Report on the assessment of the expected mitigation component of the INDC for the power-generating sector and that established in PRODESEN 2016 – 2030.

EXECUTIVE SUMMARY

Introduction

Mexico was the first developing country to present its Intended Nationally Determined Contributions (INDC) in March 2015. Its unconditional target was to reduce 22% of greenhouse gas (GHG) emissions by 2030, which represents 210 million tons of carbon dioxide equivalent ($MtCO_2e$). The power-generating sector would be able to contribute to that goal with a 63 $MtCO_2e$ reduction, that is to say, about a third of the national target. To do so, power generation from renewable energy sources must reach a share of 35% by 2024 and 43% by 2030.

The Electric Power Industry Law (LIE) was passed as part of the country's energy reform to foster sustainable development in the power industry, fulfillment of public and universal service obligations, renewable energy sources and reduction of pollutant emissions. For that purpose, the first Transition Strategy to Promote the Use of Cleaner Technologies and Fuels contained in the Energy Transition Law (LTE) and the General Law on Climate Change (LGCC) was updated.

The overall objective of this Report is to "present a quantitative assessment of the contribution of the power sector's GHG emissions for 2030 as established in the latest official plans, as well as identify areas of opportunity to achieve (and even surpass) the emission reduction targets set for the power sector in Mexico's Nationally Determined Contributions (NDC)."

According to the Program for the Development of the National Power System (PRODESEN 2016-2030), in 2015, power generated from renewable energy sources represented 20.3% of the total energy production of the National Electric System (SEN). This percentage is expected to increase in accordance with the targets established in the LTE for 2018, 2021 and 2024 in order to reach 37.7% by 2030. In the same vein, the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels aims to increase the share of renewable energy sources to reach 31.3% by 2020, 39.2% by 2025, 37.7% by 2030, 40.8% by 2035 and 50% by 2050. This would allow Mexico to meet its unconditional Nationally Determined Contribution (NDC) target.

Methodology

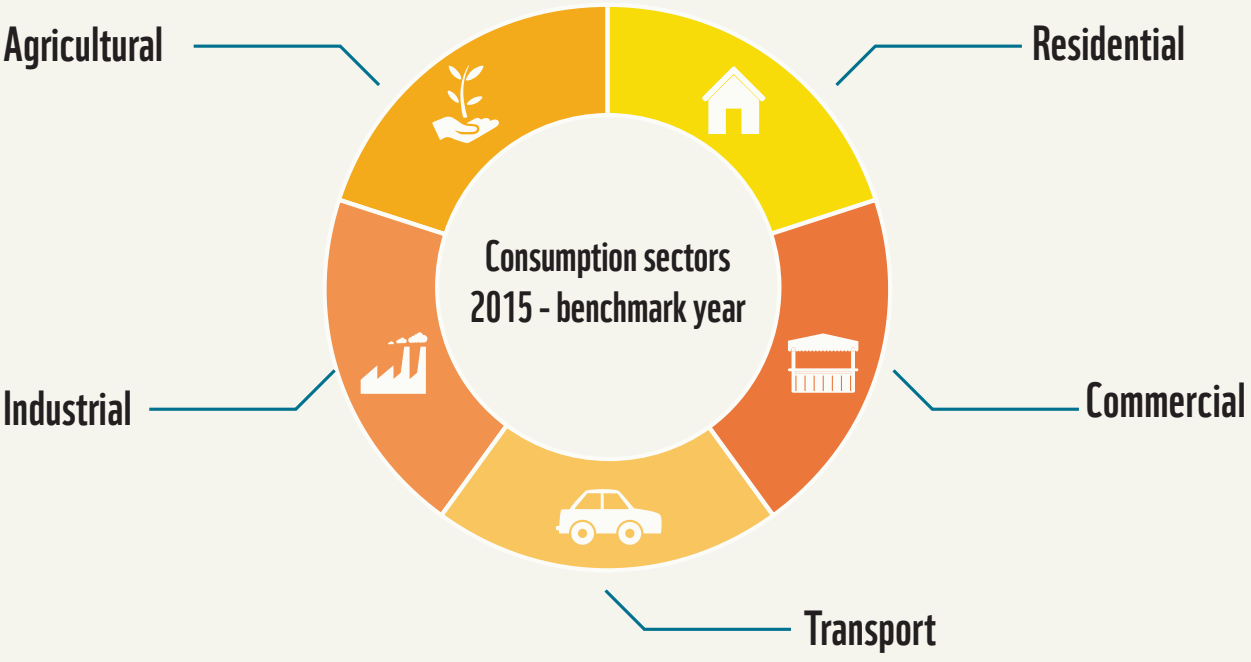
The construction of Mexico's power sector's Baseline or Trend Scenario for GHG emissions was based on two components: 1) the setting of a benchmark year, which is 2015, and 2) the projections for 2030. To this effect, data from PRODESEN 2016-2030 (SENER, 2016a) was used. The Baseline Scenario was simulated using LEAP software (Heaps, 2008), which is a bottom-up modeling tool able to recreate balance between aggregate demand and the power plant supply being simulated. However, one of its constraints is that it is not an optimization model.

The LEAP model can simulate the implementation of energy policies and the mitigation of GHG emissions. It was created at the Stockholm Environment Institute (SEI), and it can identify consumption, production and extraction of energy resources in the various sectors of the economy. It is also possible to calculate the amount of emissions produced in each sector and identify other pollutants that affect the environment, such as air quality and short-lived air pollutants. However, the main focus of this analysis is on GHG emissions. It is worth mentioning that this model has been used in at least 32 countries for the presentation of their NDC.

Through the LEAP model, the feasibility of existing energy policies can be determined. The results of adjustments to these policies to achieve the GHG emission reduction goals can also be foreseen. This is possible thanks to the building of trend or alternative energy scenarios, as set out below:

Setting of the benchmark year

2015 was set as the benchmark year because it was when PRODESEN was created. Regarding the demand for electricity, five consumer sectors were defined: residential, commercial, transportation, industrial and agricultural. Data for electricity demand was gathered from the Energy Information System (SIE) from the Ministry of Energy (SENER), while information about power supply was obtained from PRODESEN 2016-2030, which collected data from 360 operation centers.



Projections for 2030

2015 was set as the benchmark year and projections for the supply and demand of electricity were made until 2030. Demand-related data was obtained from PRODESEN 2016-2030 and a consumption ratio was calculated for each of the demand sectors for every year, compared to 2015. Two energy supply-related cases were simulated:

Demand	Supply
• **PRODESEN 2016-2030**	• **Optimized PRODESEN** • **Merit order PRODESEN**

• Optimized PRODESEN case:

It received the name Planning PRODESEN 2016-2030 because it was created using an optimization model described in the PRODESEN 2016-2030. In this case, capacity was measured according to the type of technology, fuel consumption and power generation, just as in PRODESEN 2016-2030.

1,143 project records and/or plants were reviewed in PRODESEN 2016-2030, 400 of which were new projects that appeared during PRODESEN's period of analysis, while the rest were pre-existing, from 2015.

• Merit order PRODESEN case:

In this case, information related to the power capacity forecasted in PRODESEN 2016-2030 by year and type of technology was used. Conventional Mexican power plant factors were applied according to the type of technology used in order to simulate power supply and energy sector emissions in the country. The power generation calculation was simulated using the LEAP model, following merit order dispatch. Thus, emissions per year of the analysis period were estimated based on data about fuel consumption for every type of plant and information from the Intergovernmental Panel on Climate Change (IPCC) about emission factors.

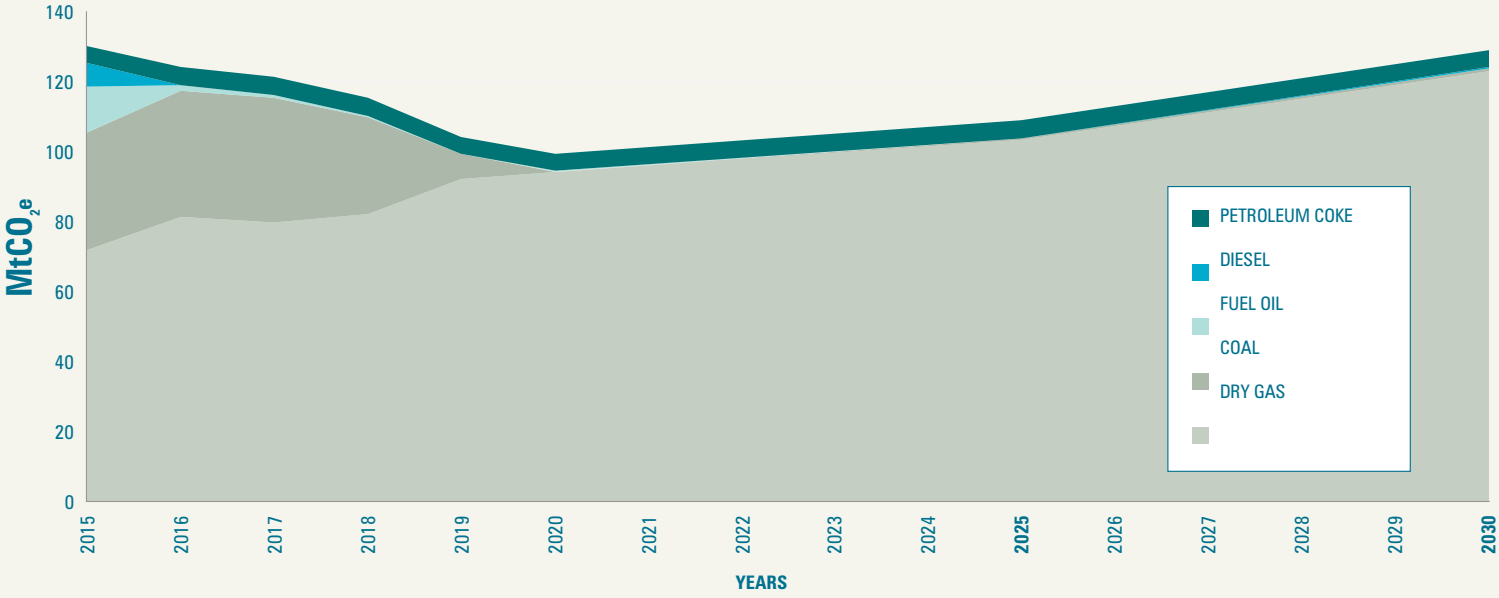
Results

This analysis presents the main results of the assessment of the contribution of GHG emissions, taking into account the official planning of the SEN in Mexico for the next 15 years.

• Optimized PRODESEN

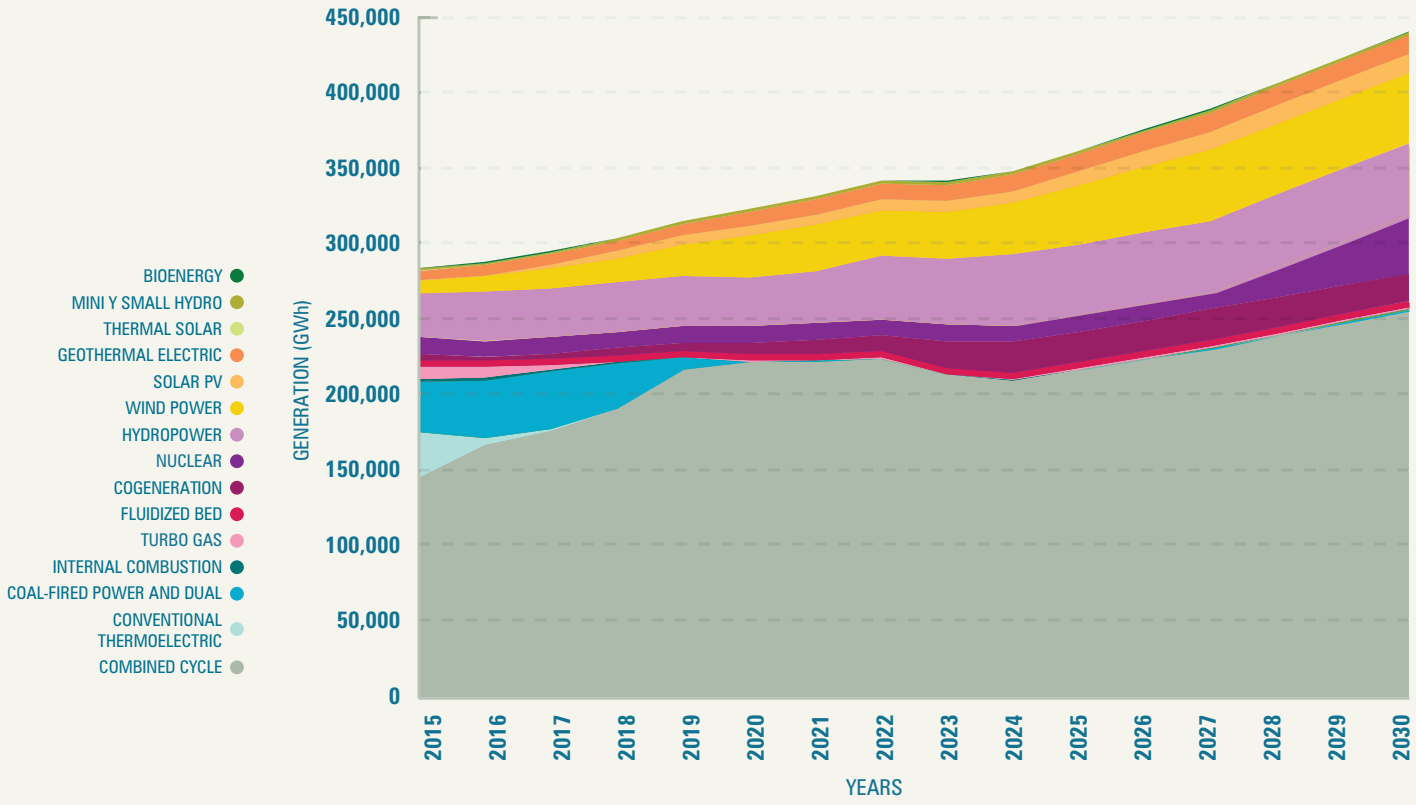
The results show that during the baseline year, the maximum amount of emissions was 129 $MtCO_2e$. Emissions keep decreasing until they fall to an expected minimum of 99 $MtCO_2e$ in 2021. Then, in 2022 they start to increase towards 129.1 $MtCO_2e$ by 2030, which is very close to the 2015 emissions level. The reduction that took place from 2016 to 2021 can be explained due to the drastic decrease in the consumption of diesel and fuel oil in conventional thermoelectric plants. Besides, coal consumption also begins to fall in 2019. In contrast, rising emission levels in 2021 are mainly caused by the use of natural gas in combined cycle power plants, which has been forecasted to increase significantly until 2030, reaching 123 $MtCO_2e$. Petroleum coke consumption remains unaltered.

CORRESPONDING GHG EMISSIONES TO THE EXPANSION OF THE SEN IN PRODESEN 2016-2030 (OPTIMIZED)



As for the share of renewable energy sources in power generation, the behavior of GHG emissions associated to the optimized PRODESEN scenario allows for the achievement of the clean energy targets established in the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels. During the 2016-2025 period, there will be an upward trend in renewable energy sources driven by the expansion of wind, solar and hydroelectric power stations. Then, their share would decrease by two points by 2030. In contrast, cogeneration and nuclear energy will grow slowly but steadily until 2022. In 2023 and 2028, these sources will undergo significant growth.

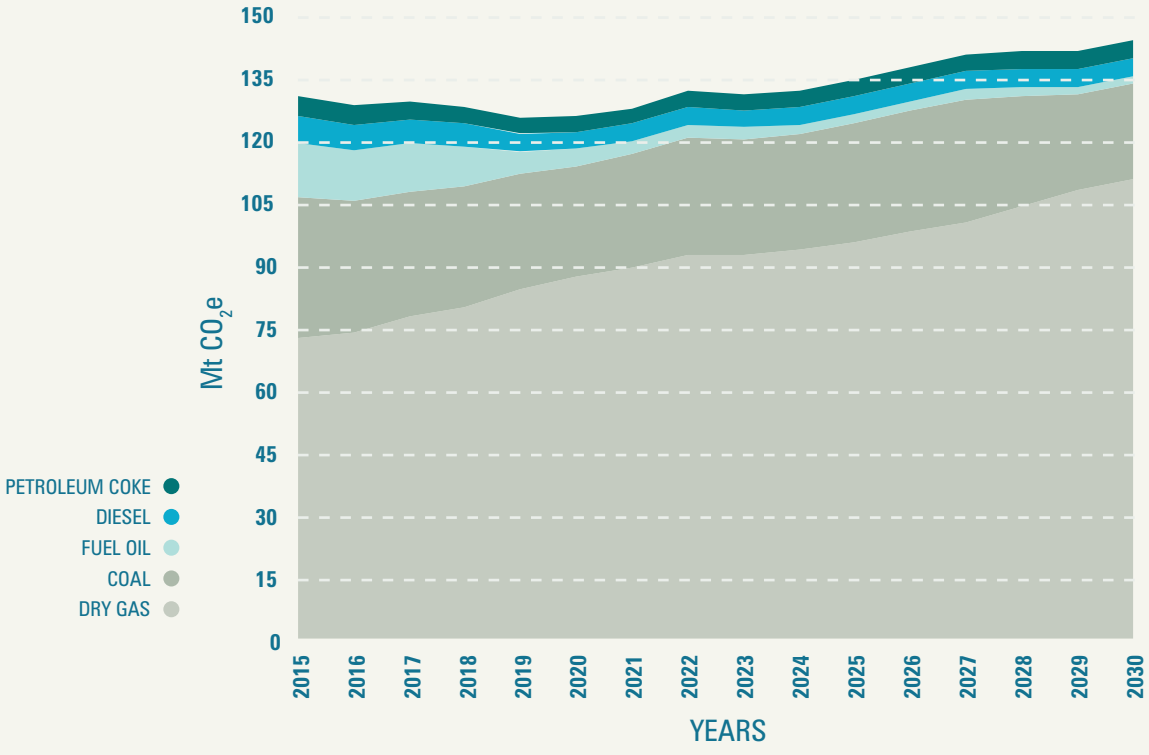
GENERATION OF ELECTRICITY FROM CLEAN ENERGY SOURCES. PRODESEN 2016-2030 (OPTIMIZED)



• Merit Order PRODESEN

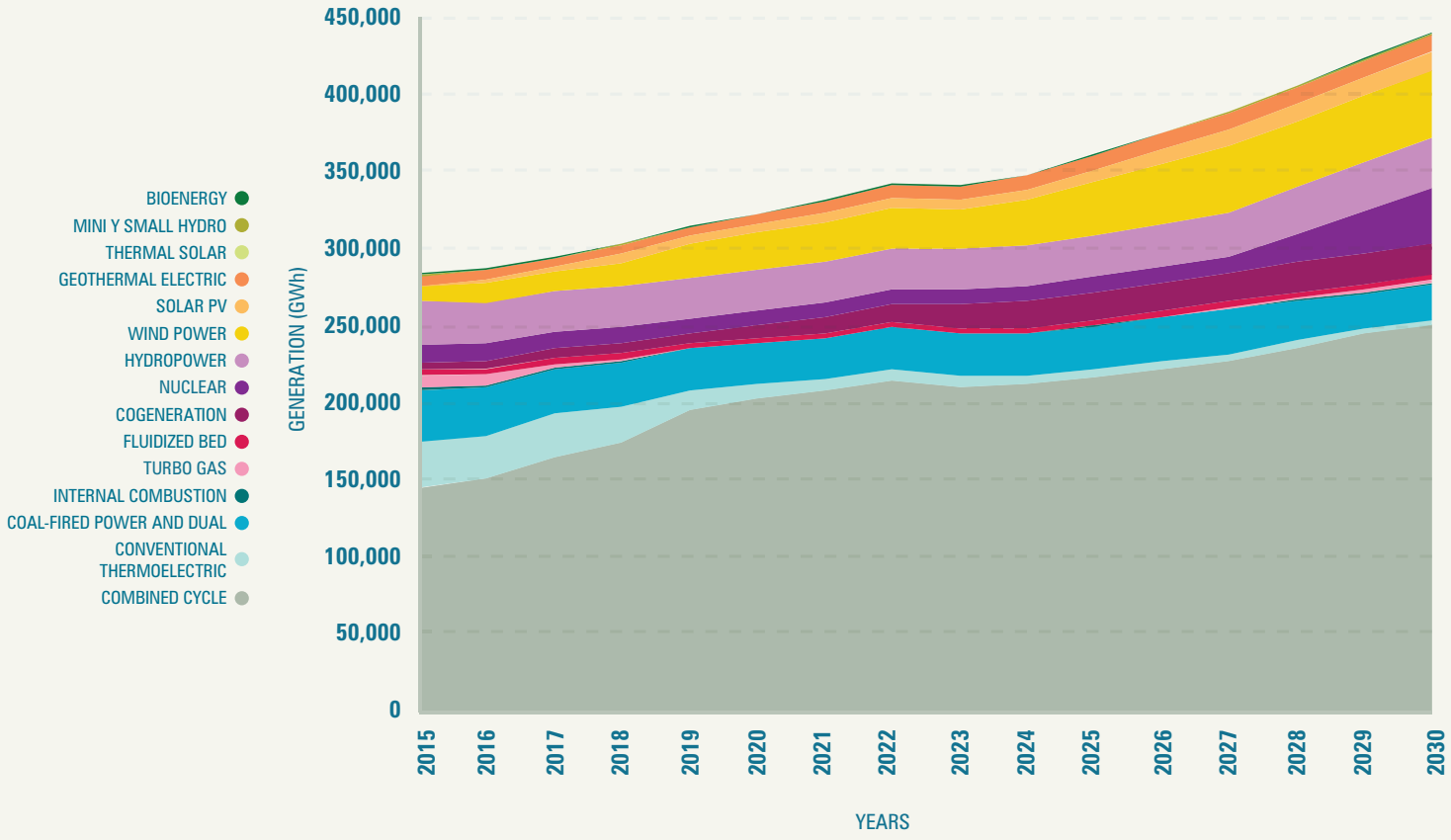
The results show that there is a downward trend during the first 4 years, where the minimum amount of emissions is 124.68 $MtCO_2e$ in 2019, which is 3.5% below the emission levels of the benchmark year (2015). Subsequently, there is an upward trend and by 2030, the amount of emissions is 143.27 $MtCO_2e$, which is 10.85% higher than in 2015. This GHG emission behavior is caused by a significant reduction in the use of fuel oil and coal in conventional thermoelectric plants from 2016 to 2019. This reduction is even greater than the emissions resulting from added capacity at plants where natural gas is used in the same period. There is an upward trend in emissions related to natural gas usage during the period of analysis. Starting in 2020, emissions will increase so much that they will counteract the reduction obtained from the decrease of fuel oil and coal use. Emissions related to this fuel will increase 53% compared to the emissions recorded in the baseline year. Emissions caused by diesel use will slightly decrease in 2016-2030, while petroleum coke emissions shall remain unaltered. Fuel oil emissions will dramatically decrease, while coal emissions will cut in about one third.

CORRESPONDING GHG EMISSIONES TO THE EXPANSION OF THE SEN IN PRODESEN 2016-2030 (MERIT ORDER).



The merit order PRODESEN scenario shows a 3 to 5-year delay in the achievement of the power generation targets established in the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels. Thus, the share of renewable energy sources would reach 25% by 2020, 30% by 2025 and 35% in 2029. As far as clean power generation goes, this scenario promotes a greater utilization of hydroelectric stations and efficient cogeneration than the optimized PRODESEN scenario.

GENERATION OF ELECTRICITY FROM CLEAN ENERGY SOURCES. PRODESEN 2016-2030 (MERIT ORDER)



Conclusions

The quantitative analysis carried out in optimized PRODESEN shows that this scenario not only reaches but even surpasses the emission reduction targets for the power-generating sector established in Mexico's NDCs. In this case, the desired share of renewable energy sources stated in the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels would also be attained. This shows that the official planning made for the energy sector intends to be aligned with the targets that were set in the NDCs.

Nonetheless, when it comes to emission reduction and changes in the power plant park, there is not enough evidence to prove that it is indeed happening. The Mexican power sector has not behaved as planned in the official scenario. There was no drastic emission reduction in 2015 and there is no evidence that conventional thermal and coal-fired power stations will cease to operate by 2019 or 2020. No evidence has been found either regarding the transition towards cleaner energy as planned in the official scenario.

The merit order PRODESEN analysis shows that as the Mexican power sector evolves, if power plants continue to function conventionally, emissions will fall below the energy sector NDCs set for 2030. Moreover, there would be a 3 to 5 year delay in the achievement of the desired share of renewable energy stated in the Transition Strategy.

It would be advisable to work closely with the people in charge of developing the next editions of PRODESEN so that the main aspects of the desired scenario for the power sector could be analyzed and represented in detail, as that would be helpful in the process of achieving the GHG emission reduction target set in Mexico's contributions. This could be accomplished by adding a new subsection to the PRODESEN, in which a quantitative analysis of the emissions produced by the national power sector could be provided.

Therefore, it is suggested that additional analyses be carried out where different power sector scenarios could be explored so as to incorporate alternative mitigation measures to the ones contemplated in the official planning, which would further reduce GHG emissions.

Contact

Ninel Escobar
Climate Change Coordinator
Tel. +52 (55) 5286 5631 Ext. 216
nescobar@wwfmex.org

For further information:

www.wwf.org.mx

www.panda.org

Design: Victor González / gvic1105@gmail.com
Mariana Sasso / mariana.pandawwf@gmail.com

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

wwf.org.mx

WWF México, Ave. México #51, Col. Hipódromo, México, D.F., C.P. 06100— Tel. +52 (55) 5286-5631.
For further information please visit www.wwf.org.mx