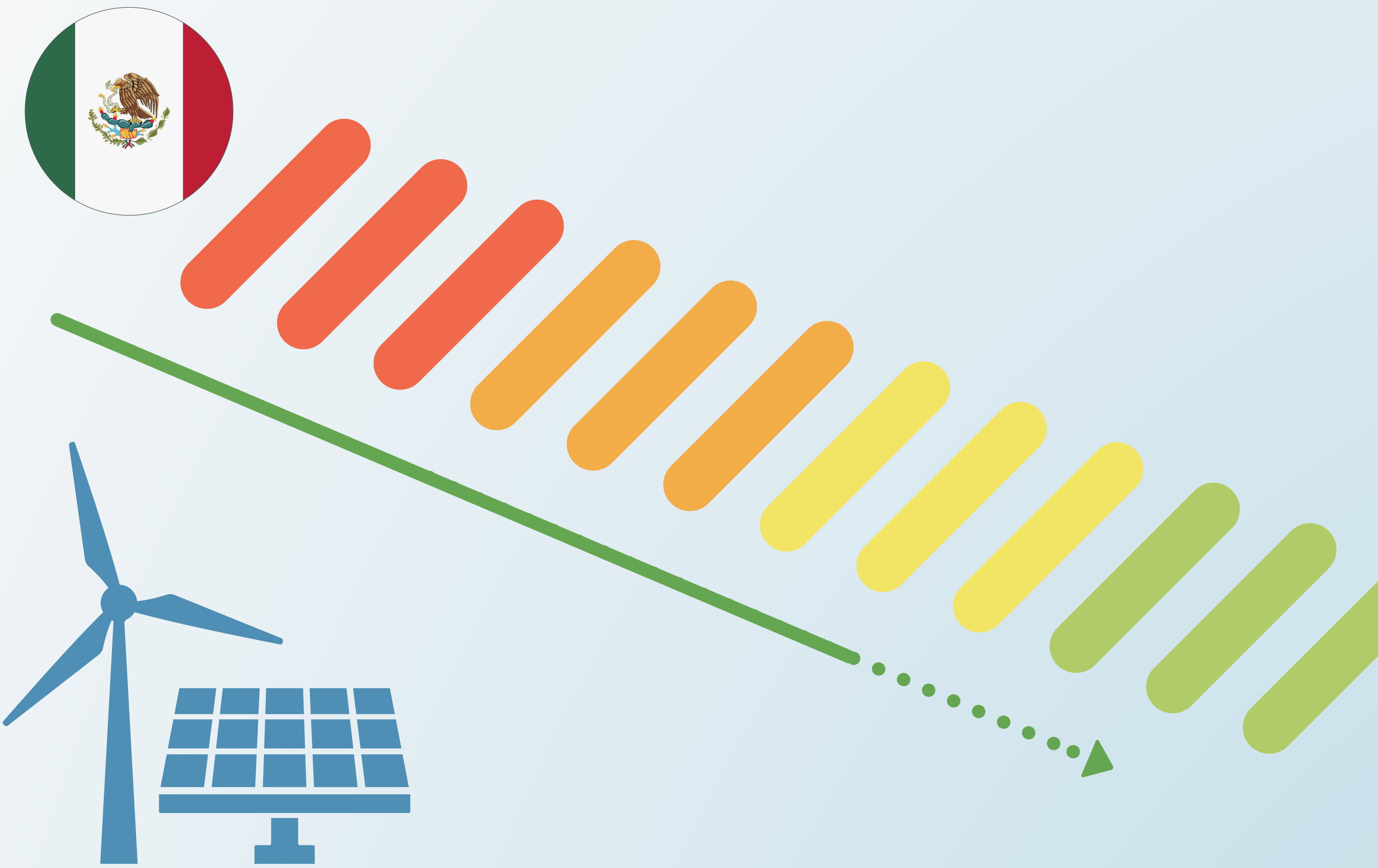
Climate Action Tracker



Climate Action Tracker

Wind and Solar benchmarks for a 1.5°C world

MEXICO

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CLIMATE ANALYTICS

NEW CLIMATE INSTITUTE

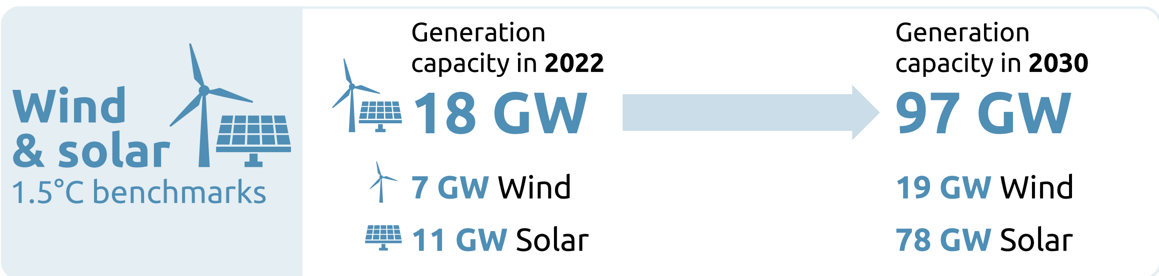
Executive Summary

Context

- Power supply is Mexico's largest GHG emitting sector.
- Mexican electricity supply is highly dependent on fossil fuels (77% in 2023). Natural gas is the dominant fuel (58%), followed by oil (9%). Coal (8%) is already phasing out.
- To meet the 1.5°C target, Mexico needs to significantly reduce the use of fossil fuels while coping with electricity demand growth. Wind and solar power will play a key role.
- Recent policies have increased support for gas-fired electricity generation and discontinued RE support mechanisms such as tenders, causing a slowdown in new wind and solar installations.
- A change in government could reinstate RE support policies, although it is likely that support for gas generation will continue, maintaining policies from the previous administration.

Key findings

- This report examines the wind and solar capacity installation Mexico needs for a 1.5°C compatible pathway, aligning with the goal of tripling renewables by 2030.
- Future electricity expansion should focus on wind and solar. Wind and solar generation in Mexico need to increase around 6x by 2030, compared to 2022 levels, to be 1.5°C compatible.
- Projected wind and solar rollout in Mexico falls short of benchmarks, with a 2030 capacity gap of nearly 50 GW for solar and 90 GW for wind under current policies. Both need significant growth to align with benchmarks.
- Mexico would need to reach around 97 GW of wind and solar installed by 2030 (19 GW and 78 GW, respectively) according to our benchmarks.
- Despite its current low levels, our model sees solar energy surpassing wind in power generation in 2030, 2040 and 2050, in line with country-level studies.



Context

At COP28, governments agreed to triple global renewable capacity by 2030 globally to stay in line with 1.5°C. This report highlights the potential implications of this COP28 decision at the national level, focusing on **Mexico**.

Wind and solar deployment is accelerating around the world. However, expected wind and solar capacity deployment under current policies falls short of what is needed for 1.5°C, and is concentrated mainly in a few regions.

Research is needed to understand the pace of wind and solar deployment that aligns with the highest plausible ambition and is compatible with 1.5°C

This project aims at answering the following questions:

- **How much wind and solar generation is needed (TWh) at the national level?**
- **How much wind and solar needs to be built (GW of capacity)?**
- **When does it need to be built by, and how quickly?**

Policy context

Mexico's 2030 NDC aims to reduce emissions by up to 35% below a BAU baseline by 2030, which is equivalent to **11-22% above 2010 levels** excluding LULUCF. The country does not yet have a formal net zero target for 2050.

Mexico's current renewable targets are to **reach 23 GW of solar and 13 GW of wind by 2030**, as of the National Electric System Development Program 2023-2037 (PRODESEN).

Under current policies and market conditions, the IEA estimates that **solar capacity will reach 28 GW in 2030**, up from 10.8 GW in 2022. Meanwhile, **wind capacity is projected to reach 10 GW in 2030**, up from 6.9 GW in 2022.

Recent policy developments have prioritized gas-fired electricity generation, discontinuing RE support mechanisms like RE auctions, which have slowed new wind and solar installations. While a change in government could restore RE policies, continued support for gas generation is expected to persist.

International support

The key analytical elements (high ambition country-level studies and downscaled 1.5°C compatible global pathways, see Methods) do not consider financing requirements.

Significant global resource transfers will be required in line with 'common but differentiated responsibilities and respective capabilities' to achieve these benchmarks.

We do not quantify the technical and financial support needed to achieve the wind and solar rollout presented in this report. This should be a country-driven exercise and some governments have already initiated such processes.

High-income countries will need to provide substantially increased climate finance to support emissions reduction abroad, in line with their 'fair share' of climate action.

Achieving these benchmarks in lower-income countries is therefore a global responsibility, rather than a domestic responsibility. Therefore, ambitious climate finance commitments and delivery are essential to support high ambition at the national level.

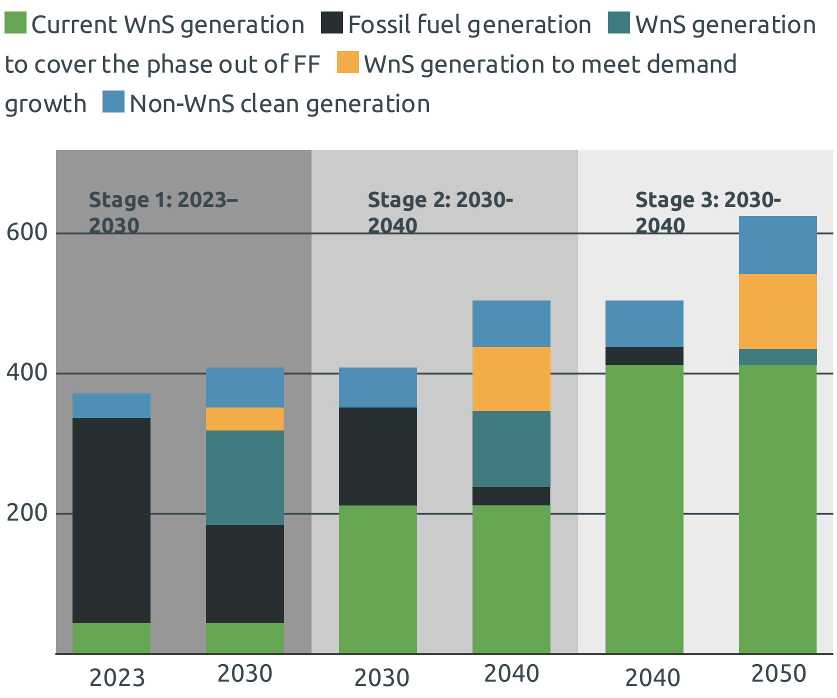
National enabling factors

Key enabling factors for ambitious wind and solar rollout include:

- **Institutional capacity.** A rapid build-out of wind and solar will require the governance and institutional capacity to develop, implement and enforce policy frameworks.
- **Just transition.** A just transition will be needed to take along all stakeholders, particularly those employed by the fossil economy.
- **Grid development.** Substantial increases in both transmission and distribution grid infrastructure will be necessary to integrate large-scale new wind and solar generation into the power system.
- **Fossil fuel phase-out.** Existing fossil fuel infrastructure often will need to be retired earlier than its economic lifetime. Policies need to be developed to achieve the early phase out of fossil fuel plants.
- **System flexibility.** Energy storage (diurnal and seasonal), flexible generation technologies such as hydro and geothermal, and increased demand side flexibility will all be crucial.
- **Market design.** Reform of market designs and regulation adapted to RE-based systems that incentivise and mobilise investments to install renewable energy at the scale needed (e.g., minimise cost of capital, ensure revenue certainty, etc).

Results

Stages of power sector decarbonisation



The stages of the electricity system transition in Mexico

WnS = Wind and Solar

Figure 1 – Electricity generation in each stage in TWh

In a 1.5°C pathway, countries must add solar, wind, and other clean technologies to meet rising power demand while replacing phased-out fossil fuels. The evolution of the power capacity mix over successive decades varies across countries.

From now until 2030, Mexico would need to add 2 GW of wind and 12 GW of solar capacity to meet growing demand alone. Another 8.4 GW of wind and 51 GW of solar will be needed to displace the share of fossil fuels in the electricity generation mix.

Power sector transformation and the increasing participation of variable renewable energy (VRE) – mainly wind and solar – in a country's power mix gives rise to a set of technical challenges linked to the integration of VRE sources. Six phases can be distinguished here, from phase 0 (pre-development with negligible amount of VRE shares) to phase E (with over 80% VRE shares). More information about these phases can be found in Annex A.

Meeting the benchmarks for 2030 will put Mexico in Phase D, with wind and solar making up 52% of the generation mix. Periods in which VRE availability exceeds demand occur more frequently than in earlier phases. Ensuring system stability while continuing to increase renewable penetration requires additional measures, such as expanded demand response, stronger interconnections and large-scale energy storage. Market design and regulatory frameworks become increasingly important to enable these solutions. Although particularly critical in this phase, many of these measures should begin in earlier phases (B and C) to provide long-term investment signals and facilitate a smoother system transformation.

Figure 1 and Table 1 both show the stages of the transition to a decarbonised power sector in terms of the volumes of existing wind and solar and what is needed to displace fossil fuels and meet demand increases. Figure 1 shows the stages in terms of electricity generation, and Table 1 shows it in terms of generation, capacity and share of the electricity mix.

Table 1: Stages of the electricity system transition detailing how much generation capacity of wind and solar will be needed to displace fossil fuels in the system and meet growing electricity demand

	2023		2030		2040		2050
Grid integration phase (share of variable renewable energy in total electricity generation)							
Phase	Phase A		Phase D		Phase E		Phase E
Share of VRE	**< 15%**		**< 70%**		**> 85%**		**> 85%**
Share of electricity generation							
Wind & Solar	**12 %**		**52 %**		**82 %**		**87 %**
Other renewables	9.2 %		14 %		13 %		13 %
Fossil Fuels	**79 %**		**34 %**		**5.2 %**		**0 %**
Generation capacity							
To displace fossil fuels		**+59 GW**		**+60 GW**		**+10 GW**	
Wind & Solar	**24 GW**	**+10 GW/yr**	**97 GW**	**+11 GW/yr**	**210 GW**	**+6 GW/yr**	**270 GW**
To meet demand increase		**+14 GW**		**+51 GW**		**+47 GW**	
Generation							
Total	**370 TWh**	11%	**410 TWh**	24%	**510 TWh**	24%	**630 TWh**
Wind & Solar	44 TWh		210 TWh		410 TWh		540 TWh
Generation Capacity of VRE (variable renewable energy)							
To displace fossil fuels			8.4 GW		2.4 GW		3.5 GW
Wind capacity	**8.4 GW**		**19 GW**		**23 GW**		**43 GW**
To meet demand increase			2 GW		2 GW		16 GW
To displace fossil fuels			51 GW		58 GW		6.7 GW
Solar capacity	**16 GW**		**78 GW**		**190 GW**		**220 GW**
To meet demand increase			12 GW		49 GW		31 GW

Note: Numbers are rounded to two significant figures, which may contribute to minor differences in totals. The calculations assume that wind, solar, and other renewables contribute equally and proportionally to displacing fossil fuels and meeting demand growth.

Future electricity demand

Electricity demand is taken from the Iniciativa Climática de México (ICM)'s study exploring net zero pathways for Mexico. We take demand from the most ambitious pathway, which achieves net zero Greenhouse Gases (GHG) emissions by 2060, which is aligned with a GHG emissions reduction pathway of 30% by 2030.

Total electricity generation in Mexico almost doubles by 2050 relative to 2021 levels, reaching 620 TWh. This is driven by economic development and increased electrification, while being partly offset by energy efficiency measures. However, there is a significant range in the studies in terms of the expected electricity generation in 2050 ranging from 620 TWh to 1800 TWh. Our demand estimate is at the lower end of that estimated by country-level studies. Assuming higher electricity demand would affect the expected growth of RE significantly.

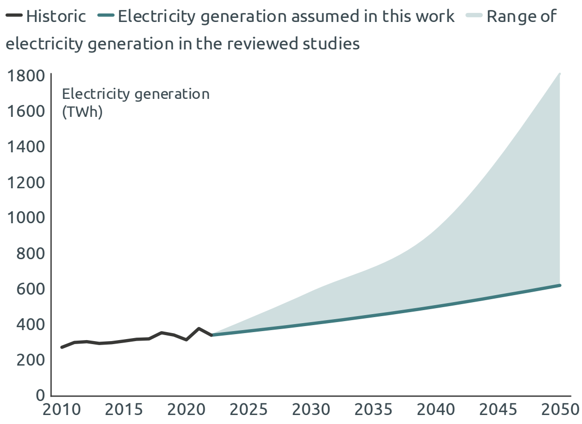


Figure 2 – Total electricity generation in TWh

Electricity generation almost doubles in Mexico over 2022–2050

The solid line shows the electricity generation projection used to develop the benchmarks

Pace of fossil fuel phase-out needed

The rate of fossil fuel phase-out is set by the overlap between country-level studies, downscaled 1.5°C compatible global pathways and the global milestones of the IEA's Net Zero roadmap, in which Mexico achieves a clean power system by 2045.

To align with 1.5°C, Mexico should start displacing fossil fuels now, phasing them out completely by 2045 while simultaneously addressing the growth in electricity demand. Wind and solar deployment will play a central role in achieving this goal.

Electricity generation from fossil fuels falls by 34-41% by 2030, compared to 2022 levels.

The fastest rate of fossil phase-out is set by Teske's study on Net-zero 1.5°C sectorial pathways for G20 countries.

To align with 1.5°C, Mexico should phase out fossil fuels by 2045 and expand renewables to meet growing demand

Mexico would need to achieve clean electricity by 2045

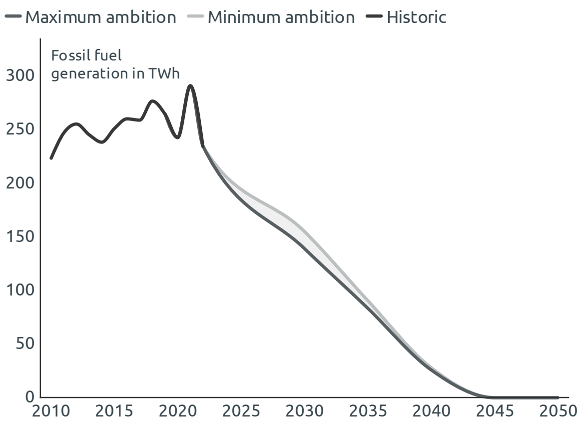


Figure 3 – Fossil fuel generation in TWh

Coal and gas phase-out in Mexico

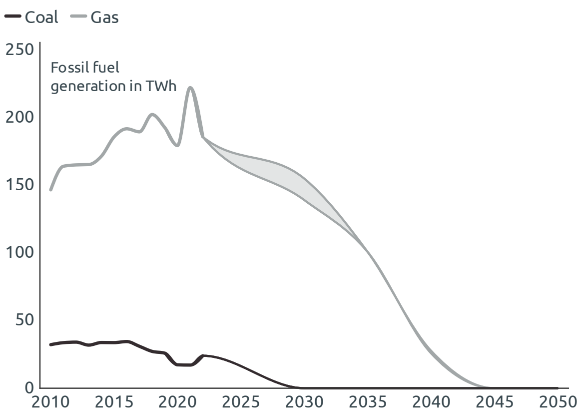


Figure 4 – Fossil fuel generation by fuel type in TWh

The role of other clean electricity generation

While wind and solar will be the workhorse of the energy transition, other clean electricity generation may play a role. We estimate the role of non- wind and solar clean electricity generation* (largely hydro, biomass, nuclear and geothermal) from country-level studies.

In our modelling, we assume that generation from clean technologies other than wind and solar in Mexico would reach 57 TWh by 2030 and 82 TWh by 2050. This is provided by hydropower, nuclear, biomass, and other renewable technologies.

Total wind and solar generation needed to align with 1.5°C

Wind and solar is then needed to meet electricity demand growth and to drive the phaseout of fossil fuels. We estimate the role of non-wind and solar clean technologies (largely hydro, biomass, nuclear and geothermal) from country-level studies.

To align with 1.5°C, wind and solar generation in Mexico would need to reach between 200 and 210 TWh by 2030. Generation in 2022 was 35 TWh. This is therefore a roughly six-fold growth in wind and solar.

Wind and solar provides around 50% of overall electricity generation in 2030, and 87% of overall generation in 2050.

This is in line with two of the most ambitious scenarios in terms of the pace of fossil phase-out in the 2020s/2030s among the national studies considered (Teske et al., Buira et al.), leading to accelerated wind and solar rollout. The net-zero scenario in the ICM modelling for Mexico yields a 35% share of electricity generation from wind and solar by 2030, with a still dominant share of natural gas at almost 50%.

To align with 1.5°C, wind and solar generation in Mexico needs to grow around 6x from 2022-2030

Wind and solar generation needs to grow 6x by 2030 relative to 2022 in Mexico

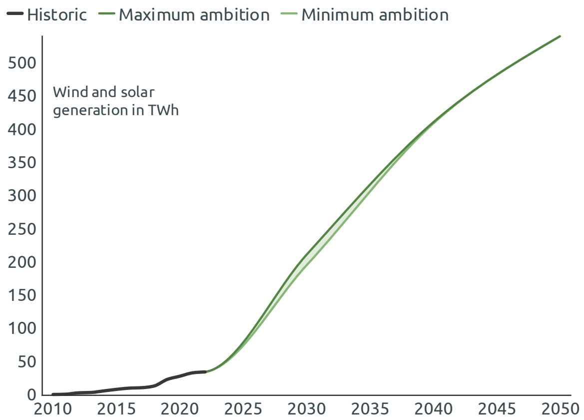


Figure 5 – Wind and solar electricity generation in TWh

Wind and solar need to provide over 80% of electricity generation in Mexico by 2050

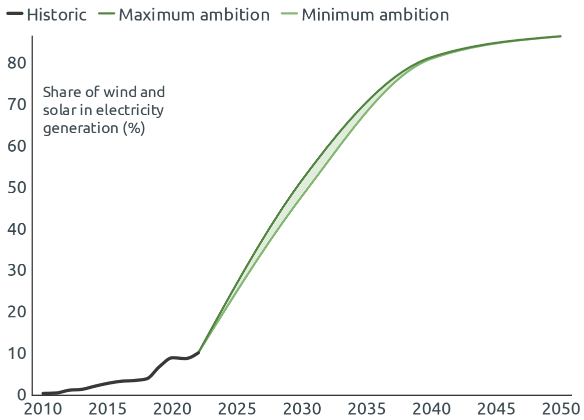


Figure 6 – Wind and solar electricity generation share (%)

* We do not consider CCS in the power sector, as we do not consider CCS a viable source of large-scale emissions reductions in the power sector.

Possible splits between wind and solar

The relative share of wind and solar deployment will vary depending on how various factors develop in the future. We explore one key uncertainty, the relative cost of solar and wind electricity generation (see methods). When accounting for this uncertainty, we see a range of possible future generation mixes between wind and solar.

We highlight the median of the range as our **central benchmark**, but do not suggest that this is the only possible breakdown into wind vs. solar. In the central benchmarking scenario, solar becomes the main source of generation, providing on average 2.3x as much generation as wind in the electricity mix by 2050. This will require a rapid uptake of non-fossil flexibility options.

In this scenario, **Mexico would need to deploy almost 100 GW of wind and solar by 2030 to limit warming to 1.5°C**. By 2050, total wind and solar capacity would need to reach towards 270 GW. Due to its higher capacity factor, greater wind deployment would reduce total capacity requirements.

Mexico needs to reach almost 100 GW of wind and solar installed capacity by 2030 to align with 1.5°C

Solar capacity would reach 78 GW in Mexico by 2030 in a 1.5°C-aligned scenario

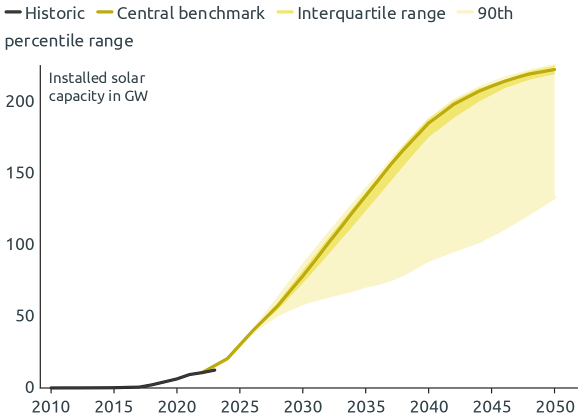


Figure 7 – 1.5°C compatible capacity benchmarks for solar in GW

Wind capacity would reach 19 GW in Mexico by 2030 in a 1.5°C-aligned scenario

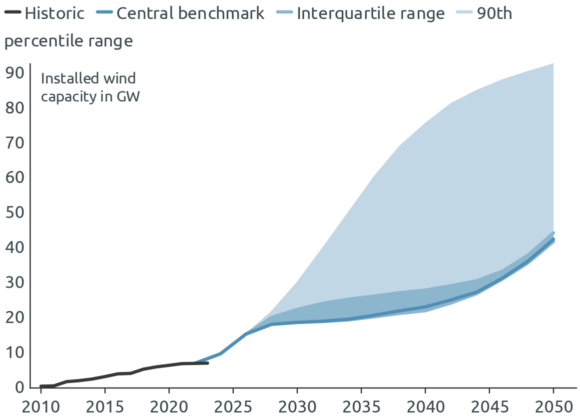


Figure 8 – 1.5°C compatible capacity benchmarks for wind in GW

Note: The benchmarks assume action from 2022.

The following table shows the wind and solar deployment needed to align with the central 1.5°C compatible benchmark produced. 2022 is historical data. All benchmark data from 2030 onwards is reported to two significant figures.

Table 2: Wind and solar electricity generation and capacity (2022–2050)

Scenario	Variable	Unit	2022	2030	2035	2040	2050
Central 1.5°Cbenchmark	Solar generation	TWh	16	140	240	330	380
Central 1.5°Cbenchmark	Wind generation	TWh	20	61	64	77	160
Central 1.5°Cbenchmark	Solar capacity	GW	11	78	130	190	220
Central 1.5°Cbenchmark	Wind capacity	GW	7	19	20	23	43

Table 3: Benchmarks translated into CAT format

Variable	Ambition	Unit	2030	2035	2040	2045	2050
Share of coal	Minimum	%	0	0	0	0	0
	Maximum	%	0	0	0	0	0
Share of gas	Minimum	%	38	22	6	0	0
	Maximum	%	34	22	5	0	0
Share of renewables	Minimum	%	61	78	95	100	100
	Maximum	%	65	78	94	100	100
Share of wind and solar	Minimum	%	48	64	81	87	87
	Maximum	%	52	64	82	87	87

Comparison to current rollout and country target

Under current policies and market conditions, deployment of solar and wind power in Mexico is well below the minimum level required to align with 1.5°C. To achieve the high pace of fossil fuel phaseout, **more wind and solar would need to be installed, about 80 GW of solar alone by 2030**.

While the current deployment of solar power is broadly on track to meet the government's 2030 targets, wind deployment must increase by at least 1.5 times to align with the wind targets.

However, **both wind and solar targets need a significant ramp-up to be aligned with a 1.5°C pathway**: solar and wind capacity targets must increase by 3.4 and 1.5 times, respectively.

Further action will be needed to drive wind deployment in Mexico at the pace needed.

There is strong support from businesses for high ambition from the government to phase out fossil fuels and transition the electricity system to be powered by renewables, with 95% of executives in Mexico polled in the Global Business Poll in favour and 80% wanting to see this transition by 2035.

Mexico's wind and solar rollout falls far short of alignment with 1.5°C

In Mexico, current rollout of solar is lagging behind 1.5°C-aligned levels

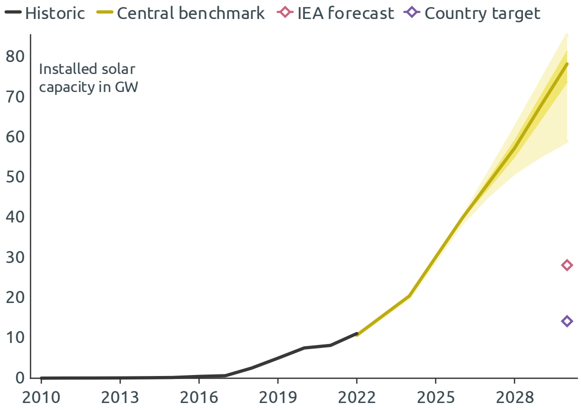


Figure 9 – Installed solar capacity in 2030 compared to targets and current policy projections in GW

In Mexico, current rollout of wind is lagging behind 1.5°C-aligned levels

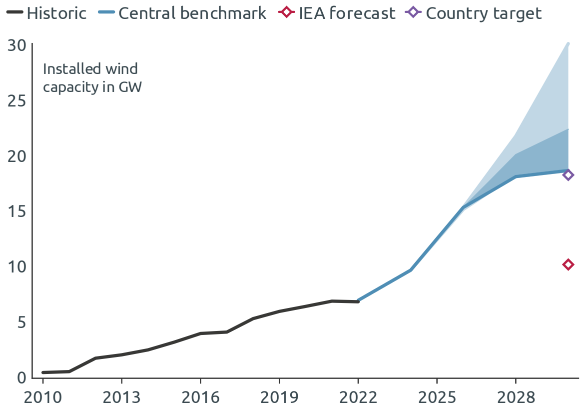


Figure 10 – Installed wind capacity in 2030 compared to targets and current policy projections in GW

Note: The target data was last pulled from Ember in January 2025. The current policies data was last pulled from the IEA in June 2025. The benchmarks assume action from 2022.

Wind and solar annual capacity additions in Mexico need to accelerate to align with 1.5°C, requiring international financial support

Mexico would need to add on average 7.7 GW/yr of solar capacity until 2030, and 7.5 GW/yr by over 2030–2050.

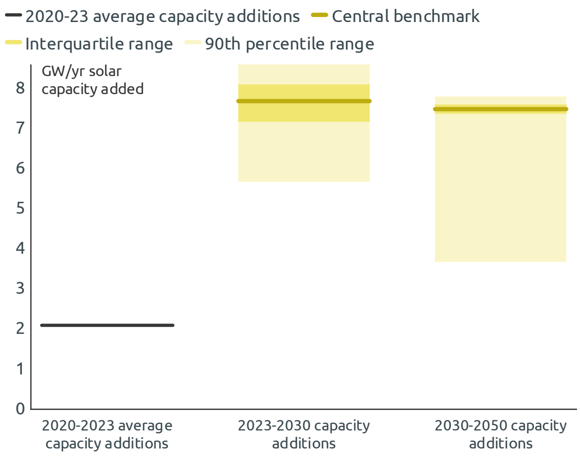


Figure 11 – Solar capacity additions per year in GW/y

Mexico would need to add on average 1.4 GW/yr of wind capacity until 2030, and 1.4 GW/yr by over 2030–2050

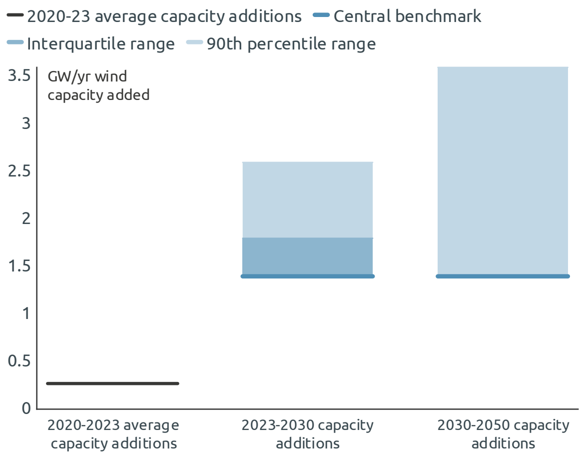


Figure 12 – Wind capacity additions per year in GW/y

Comparison with other studies

We compare the wind and solar generation seen in our analysis to that in the literature review of country-level studies. In particular, we highlight the results of modelling from Iniciativa Climática de México (ICM), exploring net zero pathways for Mexico.

Our analysis shows solar generation broadly within the range of the national literature, particularly towards 2030/2040. The results from national studies vary widely toward 2050 due to differing underlying assumptions. For wind, our analysis is generally on the lower end of the wind generation range of the national studies.

Our analysis shows higher generation from both wind and solar than the ICM study, largely due to the greater share of natural gas in this scenario in the 2030 energy mix and a delayed fossil fuel phase-out by 2060.

Both country-level studies and our modelling see solar will provide more power generation than wind in 2030, 2040 and 2050.

Our benchmarks are broadly aligned with the literature

Electricity generation from solar: comparison with literature in Mexico

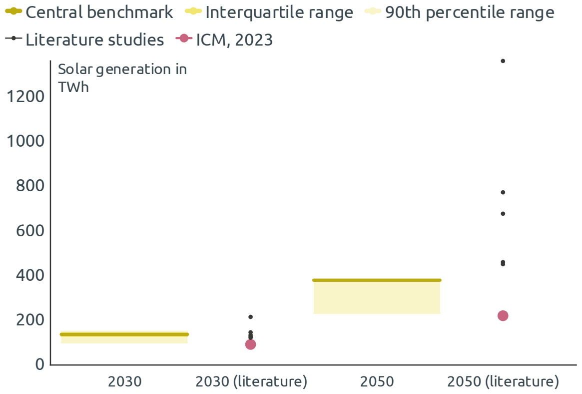


Figure 13 – Solar electricity generation in TWh

Electricity generation from wind: comparison with literature in Mexico

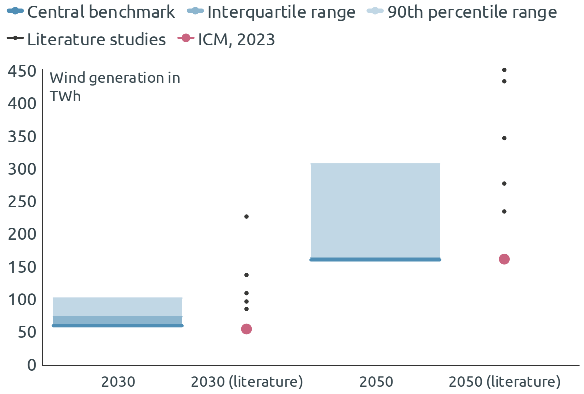


Figure 14 – Wind electricity generation in TWh

In Mexico, our benchmarks suggest that solar will provide 2.4x more electricity than wind

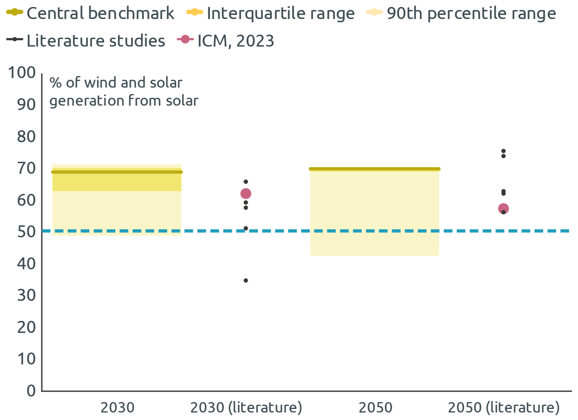


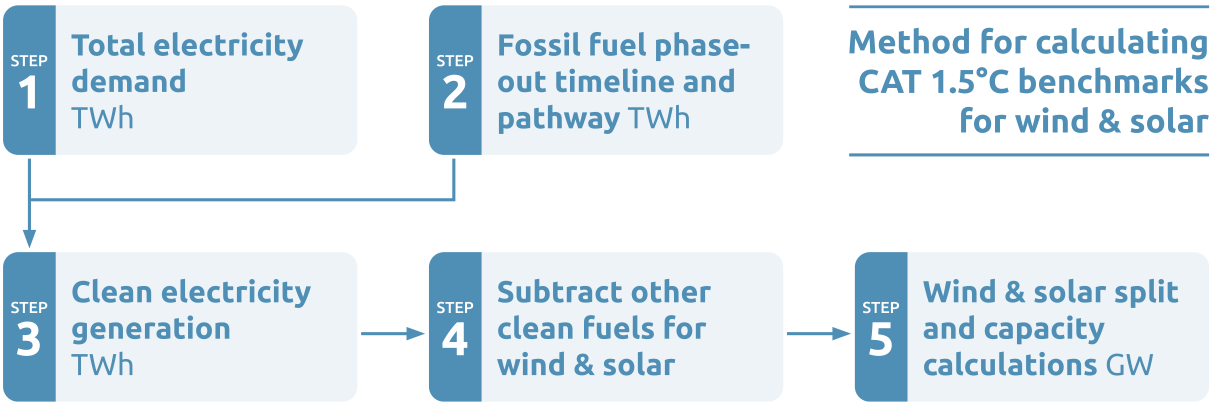
Figure 15 – Generation split between wind and solar (%)

Share of wind and solar generation that comes from solar: comparison with literature in Mexico

The area above the blue dashed line represents a power system in which solar provides more electricity generation than wind

Methodology

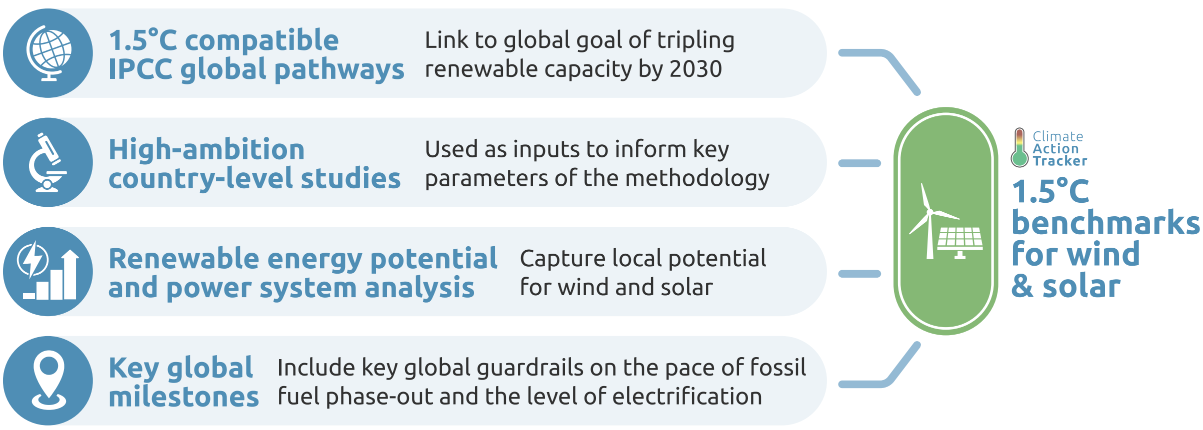
Summary of our method



Our method takes a series of steps to calculate the wind and solar generation needed for 1.5°C, and the resulting capacity deployment. The key methodological steps are highlighted below.

1. We project future electricity demand in the country.
2. We calculate the pace of fossil fuel phase-out needed to align with 1.5°C.
3. Bringing these trajectories together defines the level of clean electricity generation required to meet electricity demand growth while phasing out fossil fuels in the power sector.
4. We project non-wind and solar clean electricity generation based on country-level literature. This allows us to identify the wind and solar generation necessary to align with 1.5°C.
5. Having produced this wind and solar generation trajectory, we feed it into a simplified electricity system model (PyPSA), which calculates for a given set of cost assumptions around wind and solar, a split into wind versus solar and the associated capacity requirements.

Overlap of different elements



Our method focuses on the overlap between different elements. By looking at the range of fossil fuel phase-out which is outlined in both high ambition country-level studies and downscaled 1.5°Ccompatible global pathways, and is informed by key global milestones, we identify benchmarks which are both consistent with a global least cost pathway to limiting warming to 1.5°C but are also aligned with national–level modelling.

Combining multiple different analytical elements can help identify the most robust path to achieving a zero-carbon energy system.

For more details see the **Methods Annex**.

List of scenarios selected

Table 4: Country-level studies for Mexico

Study	Publication	Scenario selected
ICM, 2023	Rutas sectoriales para el escenario nacional emisiones netas cero de México	Net Zero Emissions
Buira et al., 2021	A whole-economy Deep Decarbonization Pathway for Mexico	Deep Decarbonization Pathway
Sarmiebto et al., 2019	Analyzing Scenarios for the Integration of Renewable Energy Sources in the Mexican Energy System – An Application of the Global Energy System Model (GENeSYS-MOD)	Climate Goals 100% Renewables
Simon et al., 2018	Transformation towards a Renewable Energy System in Brazil and Mexico – Technological and Structural Options for Latin America	Energy [R]evolution
Teske et al., 2023	Net-zero 1.5°C sectorial pathways for G20 countries: energy and emissions data to inform science-based decarbonization targets	1.5°C

Annex A

Phases of grid integration

The grid integration phase is adapted from a de Vivero et al. report detailing a qualitative assessment framework for power system transformation and an IEA report on integrating solar and wind. We use the share of VRE sources in electricity generation to classify countries into a phase. More information about the characteristics and key challenges of each phase can be found in the report.

Phase 0 (less than 5% annual VRE share): we assign this phase when wind and solar make up 0-5% of a country's electricity generation mix. Installed VRE capacity is limited, and the impact on power system operation is negligible. Integration does not require significant operational or structural changes.

Phase A (between 5% and 15% annual VRE share): we assign this phase when wind and solar make up 5-15% of a country's electricity generation mix. Conventional power system operation remains largely sufficient for day-to-day system management. However, system planning must anticipate higher future VRE shares. This includes improving forecasting tools, integrating forecasting into dispatch decisions and moving toward shorter scheduling intervals and more real-time system operation.

Phase B (between 15% and 25% of annual VRE share): we assign this phase when wind and solar make up 15-25% of a country's electricity generation mix. The contribution of VRE varies significantly over time, with periods of very low output and periods of high penetration. This variability increases the need for operational flexibility. Enhanced coordination between system operators, network operators, and distribution system operators becomes critical to maintain system efficiency and security.

Phase C (between 25% and 40% of annual VRE share): we assign this phase when wind and solar make up 25-45% of a country's electricity generation mix. Periods in which VRE dominates system behaviour become increasingly frequent. A key operational challenge is maintaining system stability during sudden disruptions in supply or demand. Curtailment of VRE may become necessary to preserve system security. Without structural adjustments, integration constraints of VRE into the system may slow further increases in renewable energy shares despite additional installed capacity.

Phase D (between 40% and 70% of annual VRE share): we assign this phase when wind and solar make up 45-80% of a country's electricity generation mix. Periods in which VRE availability exceeds demand occur more frequently than in earlier phases. Ensuring system stability while continuing to increase renewable penetration requires additional measures, such as expanded demand response, stronger interconnections and large-scale energy storage. Market design and regulatory frameworks become increasingly important to enable these solutions. Although particularly critical in this phase, many of these measures should begin in earlier phases (B and C) to provide long-term investment signals and facilitate a smoother system transformation.

Phase E (more than 70% share of annual VRE share): we assign this phase when wind and solar make up 80-100% of a country's electricity generation mix. The power system reaches very high VRE penetration. The primary challenge becomes ensuring adequacy during extended periods of low wind and solar availability. Addressing this requires long-duration energy storage, sector coupling allowing for export and import of power between economic sectors in the same country and extensive electricity trade both within regions and between countries.

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Authors names are listed alphabetically.

The Consortium

The Climate Action Tracker (CAT) is an independent scientific analysis produced by three research organisations tracking climate action since 2009. We track progress towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C.

climateactiontracker.org

Climate Analytics is a non-profit institute leading research on climate science and policy in relation to the 1.5°Climit in the Paris Agreement. It has offices in Germany, the United States, Togo, Australia, Nepal and Trinidad and Tobago.

climateanalytics.org

NewClimate Institute is an independent non-profit organisation that develops solutions to tackle climate change and drives their implementation worldwide. Through research, policy advice and knowledge sharing, we aim to raise the ambition for climate action and support sustainable development.

newclimate.org