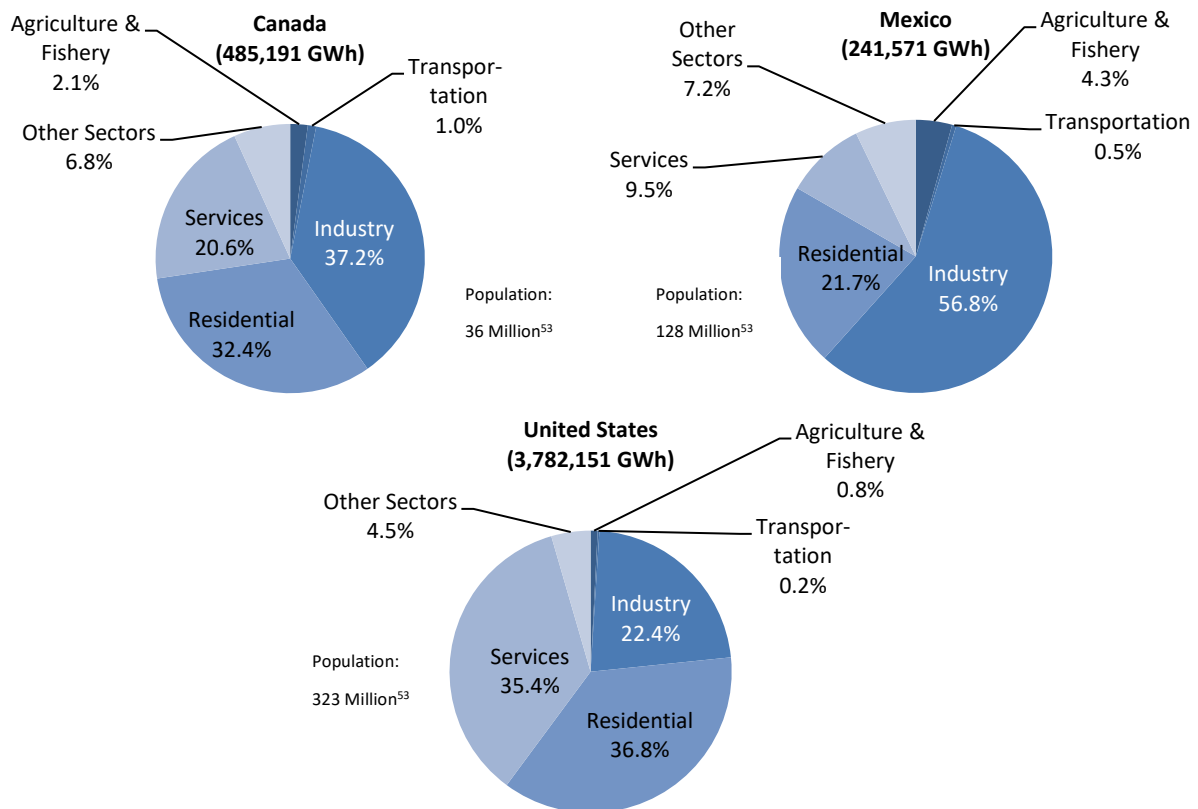
⁴⁹ PwC, 2016

⁵⁰ X-Rates, 2017 (Average Exchange Rate USD-MXN in 2016: 1USD = 18.69 MXN)

Renewable Energy

Mexico will need significantly more capacity to meet the economic and societal growth forecasts, exemplified by figure 4, which compares the present (2013) energy consumption in the three NAFTA countries and their respective sectors⁵¹. Especially notable is the relatively low share of ‘services’ and ‘residential’ of the total Mexican energy consumption.

Figure 4: Composition of Electricity Consumption per Sector, 2013 of the Three NAFTA Countries (in GWh Percentage)⁵²



In rural areas, one to two million Mexicans still lack electricity. Here, small scale local solar facilities could be a solution, rather than expanding the grid⁵⁴.

In hydro, the National Commission for Energy Efficiency (CONUEE) estimates that Mexico’s southern states have the potential to install more than 400 MW through small hydro projects⁵⁵.

By 2018, Mexico plans to triple the country’s installed wind energy capacity⁵⁶.

According to Bloomberg New Energy Finance (BNEF), by 2040 renewable energy will account for 69% of all energy sources in Mexico, reducing annual CO₂ emissions from 131M tons in 2015 to 67 million tons⁵⁷. Furthermore, BNEF expects a decrease in costs for generating onshore wind (per

⁵¹ SENER, 2015
⁵² SENER, 2015
⁵³ Population Reference Bureau, 2016
⁵⁴ The World Bank, 2016a
⁵⁵ U.S. Embassy - Mexico City, 2013
⁵⁶ Sopinka, 2015
⁵⁷ Noticias MVS, 2016

Renewable Energy

MWh) by 41% by 2040, and solar photovoltaics by 60%, making these two technologies the cheapest options for producing electricity in Mexico from 2020 onwards⁵⁸.

In the last quarter of 2016, five new large projects are going through the formal procedures with the Secretaría de Medio Ambiente y Recursos Naturales (Semarnat). One wind and one solar project will be built in Coahuila state, where substantial industrial production growth is expected. Two solar projects are planned in Chihuahua State and one combined cycle plant in the state of Sonora⁵⁹. Those five plants will add 698 MW in these northern states.

Currently gas co-generation benefits the most from the reforms, due to its low price and its definition as clean energy.

However, some of the constructions for wind parks and hydroelectric power plants have recently been blocked by neighboring towns and *ejidos* (communal agricultural land) and have been encountering legal action. Several projects had to be suspended by those *amparos* (local legal actions against the state)⁶⁰.

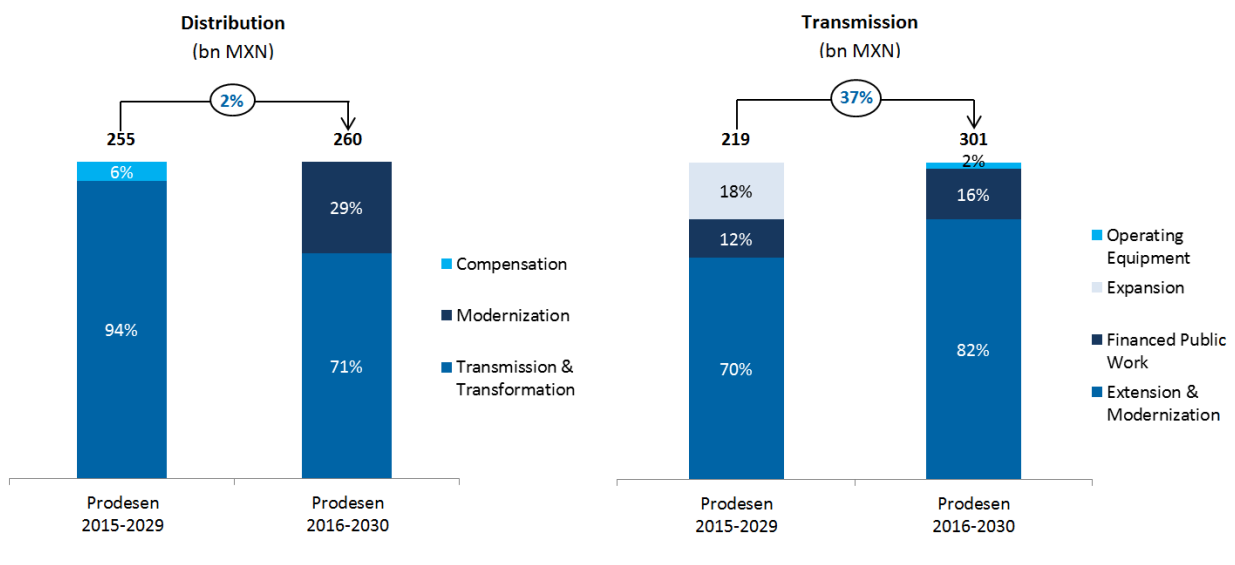
Transmission and Distribution

The increase in installed capacity will lead to a further expansion of the grid infrastructure worth approximately USD 30.5 billion in new investments⁶¹.

As indicated in figure 5, most of the investments will flow into the modernization and expansion of the distribution and transmission systems. (Please observe that the figures are in MXN, yearly average 2016: 1 USD = 18.69 MXN)⁶². Further, the 2016-2030 investment plan foresees a higher degree of modernization and publicly financed transmission projects, than the previous 2015-2029 plan⁶³.

CENACE, the Technical System Operator is responsible for managing the National Electric System and will thus oversee these new investments.⁶⁴

Figure 5: Distribution and Transmission Costs (in bn MXN)⁶⁴



⁵⁸ MacDonald, 2016b
⁵⁹ Vázquez, 2017
⁶⁰ Mexico News Daily, 2016
⁶¹ PwC, 2016
⁶² X-Rates, 2017
⁶³ PwC, 2016
⁶⁴ PwC, 2016

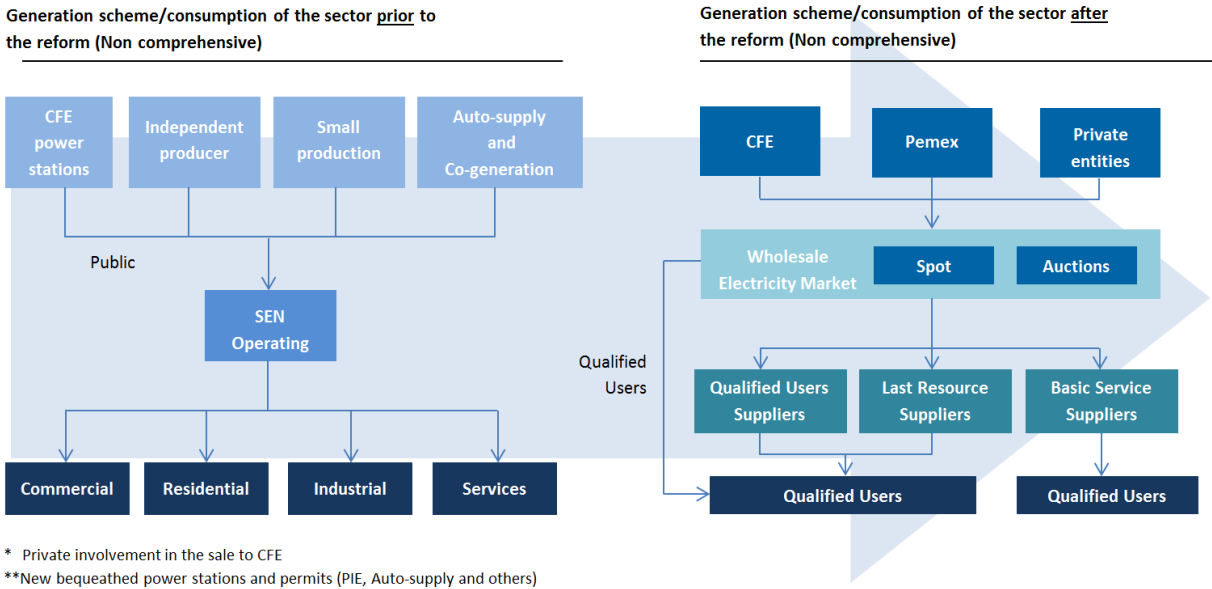
Renewable Energy

According to LIE, private companies can bid at CENACE for long term capacity contracts in energy transmission and distribution infrastructure in combination with the state utility company, or SENER, the Secretariat of Energy of Mexico, which will carry out the distribution and transmission activities⁶⁵. The first tender, a 600 km high voltage direct current line between the Valley of Mexico and the Oaxaca state, was published in October 2016. Awards for this first privately built and operated transmission line will be granted in April 2017⁶⁶. A total of 24,599 km of transmission lines are expected to be built by 2029 in order to reach the 3.5% annual capacity growth⁶⁷.

Opening the Generation Market

With the latest legislation, Mexico is breaking the monopoly for distributed energy generation, as indicated in figure 6. The graph below shows the shift of the Mexican Electricity Reform. Before, prices and supply were set by a monopoly (SEN). Now public and private energy suppliers meet energy users at a wholesale market scheme.

Figure 6: Generation Scheme Before and After the Energy Reform⁶⁸



According to Apricum⁶⁹, the opportunities for foreign developers can be found in the downstream services sector for distributed and utility-scale generation, engineering, procurement and construction.

The first ever auction for large scale renewable energy in Mexico took place on March 30th 2016, where energy developers won 15-year contracts to produce 620 MW of wind and 1,100 MW of solar energy projects⁷⁰. The contracts for solar power include the right to provide 3,000 GWh of energy for USD 40.50/MWh to the CFE from 2018 onwards and were won by Enel Green Power (Italy),

⁶⁵ PwC, 2015
⁶⁶ Argusmedia, 2016
⁶⁷ PwC, 2015
⁶⁸ PwC, 2014
⁶⁹ Apricum, n.d.
⁷⁰ Dezem & Williams, 2016

Renewable Energy

SunPower Systems Mexico (USA) and Recurrent Energy, a subsidiary of Canadian Solar Inc. and Alten Renewable Energies (Spain/The Netherlands)⁷¹. The awarding of 5.4 million project related CELs (Tradable Clean Energy Certificates), in addition to the electricity tariffs, is needed to reach the above prices (see next page for a description).

The new solar projects are located in the states of Aguascalientes, Guanajuato and Coahuila. The contracts are expected to generate USD 2.1 billion in investments according to the Vice Minister of Energy, Cesar Hernandez.

This first Mexican renewable power auction attracted 109 bidders, who submitted 468 technical offers, while 69 bidders presented financial bids⁷². The second auction in September 2016 resulted in USD 4bn in investments in solar and wind energy for the production of 8.9 GWh, which represents 3% of the current energy generation in Mexico⁷³. The price agreed is set at USD 33.47/MWh. There will be more auctions in the coming months. Mexico forecasts private investments in the energy industry to reach USD 62.5 billion by 2018⁷⁴.

Certificates

Tradable Clean Energy Certificates (Certificados de Energías Limpias “CEL”) are instruments issued by the Mexican Energy Regulatory Commission (“CRE”)⁷⁵. Requirements and criteria are defined by SENER. Every “clean energy” producing plant will receive one CEL for each MWh generated and most industry participants will be required to obtain CELs in an open market⁷⁶. Those large companies need to reach 5% of renewable energy consumption by 2018. This new policy will come into effect in 2018 and will have a positive effect on the competitiveness of clean energy producers. Mexico promotes carbon reduction through cost effectiveness among its partners in the Pacific Alliance, where a common carbon market has been discussed⁷⁷.

Pricing

Mexico subsidizes almost all the energy generation including electricity, gasoline, diesel, and liquefied petroleum gas, which costs around USD 12.9 billion per year, equivalent to 1.7% of GDP⁷⁸. Subsidies are for most of the residential and agricultural consumption, while the commercial and industrial sectors are charged at the market prices⁷⁹.

In 2014 Mexico introduced a carbon tax on fossil fuels in order to promote cleaner fuels and to raise the awareness of CO₂ emissions. The law, “Excise Tax Law on Production and Services (IEPS Law)” and its amendments from 2016, stipulates increasing taxes according to the CO₂ emissions of the different types of fossil fuels. Only natural gas is exempted from any taxes⁸⁰.

Mexico counts on market oriented regulation schemes, instead of feed-in tariffs. Therefore, renewables compete directly with fossil fueled plants. Those schemes include net metering and self-supply, as well as small-scale producer schemes, in which renewable energy plants must compete directly with fossil-fired power plants. In order to get permits for energy projects, the provider presents the Ministry of Energy with not only an assessment of the social impacts, but also with mitigation measures⁸¹.

⁷¹ Díaz López, 2016

⁷² Díaz López, 2016

⁷³ García, 2016b

⁷⁴ Dezem & Williams, 2016

⁷⁵ Lajous, 2014

⁷⁶ Jones Day, 2015

⁷⁷ Diario de Puebla, 2016

⁷⁸ Sopinka, 2015

⁷⁹ Alvarez & Valencia, 2015

⁸⁰ The World Bank Group, 2016c

⁸¹ KMPG International Cooperative, 2015

Renewable Energy

Besides the regular subsidized household tariff, there are two other major non-subsidized tariffs driving the Mexican electricity market⁸². Firstly, for high energy consuming households (around 1 million) residential electricity prices cost up to 28 USDc/KWh⁸³. Secondly, for commercial facilities the tariff reaches up to 23 USDc/KWh⁸⁴.

It is expected, that new energy providers will be entering niche areas of generation and supply. The provinces Nuevo Leon (4.7 million inhabitants) and Queretaro (0.8 million inhabitants) have been named as favored locations, due to their growth potential and the lack of homemade devices stealing electricity from the grid (“diablitos”)^{85/86}.

Table 3: Cost for Renewable Energy Expected for the Upcoming Decades⁸⁷

| Type of Energy | Costs 2010 - 2020 (USD 2009 for MWh) | | | Costs 2021 - 2035 (USD 2009 for MWh) | | | Learning Effect |
|------------------------------|-----------------------------------------|------|------|-----------------------------------------|------|------|--------------------|
| | MIN. | MAX. | AVG. | MIN. | MAX. | AVG. | |
| Biomass | 119 | 148 | 131 | 112 | 142 | 126 | 5% |
| Onshore-Wind | 63 | 126 | 85 | 57 | 88 | 65 | 7% |
| Offshore-Wind | 78 | 141 | 101 | 59 | 94 | 74 | 9% |
| Geothermal | 31 | 83 | 52 | 31 | 85 | 46 | 5% |
| Solar FV - large scale | 195 | 527 | 280 | 99 | 271 | 157 | 17% |
| Solar FV - buildings | 273 | 681 | 406 | 132 | 356 | 217 | 17% |
| Concentrated Solar Plants | 153 | 320 | 207 | 107 | 225 | 156 | 10% |

The table above shows the expected reduction over time of different types of power generation. E.g. the cost of solar power (large scale) is expected to fall from an average of USDc 28/KWh to USDc 15.7/KWh by 2035. The learning effect indicates by how much (in percent) the investment costs should fall by every duplication of the previously accumulated installed capacity.

Regulatory Agencies

The following regulatory agencies are responsible for everything from bidding, contracts and regulation to tax collection:

- Secretaría de Hacienda y Crédito Público [SHCP] (Ministry of Finance)
- Secretaría de Energía [SENER] (Ministry of Energy)
- Comisión Nacional de Hidrocarburos [CNH] (National Hydrocarbons Commission)
- Comisión Reguladora De Energía [CRE] (Energy Regulation Commission)⁸⁸
- Comisión Federal de Electricidad [CFE] (Federal Electricity Commission) is the current state monopolist in producing and providing electricity.

⁸² Apricum, n.d.

⁸³ Apricum, n.d.

⁸⁴ Apricum, n.d.

⁸⁵ Meana, 2016

⁸⁶ Apricum, 2014

⁸⁷ SENER, 2012

⁸⁸ EY (n.d.)

Renewable Energy

2.2. Government Incentive Programs

There is a wide range of government incentive programs, especially through CONUEE, which are internationally funded. A list of major programs is provided in table 4:

Table 4: Government Incentive Programs

| Program | Description |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONUEE | CONUEE's program is funded through the World Bank via a USD 50 M loan from the Clean Technology Fund, a USD 250 m loan directly from IBRD and a USD 7 m Global Environmental Facility grant. |
| CONACYT | Are government programs similar to the Swiss CTI funding, to co-finance R&D energy projects between private sector SMEs, universities and research centers ⁸⁹ . |
| FOTEASE | FOTEASE 2014 (Fund for Energy Transition and Sustainable Use of Energy) grants USD 57 m through the federal government to support renewables and energy efficiency ⁹⁰ . This is used for funding different projects, such as change of lightbulbs. |
| CFE | CFE compensates small energy producers in order to reach a regular income and to stabilize prizes ⁹¹ . |
| Banco de Energia | Banco de Energia is a mechanism that receives the accumulation of overcapacity from producers of "own use" energy in order to sell it either when demand is higher or to the CFE ⁹² . |
| Net Metering | Net Metering for small scale projects of up to 10 KWp (Kilowatt-Peak=rated output) for homes and 30 KWp for companies ⁹³ . Cost for energy delivery to the national grid will be offset. |
| Transmission Fees | Clean energy producers profit from a discount in transmission fees: The fees for clean energy transmission cost 0.008 USD/KWh compared to the regular 0.018-0.02 USD/KWh ⁹⁴ . |
| Tax Incentives | Investments in machinery and equipment for production of renewable energy can be depreciated within 12 months. Non-polluting equipment for clean energy production will be excluded from Import and Export General Tax. Companies that generate renewable energy and maintain their operation for at least five years can deduct 100 % of their investment from their income tax payments in the period of one fiscal year ⁹⁵ . |
| Other Financing Mechanisms | Renewable financing schemes: Nacional Financiera, S.N.C. (NAFIN): is a national development bank that promotes modernization of the industrial sector and acts as a financial agent of the Federal Government. Its sources are derived from international development banks ⁹⁶ . Banco Nacional de Obras y Servicios, S.N.C. (BANOBRAS): is the national development bank for public works and private investments ⁹⁷ . Banco Nacional de Comercio Exterior (BANCOMEXT): is a national development bank. It aims to increase productivity and competitiveness of international Mexican firms ⁹⁸ . Fideicomiso de Riesgo Compartido (FIRCO): is a parastatal entity, promoting agriculture and fishery ⁹⁹ . |

⁸⁹ Gobierno de la República & Consejo Nacional de Ciencia y Tecnología [Conacyt], 2014

⁹⁰ Secretaría de Economía & Pro México, 2015

⁹¹ Secretaría de Economía & Pro México, 2015

⁹² Cogenera México, 2012

⁹³ Secretaría de Economía & Pro México, 2015

⁹⁴ Secretaría de Economía & Pro México, 2015

⁹⁵ Rodríguez-Ibáñez, 2013

⁹⁶ Nacional Financiera, 2008

⁹⁷ Banobras, n.d.

⁹⁸ Bancomext, 2015a

⁹⁹ Fideicomiso de Riesgo Compartido [Firco]. (2015)

Renewable Energy

Cont.: Table 4: Government Incentive Programs

| Program | Description |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mission Innovation Research Grants | The member states of 'mission innovation' pledged to double the public and private investments into innovative technologies in clean energy . In July 2016 SENER pledged USD 310 m for local scientific institutions called Centros Mexicanos de Innovación en Tecnologías Eólica, Geotérmica, Solar, Bioenergía y Océano (CEMIE). Those centers are partnerships between universities, research centers and private companies . |

2.3. International Programs

IADB and CIF are the main financing options for renewable energy projects.

Table 5: International Programs

| Program | Description |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| World Bank (IBRD) Projects | 2015: Project ID: P145618: USD 16.84 m: Sustainable Energy Technologies Development for Climate Change "improves the institutional capacity of Air Climate Energy (ACE) technology institutions (both public and private) in the territory of the recipient. Further it fosters the commercialization of ACE technologies by providing financial incentives to the private sector. Together they are expected to lead to GHG emissions reduction in the future" ¹⁰⁰ . The United Mexican States are the sole recipient of the funds, which finance the different programs and funds are diverted to FIDE (Fideicomiso de Ahorro de Energia) ¹⁰¹ . |
| NADB | 2015: USD 18.5 m: Solar Project Ahumada, Chihuahua. |
| NADB | USD 80 m: Wind Energy: La Mesa, Victoria, Güémez, Tamaulipa. |
| IADB | 2015: Project ID: ME-X1023: USD 100 m: Financial program to promote the gas market, cogeneration and renewable energy. "The objective is to promote private and public-private investments in productive public infrastructure in Mexico, in line with the objectives set forth in the National Infrastructure Program (PNI) for the energy, water, tourism, communications, and transportation sectors ¹⁰² . Within this context, the objective of the first program is to boost private and public-private investment in public gas, cogeneration and renewable energy infrastructure projects, in order to improve energy intensity and reducing the energy sector's contribution to climate change. To this end, the Bank will provide loans and guarantees to BANOBRAS to enable BANOBRAS to directly finance and leverage private-sector resources for productive infrastructure projects in the gas, cogeneration, and renewable energy sectors" ¹⁰³ . |
| IADB | 2015: Project ID: ME-L1172: USD 200 m: Risk management in gas and renewable energy ¹⁰⁴ . The fund seeks to mitigate financial risk of clean energy projects and secure their cash flow. This Program will fund BANCOMEXT, who will finance renewable energy and energy efficiency projects directly or through other international financial institutions. Bancomext finances renewable projects beyond USD 3 m ¹⁰⁵ . |
| IADB | 2015: Project ID: ME-M1106: USD 500,000: Ilumexico: Improving Energy Access in Rural Communities in Mexico. |
| IADB | 2014: Project ID: ME-L1160: USD 200 m: Financing for energy efficiency and clean energy projects via NAFIN Mexico's National Development Bank. The government seeks a 30% reduction of greenhouse gases by 2020. The highest potential to do so is in the energy sector ¹⁰⁶ . USD 100 m will be used to co-finance projects for renewable energy in projects that take longer than five years. USD 100 m will be used to finance projects for cogeneration plants in the industrial sector as well as for SMEs ¹⁰⁷ . Funds are distributed through NAFIN. |

¹⁰⁰ The World Bank, 2016b

¹⁰¹ The World Bank, 2016c

¹⁰² IDB, 2015b

¹⁰³ IDB, 2015c

¹⁰⁴ IDB, 2015d

¹⁰⁵ Bancomext, 2015b

¹⁰⁶ IDB, 2014a

¹⁰⁷ IDB, 2014a

Cont.: Table 5: International Programs

| Program | Description |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CIF | 2012: USD 20 m: Geothermal energy provides low carbon base-load capacity and represents one of the most effective electricity generation alternatives among clean energy sources ¹⁰⁸ . |
| CIF | 2011/2012: Project ID: PCTFMX052A: USD 110 m: The Energy Efficiency Program promotes the expansion of the supply for energy efficiency financing products and services by local financial intermediaries (LFIs) in Mexico. This will be accomplished by providing LFIs with the financial knowledge and technical cooperation needed, to develop projects and build a track-record of successful investments. The commercial banking component, the piece of the program financed by USD 22.4 m of CTF resources, guarantees the necessary funding to enable banks to expand their loan portfolios into energy efficiency financing and capacity building in order to implement the program ¹⁰⁹ . Since the programs implementation, it has been amended twice. In August 2013, the scope of the program was broadened to expand the benefits. Firstly, other financial intermediaries were included (in addition to commercial banks), such as investment funds or facilities, financial trusts, leasing companies, asset managers, energy servicing companies and insurance companies. Secondly, as an additional eligible technology, behind-the-meter small-scale renewable energy was added. Furthermore, the FIRA Green Line project was established with USD 2 m of CTF resources. A second amendment in November of 2014 changed coverage parameters at the warehousing phase, coverage to bond issuance, and technical cooperation activities. |

2.4. Recommendations

The start of auctions in the solar power market in 2016 triggered large investments with immediate effects. International solar companies operating in Mexico will need experienced subcontractors in order to build the solar parks, which are currently auctioned. There will be growth in small scale solar parks for rural areas and specialized companies can benefit from the government programs, which are supporting the millions of Mexicans, who still do not have electric power.

Leading Mexican and international players are already in the market (Abnegoa, Alstom, Sanyo Kyocera, Siemens etc.) . Large investments in solar energy will follow in the 2020s, when solar power is supposed to become the cheapest option to generate electricity. Companies with several years of proven experience in the Mexican market may have a competitive advantage for the tenders.

Swiss companies with a proven international track record should be well poised to compete in the market for renewable energy systems.

Figure 7: Major Renewable Energy Companies with a Presence in Mexico¹¹⁰



¹⁰⁸ CIF, n.d.a

¹⁰⁹ CIF, n.d.b

¹¹⁰ Secretaría de Economía & Pro México, 2015

3. Energy Efficiency

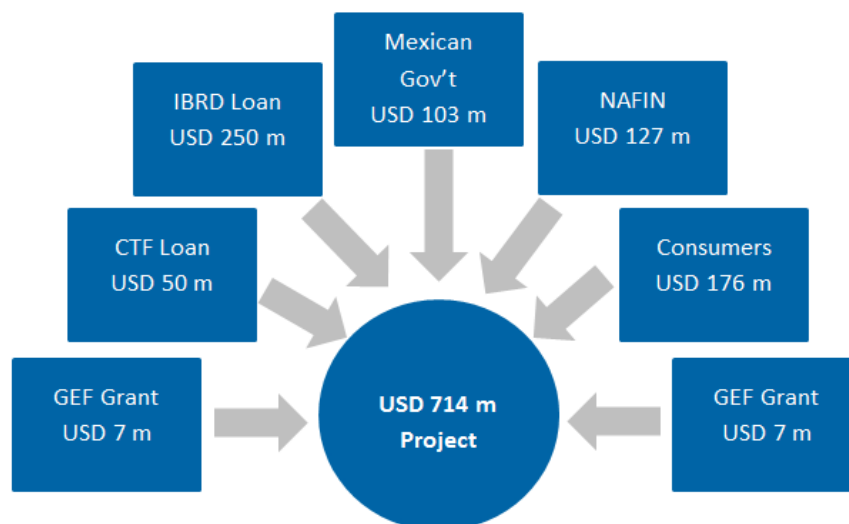
3.1. Issues

Estimates by Mexico's National Program of Sustainable Use of Energy 2014-2018 (Programa Nacional para el Aprovechamiento Sustentable de la Energía, PRONASE¹¹¹) indicate, that energy efficiency mechanisms may save energy consumption by approximately 34,800 to 40,500 GWh by 2025¹¹².

The International Finance Corporation (IFC) estimates an investment potential of around USD 3-4 billion by 2030 in energy efficiency measures for the industry, the transportation sector and in buildings¹¹³.

Figure 8 below describes Mexico's co-financing program to cut greenhouse gases and invest in residential energy efficiency measures. The co-financing package has been put in place to combine funds in order to implement Mexico's national climate change strategy. The funds are used to provide financial incentives for energy efficient production¹¹⁴.

Figure 8: Several Institutions Co-Financing the Residential Energy Efficiency¹¹⁵



CONUEE's energy efficiency strategy has the aim to reduce residential and municipal power consumption through increasing the energy efficiency of household lighting and appliances. Once implemented, the annual CO₂ emissions should be reduced by 5.14 million tons and savings of electricity by 10 TWh.

In addition, Mexico has in a recent NAFTA meeting agreed to further improve appliance and equipment efficiency standards, introducing the ISO 50001 energy performance standard¹¹⁶.

From a Benefit-Cost-Ratio perspective, the energy efficiency measures have a significantly higher impact than the renewable energy programs mentioned above¹¹⁷.

¹¹¹ SENER, 2014

¹¹² Inter-American Development Bank [IDB], 2015a

¹¹³ IFC, 2016

¹¹⁴ The World Bank, 2013

¹¹⁵ The World Bank, 2013

¹¹⁶ The White House, 2016a

¹¹⁷ Sopinka, 2015

Energy Efficiency

Mexico will also need to look into transmission losses, which are the highest of all OECD countries¹¹⁸. The new energy efficiency policy is supported by the National Commission of Efficient Use of Energy, (CONUEE), which is closely collaborating with the Danish Energy Agency.

CONUEE gives technical and financial support to municipal programs regarding energy efficiency measures. Nevertheless, only a few municipalities and states are taking part in the programs. Banobras, the Federal Bank for Public Infrastructure and Services, finances projects, which will be repaid by savings of energy or through the DAP (Derecho de Alumbrado Publico), a municipal tax for public lighting. The government of Peña Nieto claims to have saved over USD 100 million thanks to its efficiency measures¹¹⁹.

According to Copenhagen Consensus' estimations, the most efficient energy reduction measure is the removal of the fuel subsidies¹²⁰, which took full effect in January 2017, leading to a 14-20% increase in fuel prices (unleaded gasoline: 14%; premium gasoline: 20%; diesel: 16.5%)¹²¹, whereas the economic benefit from investments into renewable energies has a regressive economic impact (less than 1), as indicated in table 6 below:

Table 6: Cost/ Benefit of Mexican Energy Measures¹²²

| Target | Benefit | Cost | Benefit Cost Ratio |
|-----------------------|-------------------------------------------|-----------|----------------------------------|
| Renewable Energy | Midrange: \$4.25bn \$3.5 - \$5 bn | \$14 bn | <1 |
| Energy Efficiency | \$803 - \$1'060 m | \$307 m | 2.6 - 3.5 |
| Remove Fuel Subsidies | Midrange: \$12.32bn \$0.44 - \$24.2 bn | \$3.35 bn | Midrange: 3.68 0.13 - 7.23 |

*social protection programs to compensate the poorest for higher transportation cost

As the population relies on CFE as the sole energy provider subsidizing the electricity use, efforts for efficiency in residential housing do not have a large financial impact. The first moves in energy efficiency are currently in public and private lightbulbs. Efficiency measures in municipalities and other public organizations are supported by the different national programs mentioned and will lower their energy expenditures substantially.

¹¹⁸ Speyside Corporate Relations, 2016

¹¹⁹ SENER, n.d.

¹²⁰ Sopinka, 2015

¹²¹ Martin & Cattan, 2016

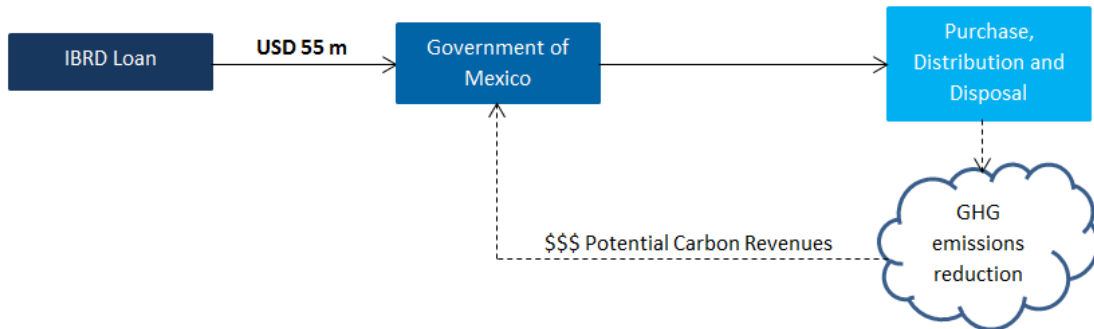
¹²² Sopinka, 2015

¹²³ The World Bank, 2013

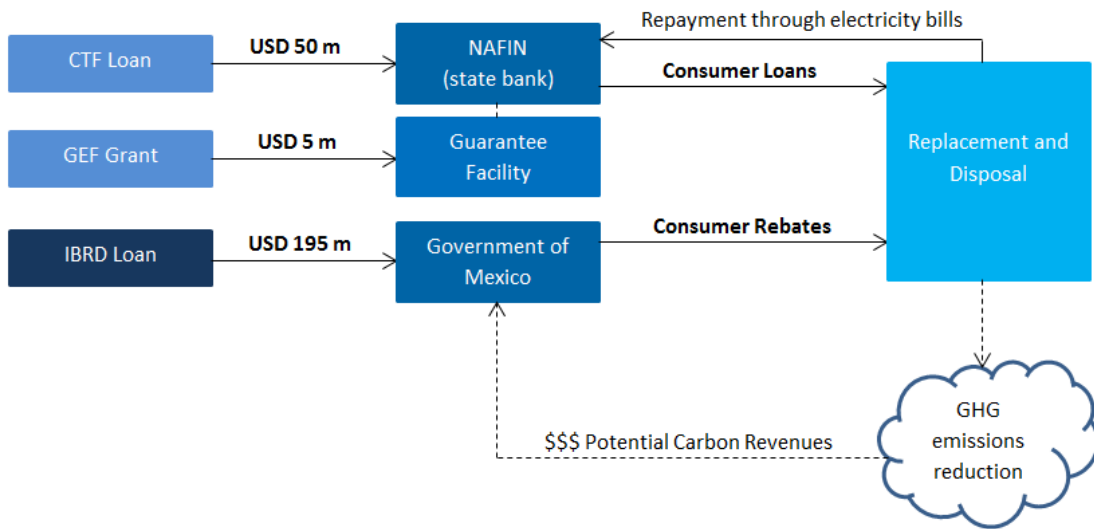
Energy Efficiency

Figure 9: Funding in Energy Efficiency¹²³

Light Bulb Replacement Component:



Appliance Replacement Component:



The residential energy efficiency program financed by the World Bank and other organizations is planned for 12 years.

3.2. Government Incentive Programs

There is a wide range of government incentive programs, especially through CONUEE, which are internationally funded. A list of major programs is provided in table 7:

Table 7: Government Incentive Programs

| Program | Description |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONUEE | CONUEE’s program is funded through the World Bank via a USD 50 M loan from the Clean Technology Fund, a USD 250 m loan directly from IBRD and a USD 7 m Global Environmental Facility grant. |
| CONACYT | Are government programs similar to the Swiss CTI funding, to co-finance R&D energy projects between private sector SMEs, universities and research centers ¹²⁴ . |

¹²⁴ Gobierno de la República & Consejo Nacional de Ciencia y Tecnología [Conacyt], 2014

Energy Efficiency

Cont.: Table 7: Government Incentive Programs

| Program | Description |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FIDE | Fideicomiso para el Ahorro de Energía Eléctrica (FIDE) is a private non-profit trust from the Comisión Federal de la Electricidad, which funds energy saving projects. The trust has two categories: FIDE Energy Efficiency and FIDE Business Eco-Credit for the distributed sector, with a maximum amount of USD 22,000 per project. FIDE is a financing tool for renewables and cogeneration projects under 500 KW ¹²⁵ . |
| FOTEASE | FOTEASE 2014 (Fund for Energy Transition and Sustainable Use of Energy) grants USD 57 m through the federal government to support renewables and energy efficiency ¹²⁶ . This is used for funding different projects, such as change of lightbulbs. |
| Banco de Energía | Banco de Energía is a mechanism that receives the accumulation of overcapacity from producers of “own use” energy in order to sell it either when demand is higher or to the CFE ¹²⁷ . |

3.3. International Programs

The main program is from the World Bank, supporting energy efficiency measures in municipalities.

Table 8: International Support Programs

| Program | Description |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| World Bank (IBRD) Projects | 2015: Project ID: P145618: USD 16.84 m: Sustainable Energy Technologies Development for Climate Change “improves the institutional capacity of Air Climate Energy (ACE) technology institutions (both public and private) in the territory of the recipient. Further it fosters the commercialization of ACE technologies by providing financial incentives to the private sector. Together they are expected to lead to GHG emissions reduction in the future” ¹²⁸ . The United Mexican States are the sole recipient of the funds, which finance the different programs and funds are diverted to FIDE (Fideicomiso de Ahorro de Energía) ¹²⁹ . |
| World Bank (IBRD) | 2016-2029 Project ID: P149872: USD 100 m Mexico - Municipal Energy Efficiency Project. “The objective of the project is to promote the efficient use of energy and natural resources in the borrower’s municipalities by carrying out energy efficiency investments in selected municipal sectors, and contributing to strengthen the enabling environment” ¹³⁰ . |
| World Bank (IBRD), IBRD, CTF, NAFIN | 2011: Residential Energy Efficiency Program ¹³¹ . Increases the penetration of more efficient technologies in the residential electricity sector and implements the scrapping of old appliances and public intervention coupled with innovative financing. Total USD 714 m. (Financing sources see figure 7) Objective: reduction of 5.14 m tons CO ₂ and 10 TWh. |
| IADB | 2015: Project ID: ME-L1172: USD 200 m: Risk management in gas and renewable energy ¹³² . The fund seeks to mitigate financial risk of clean energy projects and secure their cash flow. This Program will fund BANCOMEXT, who will finance renewable energy and energy efficiency projects directly or through other international financial institutions. Bancomext finances renewable projects beyond USD 3 m ¹³³ . |
| IADB | 2014: Project ID: ME-L1160: USD 200 m: Financing for energy efficiency and clean energy projects via NAFIN Mexico’s National Development Bank. The government seeks a 30% reduction of greenhouse gases by 2020. The highest potential to do so is in the energy sector ¹³⁴ . USD 100 m will be used to co-finance projects for renewable energy in projects that take longer than five years. USD 100 m will be used to finance projects for cogeneration plants in the industrial sector as well as for SMEs ¹³⁵ . Funds are distributed through NAFIN. |

¹²⁵ Fideicomiso Para El Ahorro de Energía Eléctrica [FIDE], 2017

¹²⁶ Secretaría de Economía & Pro México, 2015

¹²⁷ Cogenera México, 2012

¹²⁸ The World Bank, 2016b

¹²⁹ The World Bank, 2016c

¹³⁰ The World Bank, 2016d

¹³¹ The World Bank, 2013

¹³² IDB, 2015d

¹³³ Bancomext, 2015b

¹³⁴ IDB, 2014a

¹³⁵ IDB, 2014a

Cont.: Table 8: International Support Programs

| Program | Description |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IADB: IDB/CTF | USD 125 m energy efficiency financing through the issuance of green bonds. The two energy servicing companies ECON and VEOLUS could profit from those funds during the first phase ¹³⁶ . |
| CIF | 2011/2012: Project ID: PCTFMX052A: USD 110 m: The Energy Efficiency Program promotes the expansion of the supply for energy efficiency financing products and services by local financial intermediaries (LFIs) in Mexico. This will be accomplished by providing LFIs with the financial knowledge and technical cooperation needed, to develop projects and build a track-record of successful investments. The commercial banking component, the piece of the program financed by USD 22.4 m of CTF resources, guarantees the necessary funding to enable banks to expand their loan portfolios into energy efficiency financing and capacity building in order to implement the program ¹³⁷ . Since the program's implementation, it has been amended twice. In August 2013, the scope of the program was broadened to expand the benefits. Firstly, other financial intermediaries were included (in addition to commercial banks), such as investment funds or facilities, financial trusts, leasing companies, asset managers, energy servicing companies and insurance companies. Secondly, as an additional eligible technology, behind-the-meter small-scale renewable energy was added. Furthermore, the FIRA Green Line project was established with USD 2 m of CTF resources. A second amendment in November of 2014 changed coverage parameters at the warehousing phase, coverage to bond issuance, and technical cooperation activities. |
| CIF | 2014: Project ID: XCTFMX100A: USD 2.1 m for Energy Efficiency in Food processing Sector supporting FIRA (Trust Funds for Rural Development), a development bank supporting rural areas ¹³⁸ . |

3.4. Recommendations

Energy Efficiency Measures

Due to the rising energy demand, the need for energy efficiency measures in Mexico is obvious. The large and fast growing industrial complex does not receive government subsidies for its energy use and will need to purchase CLEs from 2018 onwards. The Mexican companies will have a natural need for efficient energy measures in order to lower their cost base. Swiss Cleantech firms have vast experience in energy efficiency measures for manufacturing companies.

The large electricity transmission loss in Mexico seems to be another market opportunity for Swiss companies.

¹³⁶ IDB, 2015a

¹³⁷ CIF, n.d.b

¹³⁸ Fira, 2014

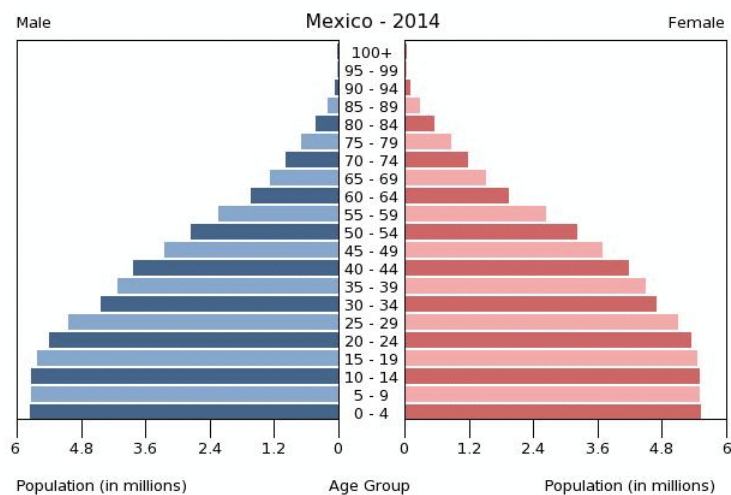
4. Sustainable Buildings

4.1. Issues

Mexicans require more and larger housing. Home owners from 25 to 45 years of age will be growing from 37.8 million people in 2005 to 45.8 million by 2030¹³⁹. Therefore, over 500,000 new homes are being built every year¹⁴⁰. Several programs for housing (the National Housing Program 2014-2018) and urban development (National Program for Urban Development 2014-2018) were approved in April 2014 in order to achieve the objectives outlined in the Program. The housing sector amounts to over 10% of Mexico's GDP. Mexico's National Housing Policy from 2015 includes the construction of around 11 million new homes and renovations of 9 million homes by 2030. Combined, the programs form a crucial step towards a broader qualitative shift in the Mexican housing policy towards larger urban developments in connection with urban service networks¹⁴¹. Infonavit is the largest housing fund in Mexico and is mainly involved in these policy changes. The Vida Integral Infonavit program includes 20 different factors defined by Infonavit, which will support funding^{142/143}.

Without any environmental measures, the current housing boom would lead to additional greenhouse gas (GHG) emissions of 25 Mt CO₂ per year by 2020¹⁴⁴. Therefore, in 2012, the National Housing Commission CONAVI developed the National Appropriate Mitigation Action (NAMA) program, which aims to reduce emissions. In December 2013, the Mexican government approved the Sectoral Program for Rural, Territorial and Urban Development 2013-2018 (Programa Sectorial de Desarrollo Urbano).

Figure 10: Mexico's Demographic Situation Implies Further Growth in Housing¹⁴⁵



¹³⁹ Wharton University of Pennsylvania, 2011

¹⁴⁰ Picornell, 2015

¹⁴¹ OECD, 2015

¹⁴² Infonavit, 2017

¹⁴³ Central Intelligence Agency [CIA], 2016

¹⁴⁴ German Federal Ministry for the Environment, 2014

¹⁴⁵ IndexMundi, 2016

Sustainable Buildings

Residential buildings are responsible for 17%-21.7% of the country's energy consumption^{146/147}. Sustainable buildings are rather new with only 139 (2015) LEED certified buildings¹⁴⁸. In 2012, a construction company and the City Express Hotel chain¹⁴⁹ started using EDGE certification from IFC¹⁵⁰. Currently, many new developments in the high prestige zones of Mexico City seek to obtain LEED Certification from the U.S. Green Building Council. National sustainable strategies also include a voluntary norm towards sustainability¹⁵¹. The Distrito Federal (Mexico City) promotes, in its Financial Code 2013, green construction, which includes tax reduction for house owners of up to 20% on the rights of water supply and companies, which can save up to 60% on salary tax^{152/153}. In the tourism sector there are 28 projects with Earth Check certification and 13 Green Globe certified projects¹⁵⁴. Mexico City is currently building a new airport for 120 million passengers, which will be the first worldwide to be LEED platinum certified¹⁵⁵.

Further, the country is currently building new industrial complexes and a large number of factories. Due to competitive wages, low regulations and its unrivalled trade relationships, containing over 40 free trade agreements,¹⁵⁶ Mexico has a fast growing manufacturing industry, including car manufacturing. Car manufacturing is highly energy consuming and green building and energy efficiency options will be of great interest.

4.2. Funding Programs

Programs in green buildings often support the lower priced sector of real estate inventory by reducing the mortgage interest, as indicated in table 9, below:

Table 9: Green Building Support Programs

| Program | Description |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hipoteca Verde | The hipoteca verde (green mortgages program) has been inaugurated by Infonavit to promote low energy usage buildings for low income households. Meaning, they finance up to USD 1,250 for eco technologies. ¹⁵⁷ The new green mortgage program for sustainable housing is on average about USD 6 more expensive per month, than a conventional mortgage. However, it will be saving USD 17 per month on bills, by consuming less electricity, water and gas ¹⁵⁸ . |
| Ecocasa SHF | The Ecocasa SHF (Sociedad Hipotecaria Federal) program finances green building mortgages. The goal is a reduction of 20% in greenhouse gas emissions from new buildings. The program subsidizes the mortgage interest rate to the builder, which compensates the additional cost for eco-friendly technology. Hence, the price of a building is the same as without the measures ¹⁵⁹ . |
| NAMA | Nationally Appropriate Mitigation Action (NAMA) is implemented by the Mexican National Housing Commission (CONAVI) ¹⁶⁰ . It focuses on a building's overall energy performance and supports cost and energy-efficient building concepts together with SHF. It includes capacity building, innovation and the improvement of existing incentive programs, supporting more ambitious energy efficiency plans. |

¹⁴⁶ German Federal Ministry for the Environment, 2014

¹⁴⁷ SENER, 2015

¹⁴⁸ Crea, 2015

¹⁴⁹ Menes, R., 2015

¹⁵⁰ IFC, n.d.

¹⁵¹ Secretaría de Economía, 2013

¹⁵² United Nations Environment Programme [UNEP]. (2014)

¹⁵³ Gobierno del Distrito Federal, 2009

¹⁵⁴ Téllez Martínez et al., 2014

¹⁵⁵ Nájjar, 2014

¹⁵⁶ Althaus & Boston, 2015

¹⁵⁷ Building and Social Housing Foundation [BSHF], n.d.

¹⁵⁸ Calderón & Lagos, 2015

¹⁵⁹ Sociedad Hipoteca Federal [SHF], n.d.

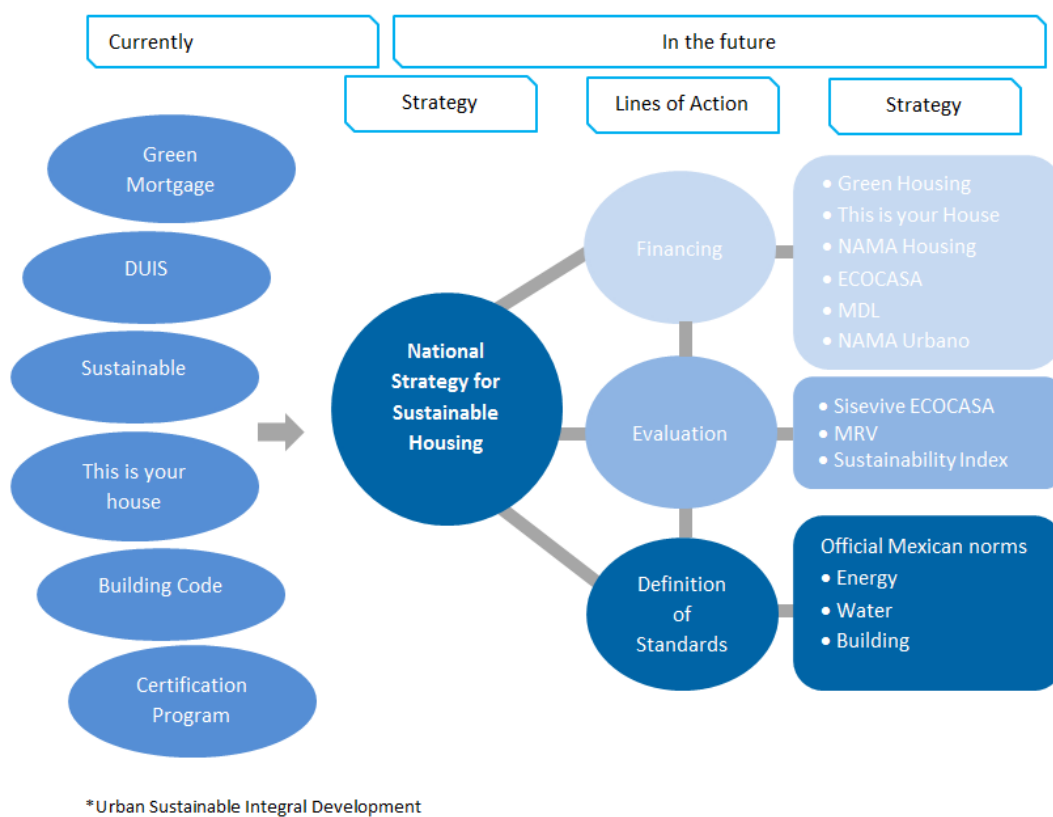
¹⁶⁰ Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ], n.d., a

Sustainable Buildings

Cont.: Table 9: Green Building Support Programs

| Program | Description |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SiSeViVe | Eco casa evaluates measures and enables sustainable designs for energy efficiency and green building solutions in the social housing sector, saving both energy and water ¹⁶¹ . It is supported by GIZ, the German Development Agency. |
| NSSH | The National Strategy of Sustainable Housing (NSSH) was developed in order to integrate policies and strategies to promote sustainable buildings, setting short medium and long term objectives regarding financing, evaluation and standard definition. It has been instituted in order to align national programs and strategies ¹⁶² . |

Figure 11: Financing Schemes of the National Sustainable Housing Strategy¹⁶³



The figure above shows how the existing financial incentive programs are now aligned in their actions to support the new National Strategy for Sustainable Housing.

4.3. Recommendations

As population grows, there will be a growing need for housing, preferably green buildings. Residential and commercial buildings need new energy saving solutions and the governments supports some measures already. In an environment, where energy production lags behind consumption, innovative energy saving solutions will prevail.

¹⁶¹ INHAB, n.d.

¹⁶² Conavi, 2015

¹⁶³ UNEP, n.d.

Sustainable Buildings

Swiss companies with proven technologies and know-how can enter into an environment, where there is a strong political intention to support such measures and where the cost of electricity and CO₂ exceed the cost of such measures.

Growth prospects can also be found in the large and ever growing Mexican industrial complex. Mexican factories and mines are highly energy intensive, but are paying the full price for electricity. Therefore, possible reductions of their fixed costs, using less electricity, form an incentive for investments into new energy saving technologies.

There is a clear possibility for Swiss companies to enter this market. Swiss clusters, such as SIA (Schweizerischer Ingenieur und Architektenverein) or SVUT (Schweizerischer Verband für Umwelttechnik) should inform their members regarding this interesting option.

It is advisable to directly collaborate with the financing organizations mentioned, as they advise the builders and buyers in their eligibility for financing schemes.

5. Mobility

5.1. Issues

Public transport is highly inefficient in Mexico, and traffic in the big cities continues to be a significant problem due to an insufficient infrastructure. There is a lack of institutional capacity to plan, design and implement projects successfully. The mobility law of Mexico City from 2014 creates a new mobility hierarchy, placing pedestrians and cyclists higher than motorists¹⁶⁴. The law emphasizes the right to mobility and is triggering local projects supporting sustainable mobility models.

Similar to European cities, several cities in Mexico are now initiating projects of tramways¹⁶⁵. After several failed attempts to revive Mexico's train systems, President Oscar Peña-Nieto announced in 2015 new projects including several intercity train lines such as Mexico City to Toluca and Queretaro, a new Metro line in Monterrey and the urban line in Guadalajara¹⁶⁶. Those projects have a total value of around USD 7 billion. The two train companies Ferrocarril de México (Ferromex) and Kansas City Southern de México are conducting investments of around USD 3 billion for new cargo train infrastructure, due to the growing output of vehicle manufacturing¹⁶⁷.

5.2. Funding Programs

Table 10: Mobility Funding Programs

| Program | Description |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PNDU | 2014-2018: The National Urban Development Program (Programa Nacional de Desarrollo Urbano 2014-2018, PNDU) has, among others, the objectives to control urban sprawl, to promote well-being and sustainable mobility, and to avoid the development of irregular and informal settlements. The share of funding for sustainable urban transport projects (e.g. mass transit, pedestrian and cyclist improvements) could be increased by further projects, financed by local governments ¹⁶⁸ . |
| Fondo Metropolitano | 2016: The Federal Metropolitan Fund (Fondo Metropolitano) provides an avenue of support for sustainable mobility projects ¹⁶⁹ . In the 2016 budget the fund received USD 600 m for infrastructure measures. Those assets finance projects in the states and are used mostly for road pavement ¹⁷⁰ . |
| Climate Investment Fund/ CTF | 2010: Project ID: XCTFMX048A: A CTF allocation of USD 200 m, USD 150 m from IBRD, USD 767 m from FONADIN USD 737 m from local governments and USD 2,344 m from the private sector form this CIF program from 2010 ¹⁷¹ . The program upgrades and modernizes urban transportation in selected Mexican cities, in order to lower air and noise pollution, congestion and greenhouse gas emissions. The projects aim "to contribute to the transformation of urban transport in Mexican cities toward a lower carbon growth path" ¹⁷² . "The USD 4.2 bn project is expected to save approximately 1.96 m tons of CO2 emissions per year until 2017" ¹⁷³ . Banobras, (Banco Nacional de Obras y Servicios Públicos S.N.C., the state owned National Works and Public Services Bank in Mexico) is the borrower and is responsible for procurement, financial management and oversight of the funds. |

¹⁶⁴ World Resources Institute, n.d.

¹⁶⁵ Del Toro, 2016

¹⁶⁶ Fuentes Vivar, 2015

¹⁶⁷ Informador, 2016a

¹⁶⁸ Diario Oficial De La Federación, 2014

¹⁶⁹ Diario Oficial De La Federación, 2016

¹⁷⁰ Garduño Arredondo, 2012

¹⁷¹ The World Bank, 2010

¹⁷² The World Bank, 2010

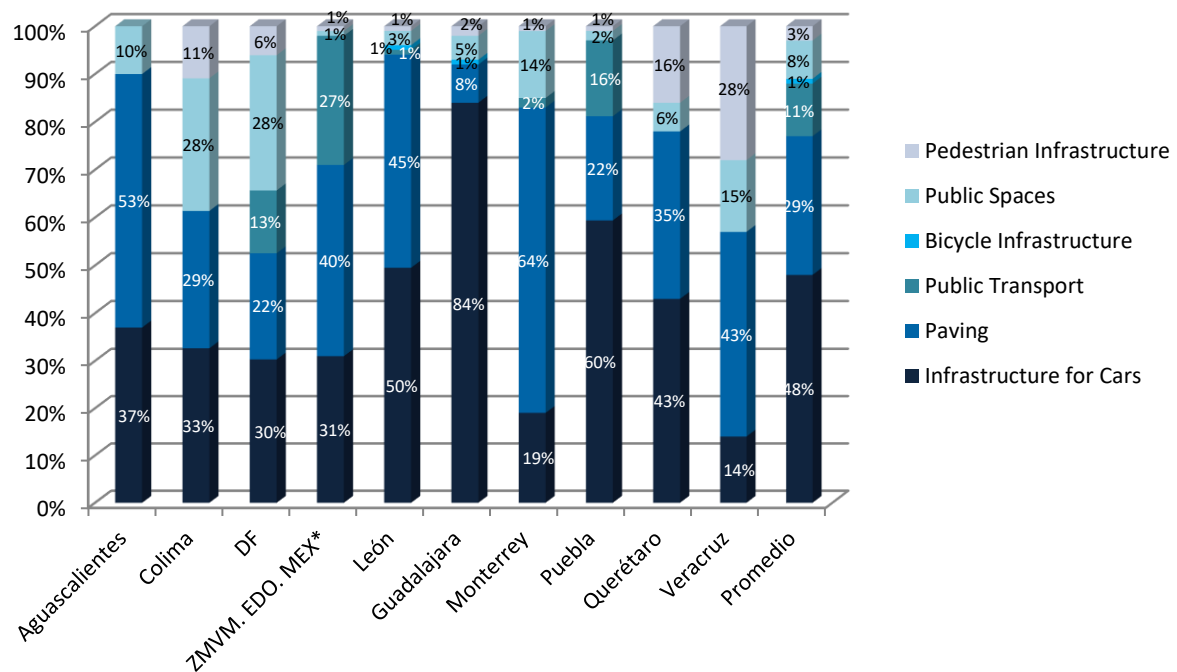
¹⁷³ CIF, n.d.c

Mobility

Cont.: Table 10: Mobility Funding Programs

| Program | Description |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UTTP | The Urban Transport Transformation Project (UTTP) aims to prioritize improvements in Mexican mass transit by investing into bus rapid transit (BRT) and non-motorized transport (NMT). The project's objective is to contribute to the transformation of urban transport in Mexican cities toward a lower carbon growth path. This will be achieved by improving the quality of services provided by the urban transport systems in a cost efficient manner, and by deploying equipment, infrastructure-, and operational strategies that reduce CO2 emissions ¹⁷⁴ . |
| Bono verde | 2016: A large fraction of Green Bonds worth USD 49 m, issued in Dec 2016 will be invested in public transport in Mexico City ¹⁷⁵ . |

Figure 12: Percentage Distribution of Federal Funds According to Type of Mobility¹⁷⁶



* Metropolitan Area of the Valley of México

Note: Percentages may not add up to 100%, due to rounding.

Public transport and clean transportation receive only a small fraction of mobility investments.

5.3. Recommendations

Swiss companies are early movers and current leaders in sustainable mobility (e.g. car sharing, bicycle and public transportation systems)¹⁷⁷. In large cities such as Mexico City, where a new law promotes eco-friendlier mobility and road safety, experienced Swiss companies in mobility consulting and conducting eco-friendly mobility or sharing systems, could enter this new markets.

¹⁷⁴ The World Bank, 2010

¹⁷⁵ Roa, 2016

¹⁷⁶ Garduño Arredondo, 2012

¹⁷⁷ TIFFANY STONE, n.d.

Mobility

The recent programs on train and tramway infrastructure might be of interest for Swiss companies involved in rail tracks construction, locomotives and trains, as well as operative and security systems. It is recommended to partner with leading Mexican companies to secure successful project acquisitions, financing and implementation in the above mentioned mobility areas.

6. Waste Water and Drinking Water Supply in Households

6.1. Issues

Only about 50% of the waste water is treated in Mexico. Some 600 existing water treatment plants are out of order for different reasons¹⁷⁸. CONAGUA, the National Water Commission, develops potable water treatment plants and upgrades waste water plants, desalination plants, pipelines and dams for the municipalities. In 2013, CONAGUA embarked on a USD 1.4 billion long-term sustainable national water management program. This program has the target to achieve a 100% treatment of waste water by 2030, requiring around USD 500 million public annual investments in waste water treatment plants^{179,180}. Currently, CONAGUA is implementing the “Programa Nacional Hídrico 2014-2018” that promotes integrated and sustainable water management solutions, in order to strengthen water supply and access to drinking water and sewage¹⁸¹. CONAGUA will invite companies to bid on the allocation of projects to upgrade municipal waste water treatment plants¹⁸². US companies such as RWL Water and Israeli companies such as Odis Adversa are already in the market¹⁸³.

Waste water treatment will be one of Mexico’s environmental priorities, as it is the “least developed part of Mexico’s water sector”¹⁸⁴. Although Mexico has almost doubled its volume of treated waste water in the last decade, it is still not enough to keep up with the demand¹⁸⁵. Waste water occurs in three sectors, urban, industrial and agricultural.

Waste water infrastructure has only been installed recently in urban areas. Many small towns and villages are still not connected to it. Many treatment plants operate below their actual capacity, due to a lack of maintenance and trained personnel¹⁸⁶. Activated sludge, a process for treating sewage and industrial waste waters using air and a biological floc, is used in 44% of all collected waste water. Another method includes waste stabilization ponds. A natural process using a combination of macro-physic plants, substrates and micro-organisms is used for 18% of collected municipal waste water. There is a large need for affordable waste water systems with low maintenance costs, which are environmentally sustainable¹⁸⁷.

Mexico City’s waste water has been used for agricultural irrigation, mainly for alfalfa, barley, wheat and corn in the valleys north of the city¹⁸⁸. 80% of the waste water used for irrigations, is uncleaned and unregulated¹⁸⁹, causing public health and environmental problems among the consumers of their products and the immediate surroundings¹⁹⁰.

Since less than 10% of the capital’s waste water is treated¹⁹¹, the government has implemented a water treatment program (Programa de Sustentabilidad Hídrica de la Cuenca del Valle de México, PSHCVM). Furthermore, the government is building the world's largest waste water treatment plant,

¹⁷⁸ Luege Tamargo, 2016

¹⁷⁹ Comisión Nacional Del Agua [Conagua], n.d.

¹⁸⁰ Luege Tamargo, 2016

¹⁸¹ BID, n.d.

¹⁸² Agentschap NL Ministerie van Economische Zaken, Landbouw en Innovatie, 2012

¹⁸³ RWL Water, 2015

¹⁸⁴ Hinman & Kreps, 2016

¹⁸⁵ Hinman & Kreps, 2016

¹⁸⁶ Zurita, Roy, & White, 2011

¹⁸⁷ Hinman & Kreps, 2016

¹⁸⁸ Stainton, 2016

¹⁸⁹ Carranza, Vega & Vega, 2011

¹⁹⁰ Jarman, 2016

¹⁹¹ Luege Tamargo, 2016

Waste Water and Drinking Water Supply in Households

Atotonilco¹⁹², with a maximum capacity of 3.6 million m³/day, with a total investment of around USD 550 million.

The treatment plant is financed through a share of 49% by the Mexican government and 51% by an international private investment consortium, which includes firms from Mexico, Japan and Spain¹⁹³. It is expected to clean about 60% of the waste water in the Metropolitan Area of Mexico City¹⁹⁴. Although 85% of the project has been concluded, the construction stalled in December 2015 for several months, due to discrepancies between the building consortium ATVM, which has signed a 30 years contract with CONAGUA, and the municipal government of Atotonilco. The reasons were alleged missed construction license fees, municipal tax payments and interests amounting to a total of USD 31 million¹⁹⁵. The consortium lost around USD 10 million during this interruption¹⁹⁶. After federal judges ordered the local authorities to continue, the mayor interfered with other charges and repeated this procedure nine times¹⁹⁷. Nevertheless, the project won the IIC 2016 Infrastructure 360 Award from the Inter American Investment Bank¹⁹⁸. Works resumed in June 2016 with a planned inauguration in 2017¹⁹⁹.

6.2. Drinking Water Issues

Water has become a scarce resource in some parts of Mexico. 9 million Mexicans have no access to fresh water in their homes²⁰⁰. According to the UN, “the main drivers of this change are the unregulated economic development and population growth, the growing demand for water by agriculture and industry, the pollution of surface water and groundwater, the deforestation and soil erosion, and the emerging impacts of the climate change”²⁰¹. According to Euromonitor International, 80% of Mexicans drink bottled water because they do not trust the tap water quality²⁰².

The reason for the water supply and services issues in Mexico are often the quality and efficiency of the water distribution, as 30-40% of the water is lost due to inadequate pipes²⁰³. 77% of water is used for agriculture, only 14% for public supply²⁰⁴.

Most water projects are financed through Public Private Partnerships (PPP) and managed by CONAGUA²⁰⁵. In total, during the 2015-2018 period, CONAGUA’s budget for water infrastructure development is USD 4 billion²⁰⁶. This will be leveraged to develop 1,200 new potable water treatment plants, to upgrade current waste water treatment plants, new desalination plants, water pipelines, and dams²⁰⁷. The overall Mexican municipal water and waste water market is expected to grow 7% annually between 2013 and 2018^{208/209}.

CONAGUA manages water resources at the federal level and is the only entity authorized to delegate or grant concessions for water usage. At community level the municipal governments provide water

¹⁹² BNamericas, 2017

¹⁹³ Sandino, 2015

¹⁹⁴ Nogarin, 2016

¹⁹⁵ Maldonado, 2015

¹⁹⁶ Romero, 2016

¹⁹⁷ Luege Tamargo, 2016

¹⁹⁸ Inter-American Investment Corporation [IIC], 2016

¹⁹⁹ Martínez, 2016

²⁰⁰ Speyside Corporate Relations, 2016

²⁰¹ Un Water, 2013

²⁰² Informador, 2016b

²⁰³ Personal Interview with Fabian Yañez, CEO Odis Adversa, 14.07.2016

²⁰⁴ Conagua, 2015a

²⁰⁵ Conagua, 2016

²⁰⁶ Conagua, 2015a

²⁰⁷ Hinman & Kreps, 2016

²⁰⁸ Hinman & Kreps, 2016

²⁰⁹ Hinman & Kreps, 2016

Waste Water and Drinking Water Supply in Households

services through decentralized utilities called “organismos operadores”, which are commissioned to develop water infrastructure. Nonetheless, they often lack technical capacity and work inefficiently. Therefore, CONAGUA became the developer and financier of water infrastructure in Mexico²¹⁰.

CONAGUA puts a special emphasis on “actions to reduce the demand, by increasing the efficiency in the use of water for irrigation and in water distribution systems in cities”^{211/212}.

However, confidence in the ability of municipalities is low²¹³. Even in Mexico City, many households live without fresh drinking water. The underground water quality is poor and has to be pumped from the hills. 70% of the city has less than 12 hours of running water and around 18% of the population has to wait several days for some hours of water. Supplies in this region are becoming increasingly tighter. There is a need for improvement of the drinking water infrastructure, as approximately 25-40% of the city’s water supply is lost due to leaking pipes²¹⁴. The city’s fresh water management has an annual budget of USD 150 million, which is not enough to improve the infrastructure. There is also growing social tension regarding the disbursement of water, - sometimes turning violent²¹⁵.

The Cutzamala System in Mexico City is one of the world’s biggest drinking water supply systems²¹⁶. Supplies must be pumped up from hundreds of meters underground, or from a distance of more than 100km, although Mexico has more rainy days than London²¹⁷. 60% of Mexico’s water resources is ground water²¹⁸. Prices in Mexico City are the highest in the country with around 80 pesos (app. USD 4) per cubic meter²¹⁹. Water supply companies using the “Build Operate and Transfer” model, (direct supply of drinking water to the end customer) reach a profitability of over 10% (in USD terms)²²⁰. In this scheme, the supply will be handed over to the municipal government after the agreed number of years of private operation.

²¹⁰ Hinman & Kreps, 2016

²¹¹ Conagua, 2015a

²¹² Conagua, 2015b

²¹³ Hinman & Kreps, 2016

²¹⁴ National Academy of Science, 2007

²¹⁵ The Guardian, 2015

²¹⁶ Conagua, 2015a

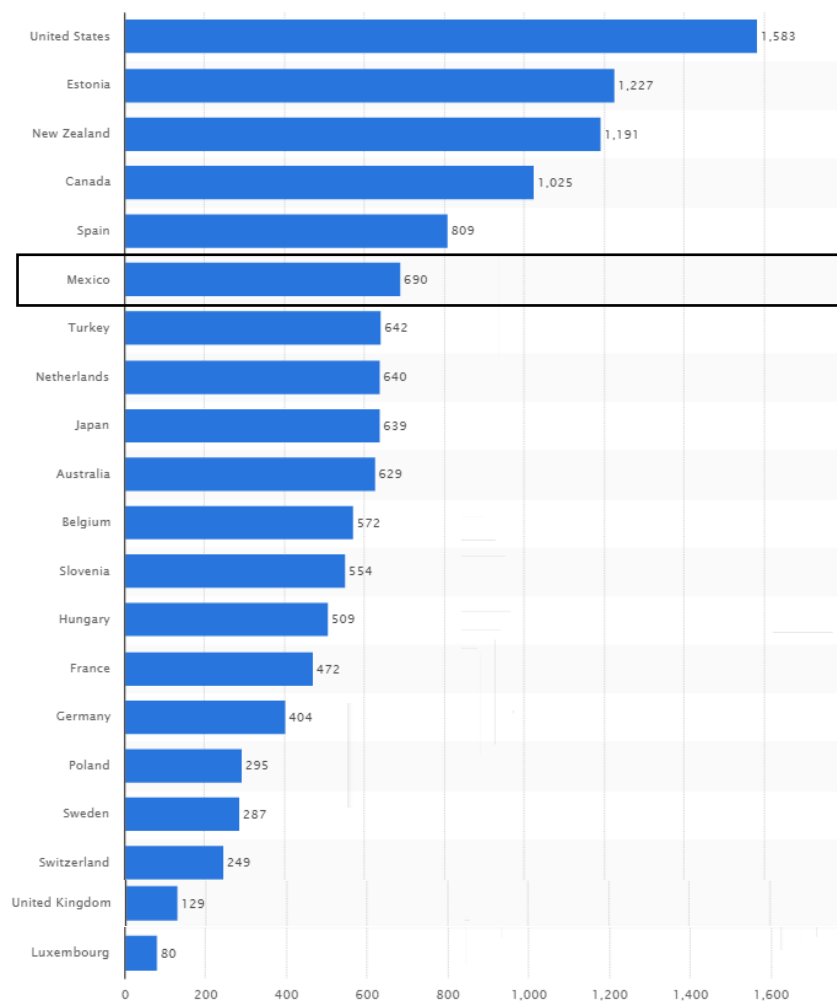
²¹⁷ The Guardian, 2015

²¹⁸ Conagua, 2015a

²¹⁹ Personal Interview with Fabian Yañez, CEO Odis Adversa Mexico, 14.07.2016

²²⁰ Personal Interview with Fabian Yañez, CEO Odis Adversa Mexico, 14.07.2016

Waste Water and Drinking Water Supply in Households

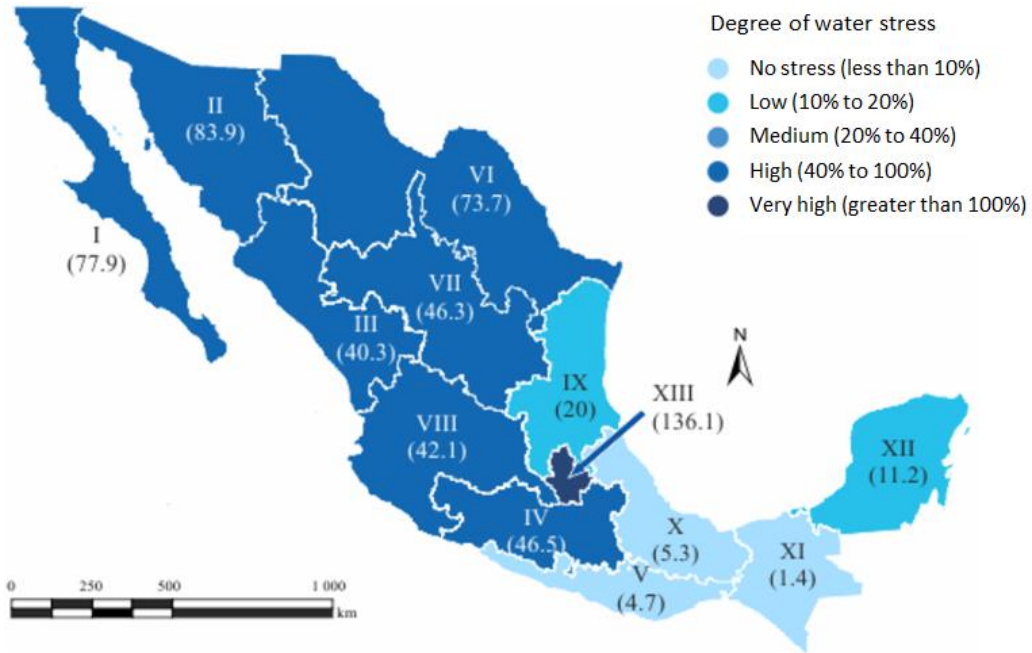
Figure 13: Annual Water Consumption per Capita in Selected Countries (in Cubic Meters) 2013²²¹

Mexico is among the countries with the highest water usage per person in the world (see figure 13). This could accelerate further infrastructure investment especially in places with high water stress. As visible in figure 14 the highest degree of water stress exists in the red and brown colored regions, which also represent the most populated areas of the country²²². New technologies in households could cut a large fraction of the water usage to the same average level as in Europe.

²²¹ Statista, 2017²²² Conagua, 2015a

Waste Water and Drinking Water Supply in Households

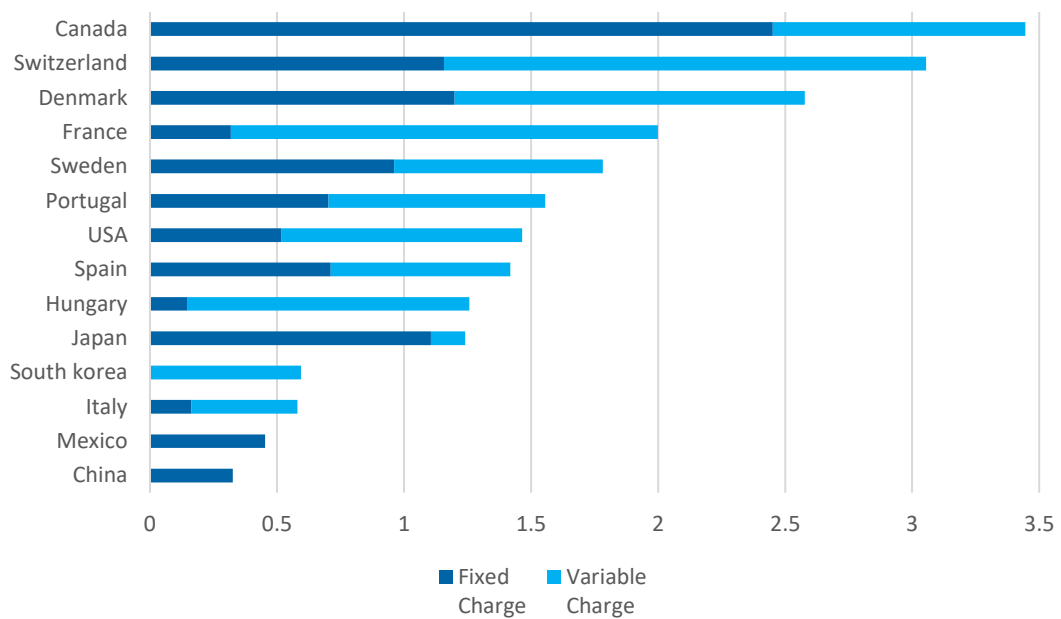
Figure 14: Degree of Water Stress, 2014²²³



Residential water prices vary between the regions. Water prices in Tijuana are ten times higher than in Ciudad Juarez.

In an international comparison the water tariffs in Mexico are among the lowest, as indicated in figure

Figure 15: Domestic Tariffs (USD/m³) – a Comparison Among Selected Countries (annual consumption of 100 m³)²²⁴



²²³ Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT], 2014

²²⁴ International Water Association, 2014

Waste Water and Drinking Water Supply in Households

6.3. Investment Programs for Both Fresh Water and Waste Water

Table 11: Investment Programs for Fresh and Waste Water

| Program | Description |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONAGUA | Conagua invites companies to bid for upgrading projects for its existing and new constructions of water facilities and desalination plants across the country ²²⁵ . |
| IADB | 2015: Project ID: ME-L1176: USD 200 m: The Program for Integral Development of the Operating Organizations of Water and Sanitation (Programa de Desarrollo Integral de Organismos Operadores de Agua y Saneamiento PRODI) has the objective of improving the quality of water and sanitation services through the increase of physical, commercial and administrative efficiency of water utilities providing technical assistance and financing infrastructure ^{226/227} . The funds are used for projects in cities from 50,000 to 900,000 inhabitants and have a five year time span ²²⁸ . The program is managed by Conagua ²²⁹ . The manual for proceedings with PRODI was published in February 2016. Regional and municipal water utility organizations can apply for funding of infrastructure or consulting services. Infrastructure projects with a value of more than USD 500,000 are tendered. Projects with higher amounts than USD 15 m are published on the UN Development Business homepage ²³⁰ . The program focuses on three pillars: - Institutional empowerment to develop the knowledge of employees of water utility companies - Infrastructure projects with a high impact - Improvement of financing schemes and support of tenders ²³¹ . |
| IADB | Strengthening of water utilities: Project ID: ME-1300: USD 300,000: The funding will support the planning and execution of loan ME-L1176 (see above) ²³² . |
| NADB | 2009: USD 42 m Construction of the South - South Waste Water Treatment Plan, Ciudad Juarez, Chihuahua, Mexico ²³³ . |
| NADB | 2015: USD 4 m South Waste Water Treatment Plant Co-generation and Improvements Project, Ciudad Juarez, Chihuahua ²³⁴ . |
| CONAGUA Project | “New Sources of Water Supply”, also known as stage IV of the Cutzamala System ²³⁵ . |
| Tenders | There are currently tenders in two states to be found at Conagua’s webpage ²³⁶ . |

6.4. Recommendations

Due to the urgent need for drinking water, fresh water management will be the priority in Mexico’s Cleantech policy. The bad reputation of local public water utility firms presents an opportunity for foreign investments. Some Mexican municipalities or private gated communities, large hotels and other facilities could install their own water supply or upgrade its existing water systems in order to improve drinking water quality. Private residential treatment options currently enjoy a double digit growth²³⁷. Often financing proves to be a big obstacle for those municipalities. Therefore, water companies can use the BOT “Build Operate and Transfer” model, where water is sold directly to the final customer, instead of selling technology to the municipality. The investment needs to be profitable for

²²⁵ Export.gov, 2016²²⁶ IDB, 2015e²²⁷ BID, n.d.²²⁸ Conagua & BID, 2016²²⁹ BID, n.d.²³⁰ Conagua & BID, 2016²³¹ Conagua & BID, 2016²³² IDB, 2015e²³³ Border Environment Cooperation Commission [BEEC], 2009²³⁴ North American Development Bank [NADB], n.d.²³⁵ Conagua, 2016²³⁶ Conagua, 2017²³⁷ Hinman & Kreps, 2016

Waste Water and Drinking Water Supply in Households

a defined amount of years, as it will then be handed over to the municipality. Companies with modern technology can sell water at a much lower price than municipalities²³⁸. Due to the low service standard by CONAGUA and the municipalities, there is a large market for private fresh water solutions.

Since the PRODI program, as shown in table 8, has just started, tenders in the water sanitation sector will soon be published. Waste water treatment is expanding fast, but significantly much more investments are needed to reach the government's goals. The goal of reaching 100% treated waste water by 2030 triggers investments of USD 500 million per year. Some large Swiss companies are already involved in building the underground waste water facilities in Mexico²³⁹.

The pipe system for drinking water and sewage is leaking and needs improvement. Although there is water stress in large parts of the country, Mexicans use more water than most other nations. This leads to interesting opportunities for more efficient water usage solutions. Swiss companies could support Mexico in this endeavor.

Swiss companies with knowledge in water treatment filtration, pumps and pipes should evaluate an entry, as they are known for offering an excellent service. Local partnerships are always recommended for successful public tenders in Mexico²⁴⁰.

²³⁸ Personal Interview with Fabian Yañez, CEO Odis Adversa Mexico, 14.07.2016

²³⁹ Schweizer Radio und Fernsehen [SRF], 2013

²⁴⁰ Hinman & Kreps, 2016

7. Water for Agriculture

7.1. Issues

Agriculture is responsible for 77% of the country's water consumption²⁴¹. In some places this leads to unsustainable extractions from ground and surface sources, which are threatening the stability of the water supply²⁴². Half of the country's agricultural production is being irrigated. Nevertheless, irrigation techniques are not very efficient. In Mexico agriculture is responsible for less than 4% of the total GDP²⁴³.

7.2. Funding Programs

Although water consumption in agriculture is far from sustainable, there are no large funding programs in place.

Table 12: Agriculture Irrigation Funding Programs

| Program | Description |
|---------|-----------------------------------------------------------------------------------------|
| NADB | 2014: USD 50 m: Don Martin Irrigation District 004 Anahuac, Nuevo Leon ²⁴⁴ . |

7.3. Recommendations

Projects to strengthen the agricultural water supply could include treated waste water in agriculture, the efficient use and reuse of water in irrigation and capture of rainwater in small dams²⁴⁵.

²⁴¹ Guerra, 2016

²⁴² The World Bank, 2015

²⁴³ CIA, 2017

²⁴⁴ BEEC, 2014

²⁴⁵ Cano Robles, n.d.

Hazardous Waste

8. Hazardous Waste

8.1. Issues

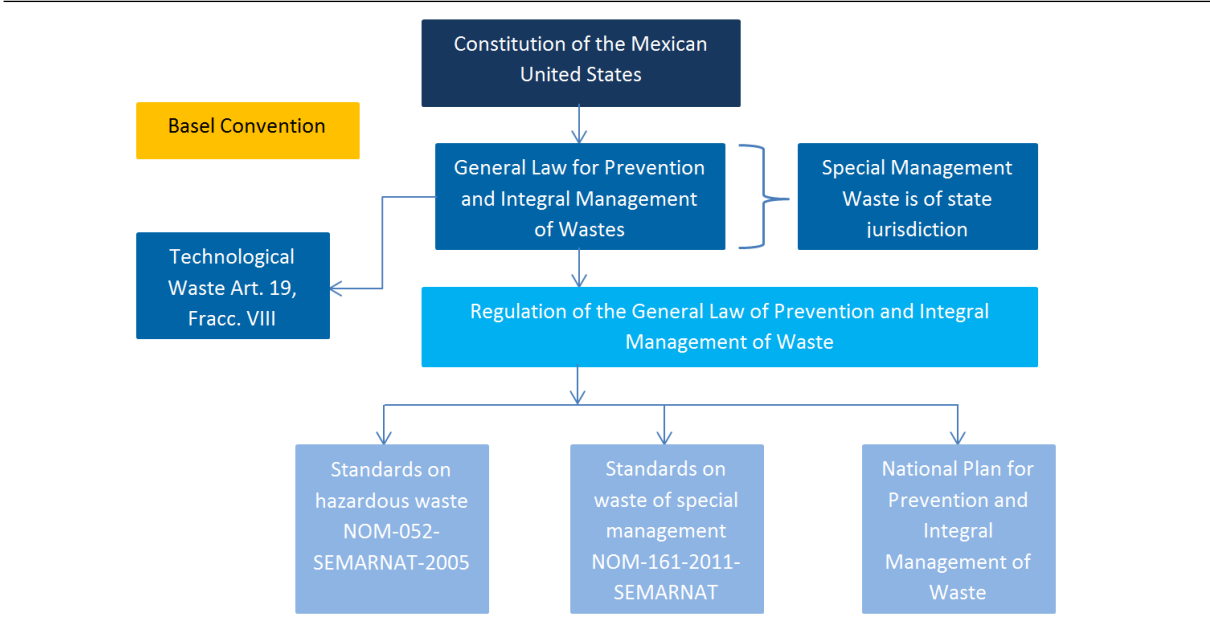
Hazardous waste is produced through different activities in industry, mining, agriculture and households. Additionally, US made hazardous waste is imported into Mexico. Many factories produce unnecessary amounts of hazardous waste due to outdated technology. Of the 10 million tons of hazardous waste, which is generated every single year in Mexico, 90% ends up in open dumps, or at abandoned mines with no control mechanisms in place.

According to the Mexican law “Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR)”²⁴⁶ and the 1988 General Law of Ecological Balance and Environmental Protection²⁴⁷, there are clear restrictions and control measurements for producers of hazardous waste. Such waste must be notified to the Ministry of Environment (Semarnat), classified and then temporally stored in waste warehouse for 6 months. Yet, these constraints are often not enforced, as there is a lack of facilities for recycling, treatment, or disposal²⁴⁸.

There are only four confinement facilities for hazardous waste in Mexico²⁴⁹. Two of which are managed by RIMSA and Proactiva, both belonging to Veolia, a French company.

Semarnat and its Procuraduría Federal de Protección al Ambiente (PROFEPA) as well as the General Department of Integral Management of Risky Materials and Activities [Dirección General de Gestión Integral de Materiales y Actividades Riesgosas (DGGIMAR)] are interested in opening more facilities, but due to fierce opposition by local populations, projects are often stopped already in the planning phase. There are 297 registered contaminated locations in Mexico, but only 12 of them are being rehabilitated²⁵⁰. The graph below shows the framework of national laws and programs regarding the management of waste.

Figure 16: Mexico’s Legal Framework for Hazardous Waste²⁵¹



²⁴⁶ Cámara de Diputados del H. Congreso de la Unión, 2006
²⁴⁷ Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT], 2006
²⁴⁸ Ecolimpio, 2015
²⁴⁹ Mendoza, 2015
²⁵⁰ Navarro, 2015
²⁵¹ Cano Robles, n.d.

8.2. Funding Programs

Table 13: Funding Program for Hazardous Waste

| Program | Description |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DGGIMAR | DGGIMAR is responsible for monitoring soil and hazardous waste ²⁵² . It is also responsible for confinement plans and risk prevention. Dirección General De Impacto y Riesgo Ambiental (DGIRA) evaluates new projects ²⁵³ . There are no special programs in this field. Semarnat is responsible for tenders in soil remediation. |

8.3. Recommendations

Since public resistance against facilities confining or treating hazardous waste is widespread, it will be challenging for Swiss companies to convince the local communities of their solutions for confinement or treatment of hazardous waste. It is a risky endeavor and therefore not recommended.

²⁵² Oswald, 2011

²⁵³ SEMARNAT, 2009

9. Recycling of Household Waste

9.1. Issues

Mexico has a massive garbage waste problem that is partially caused by citizens' resistance to recycle. Only around 3.3% is formally recycled²⁵⁴. In Mexico, the terms recycler or waste picker are often referred to people walking around landfills or searching in trash for material they can use or sell in the informal sector²⁵⁵. They form cooperatives and are strongly opposed to modern recycling technologies, which separate waste from valuable material. According to the waste law “Ley de Residuos Sólidos del Distrito Federal”, waste picking in Mexico City is forbidden. Therefore, illegal activities lead to lucrative kickback schemes with government officials and are politically difficult to resolve. Any new players in the market will have to cooperate with these groups.

Despite the considerable potential and improved general conditions, the conversion of urban waste into energy still barely exists in Mexico. BMLMX Power Company won a tender in 2012 to build a biogas plant at the world's biggest landfill in Mexico City where 14,000 tons of trash had been deposited²⁵⁶. There was fierce opposition by the “pepenadores” (waste-picker cooperatives) and their 5,000 members. They blocked the entrance and eventually reached concessions regarding the sorting of the new waste. Hence, biogas production at this new plant will never be lucrative²⁵⁷. The biogas plant is financed both by public and private institutions and will produce 40-70 MW²⁵⁸. Production is supposed to start in 2017.

Safety equipment and landfill gas extractors are being installed in Mexico. According to the German Development Agency GIZ, the investment climate for landfill gas projects is considered to be good²⁵⁹ and more landfill gas projects are currently developed. This will lead to the reduction of methane emissions. GIZ is advising the Mexican Ministry of Energy SENER, the Mexican Ministry of the Environment and Natural Resources SEMARNAT, as well as local and state institutions and universities in its Special Climate Change Program 2014-2018²⁶⁰. GIZ does not finance projects²⁶¹. The program is executed through the Mexican Agency for International Development Cooperation (AMEXCID) and includes consulting services but no project financing.

9.2. Funding Programs

Table 14: Funding Programs for Household Waste Recycling

| Program | Description |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IADB | 2014: Project ID: ME-T1247: USD 250,000: ²⁶² Supports the government of Mexico in promoting technical co-operations for the integrated management of solid waste in Mexico through strengthening infrastructure funding programs for integrated solid waste management and generating recyclables market. The program will be operating until 2018 and focusses on the assessment of the current situation. |

²⁵⁴ Cernansky, 2011

²⁵⁵ Marelló & Helwege, 2014

²⁵⁶ Godoy, 2012

²⁵⁷ Marelló & Helwege, 2014

²⁵⁸ Waste Management World, 2012

²⁵⁹ Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ], n.d., b

²⁶⁰ Gobierno de la República, 2014

²⁶¹ GIZ, n.d., b

²⁶² IDB, 2014b

9.3. Recommendations

As waste management in the whole country is partly in the hands of cooperatives, new companies entering this market would need to deal with them. This at best leads to lengthy negotiations at worst to fierce violence. Entering this market is not recommended.

10. Electronic and White Goods Waste

10.1. Issues

Mexico is producing approximately 1-1.5 million tons of E-Waste per year²⁶³, or approximately 8kg per person (compared to approximately 26kg in Switzerland)²⁶⁴. Though R2-certified recycling facilities exist, only 10% of e-waste is being recycled²⁶⁵.

At the end of 2015, Mexico changed from analogue to digital TV signals, which will lead to a replacement of 40 million old television sets²⁶⁶. Mexico is still far away from multi-stakeholder discussions achieving e-waste recycling frameworks.

There are existing E-Waste policies²⁶⁷, but the enforcement at the state level needs to be improved, as there are no facilities available in most states²⁶⁸. The General Law for the Prevention and Integrated Management of Waste of 2003 (LPRGIR) gives the federal government the responsibility over the waste management, whereas state and local governments need to issue regulations and programs on waste²⁶⁹. The Nom 161 Semarnat 2011 regulation establishes criteria regarding the handling of waste including E-Waste.

A few companies and organizations are active in the recycling of E-waste. The Punto Verde Foundation offers education convincing people to recycle²⁷⁰. The firm Recyclaelectronicos²⁷¹ has pioneered E-waste recycling without governmental support and without charging fees to producers and consumers.

In 2013 the US based company “E-Waste System” entered the market via a joint venture with Scoex S.A., but only 18 months later, the company defaulted. The recent fall in commodity prices impacts the recycling companies, which are extracting and selling valuable metals and rare earth minerals²⁷².

Ecofrigo is the only larger white goods recycling company for firms and private persons²⁷³. According to the program “Cambia tu Viejo por uno Nuevo” from 2009, there are some 14 white goods recycling centers existing in Mexico²⁷⁴.

²⁶³ Baldé et al., 2015

²⁶⁴ Le News, 2015

²⁶⁵ Linnenkoper, 2015

²⁶⁶ Perkins, 2015

²⁶⁷ Cámara de Diputados del H. Congreso de la Unión, 2015

²⁶⁸ UNEP, n.d.

²⁶⁹ Brown & Laird, 2012

²⁷⁰ Puntoverde, n.d.

²⁷¹ REMSA, n.d.

²⁷² Baker, 2014

²⁷³ Ecofrigo, n.d.

²⁷⁴ Fundación UNAM, 2014

10.2. Funding Programs

Table 15: Funding Programs for E-Waste Recycling

| Program | Description |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SCT | 2015: The Secretaría de Comunicaciones y Transportes (SCT) is responsible for the recycling of TV sets and in November 2015 tendered a project for USD 250,000 in order to open centers where old TV sets can be collected ²⁷⁵ . People that bring their analogue TV sets to these new centers will receive a 20% discount on their next electric bill. |
| IADB | 2014: Project ID: ME-M1092: USD 360,000: Integrated E-waste Management in Mexicali. This includes communication and education campaigns and E-Waste market analyses ²⁷⁶ . |

10.3. Recommendations

Swiss recycling companies could turn E-Waste and other wastes into new raw materials²⁷⁷. Mexico produces a large amount of these goods and there are not many companies involved in this market. But as in all recycling activities in Mexico, Swiss companies will have to find ways to cooperate with the existing cooperatives. Under what extend that would be possible is very difficult to evaluate.

²⁷⁵ El Financiero, 2015

²⁷⁶ IDB, 2014c

²⁷⁷ UNEP, n.d.

11. Air Pollution Control

11.1. Issues

The Mexican General Law on Climate Change from 2012 aims to reduce the country's output of CO₂ by 20% by 2020 and 50% by 2050, forcing Mexican companies to report and reduce emissions. This will require industries to implement improved monitoring and control technologies²⁷⁸.

In March 2016, over 1 million cars were banned from the streets due to air pollution alerts, as ozone levels in Mexico City surpassed the acceptable limit for four consecutive days. As a direct response, the President gave instructions for a new vehicle emission test system with the best available technology "as soon as possible"²⁷⁹. In May 2016, ozone levels reached again 150% of the limits and the government had to ban cars from the streets of Mexico City again. That was the fourth time in 2016²⁸⁰. José Sarukhán Kermez, national coordinator of the National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (Conabio)), stated in June 2016, that the country lacks the tools to measure effects on climatic change²⁸¹.

11.2. Funding Programs

The Mexican Ministry of Environment and Natural Resources (SEMARNAT) governs and implements environmental regulations and is also responsible for issuing environmental tenders for air pollution monitoring and the national Climate Change Strategy²⁸². Increased opportunities exist under the Climate Change Strategy's 'Program for the Strengthening of the Environment of States' (Programa de Fortalecimiento Ambiental de las Entidades Federativas), which is part of the National Development Plan (2013-2018)²⁸³. The program provides funding for projects at the municipal, state and federal level for compliance of environmental rules. Local governments ramp up their monitoring efforts. Only government agencies can apply for these funds and a total amount per year has not been specified.

11.3. Recommendations

The ozone crisis in March and May 2016 and the NAFTA pledges in June 2016 will trigger a stronger emphasis on pollution control systems. Well known Swiss companies in the precision business should therefore participate in tenders and enter this market. It is recommended to negotiate directly with the SEMARNAT and the relevant government entities of Mexico City and other cities.

²⁷⁸ Hinman & Kreps, 2016

²⁷⁹ The Guardian, 2016

²⁸⁰ USA Today, 2016

²⁸¹ Vicenteño, 2016

²⁸² Hinman & Kreps, 2016

²⁸³ Gobierno de la República, n.d.

12. Recommendations for Swiss Companies

In all the examined sectors, there is an urgent need for improvement. In most of them, there is a political will to improve the situation and project financing is available. Furthermore, new policies implement environmental friendly legislations. Opportunities can be found in all sectors, as the country often lacks the technological know-how. Nevertheless only some of the sectors can be recommended for a possible market entry.

Solar power generation will soon be the cheapest option to produce electricity. In addition, Mexico enjoys comparably high radiation levels in parts of the country and a new open wholesale market is leading to attractive solar power opportunities. Clean Energy Certificates are an additional way to ensure revenues for clean energy producers. Therefore, it is advisable for interested Swiss companies to start evaluating the market and getting involved in some of the upcoming projects. This presence could lead to an early foothold in the Mexican market and thus to a competitive advantage, before the expected substantial growth in solar capacity in the 2020s will take place.

Water treatment for drinking and sewage will further increase in large scale as the government and international funding institutions have earmarked substantial amounts for these water issues. The government's goal of full water servicing for the whole population is supposed to be reached by 2030. Therefore, significant investments will be needed in the coming years. Foreign companies are already in this growing market, selling pipes, filter and water systems. Due to the bad reputation of the municipalities' water services, there is a widespread need for private water companies in this enormous market. This paper recommends Swiss companies to examine this interesting market.

Energy efficient constructions are also gaining more importance. The 500,000 new buildings constructed each year in Mexico could feature Swiss products and solutions to save energy and water. Programs are promoted by government agencies. Therefore, Swiss companies need to get in close contact to the funding organizations. They need to take into account that budget constraints in the construction business are an important issue due to the low costs building requirements.

Recent smog alarms have exposed the need for improved measurement systems in Mexico. This represents another business opportunity for Swiss companies, since they have a long tradition in producing measuring components.

Due to social tension and unregulated recycling schemes, waste recycling and hazardous waste disposals are currently not recommended areas for a market entry.

Local partnerships for public tenders are strongly encouraged in Mexico. Local companies usually have a better market knowledge and understanding of the procedures in tenders and often enjoy a certain status of preference. Many different companies cooperate for tenders of certain projects and proposals include companies from different countries.

Smaller companies might follow their existing customers into the Mexican market. Others can join a Mexican firm taking part in local tenders. This is highly recommendable, as new clients might also evolve. Investors have to take VAT of 16% on imported goods into account when calculating prices. Companies exporting to Mexico will need to meet Mexican standards and demonstrate conformity.

Recommendations for Swiss Companies

The cost of accreditation for a single product in Mexico through Entidad Mexicana de Acreditación is approximately USD 4,900.

Mexico is one of Latin America's best ranking countries in the "Doing Business" database issued by the World Bank²⁸⁴. Substantial improvements in the business environment, deregulations, privatizations and the Free Trade Agreements facilitate the entrance for Swiss companies into the Mexican market. A concern is the country's aforementioned low ranking in the Corruption Perception Index. The devaluation of the Mexican Peso compared to the Swiss franc is presently an impediment for Swiss exporters and an advantage for Swiss investors.

²⁸⁴ The World Bank Group, 2016c

Center for Business in the Americas

International Management Institute
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Map of Mexico



Source: https://es.wikipedia.org/wiki/Organización_territorial_de_México

The first part of the document discusses the importance of maintaining accurate records in a business setting. It highlights how proper record-keeping can help in decision-making, legal compliance, and financial management. The text emphasizes that records should be organized, up-to-date, and easily accessible to all relevant personnel.

Next, the document addresses the challenges of data management in the digital age. With the increasing volume of data generated by various sources, businesses face significant challenges in storing, securing, and analyzing this information. The text suggests implementing robust data management strategies, including regular backups, security protocols, and the use of advanced analytics tools.

The third section focuses on the role of technology in enhancing business operations. It explores how cloud computing, automation, and artificial intelligence can streamline processes, reduce costs, and improve efficiency. The document provides examples of how these technologies are being used in various industries to drive growth and innovation.

Finally, the document concludes by emphasizing the importance of continuous learning and adaptation. In a rapidly changing business environment, organizations must stay updated on the latest trends and technologies to remain competitive. The text encourages businesses to invest in employee training and development, fostering a culture of innovation and growth.

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