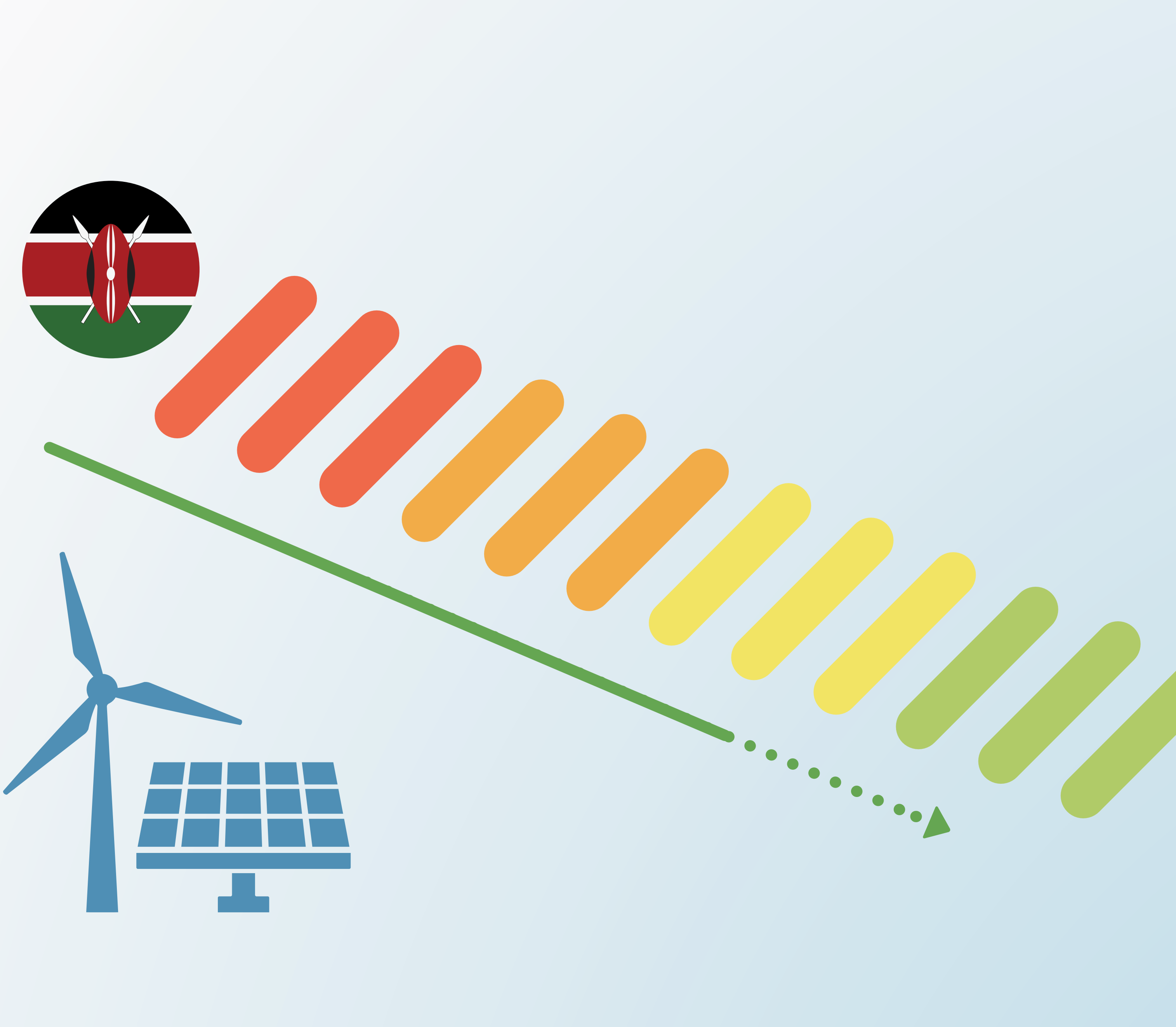


Climate Action Tracker

Wind and Solar benchmarks for a 1.5°C world

KENYA

February 2026

CLIMATE ANALYTICS

NEW CLIMATE INSTITUTE

Executive Summary

Context

- Kenya's power sector is already dominated by clean energy sources, with significant hydro, geothermal, wind, and solar potential. However, fossil fuels still provided roughly 10% of generation in 2023.
- The Kenyan Government has set a target of achieving 100% renewable electricity by 2030.
- In this report, we look at national studies and global energy system models to assess how much Kenya's wind and solar capacity needs to grow to align with the global goal to triple renewables by 2030 and the Paris Agreement's 1.5°C warming limit.

Key findings

- Kenya's wind and solar generation needs to grow between 4-4.5 times by 2030 to align with 1.5°C. This equates to 8-9 TWh of wind and solar generation in 2030, up from 2 TWh in 2023.
- Roughly 3 GW of new wind and solar would be needed by 2030 (2.1 GW solar, 1.2 GW wind). This would require average annual capacity additions of 0.3 GW/yr of solar and 0.2 GW/yr of wind from 2023-2030.
- Kenya's current rollout of wind and solar is not progressing fast enough to achieve this. Under current policies and market conditions, roughly half of the wind and solar needed to align with 1.5°C will be installed by 2030.

Wind & solar
1.5°C benchmarks

Generation capacity in **2023**	Generation capacity in **2030**
1.1 GW	**4.7 GW**
0.7 GW Wind	**2 GW** Wind
0.4 GW Solar	**2.7 GW** Solar

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 **Kenya**.

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

Kenya's 2035 Nationally Determined Contribution (NDC) is to cut emissions 35% by 2035 below business as usual (BAU) levels including LULUCF. Kenya has committed to mobilise domestic resources to achieve 20% of its emission reductions, with the further 80% contingent upon international support. Kenya has set a 2050 net zero emissions target.

Kenya also aims to reach 100% of renewables in electricity generation by 2030, but under current policies, is projected to reach a 94% share in 2030.

Under current policies and market conditions, the IEA estimates that **solar capacity in Kenya will reach 2 GW in 2030**, up from 0.4 GW in 2023. Meanwhile, **wind capacity is projected to reach 0.9 GW in 2030**, up from 0.7 GW in 2023.

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.

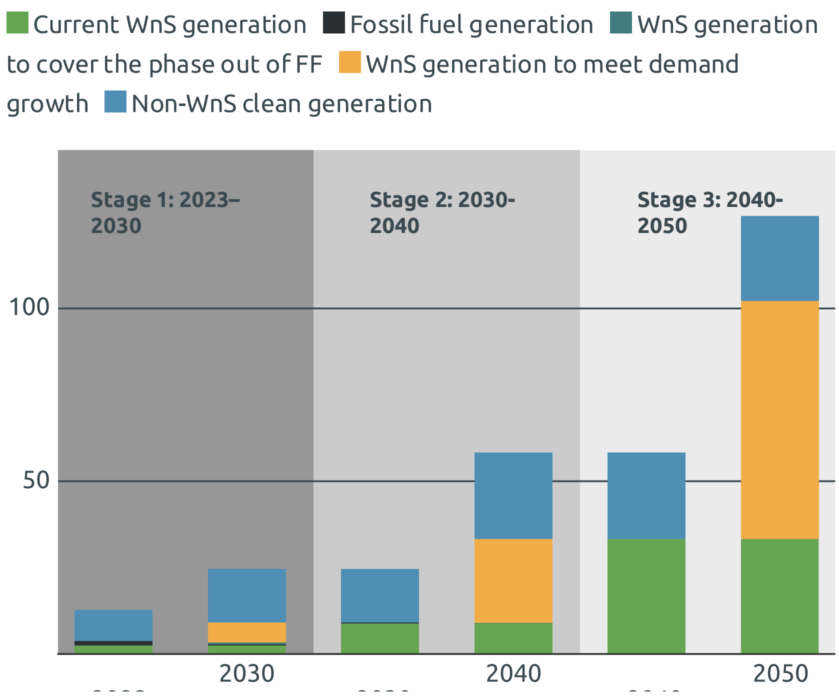
National enabling factors

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 renewable energy-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 Kenya

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, Kenya would need to add 1.2 GW of wind and 2.1 GW of solar capacity to meet growing demand alone. Another 0.1 GW of wind and 0.2 GW of solar will be needed to displace the share of fossil fuels in the 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 the phases can be found in Annex A.

Meeting the benchmarks for 2030 will put Kenya in Phase C, with wind and solar making up 36% of the 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.

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 B		Phase C		Phase D		Phase D
Share of VRE	**< 25 %**		**< 40%**		**< 70%**		**< 70%**
Share of electricity generation							
Wind & Solar	**20 %**		**36 %**		**57 %**		**81 %**
Other renewables	70 %		63 %		43 %		19 %
Fossil Fuels	**10 %**		**1.4 %**		**0 %**		**0 %**
Generation capacity							
To displace fossil fuels		**+0.3 GW**		**+0.1 GW**		**+0 GW**	
Wind & Solar	**1.1 GW**	**+0.5 GW/yr**	**4.7 GW**	**+1 GW/yr**	**11 GW**	**+2 GW/yr**	**35 GW**
To meet demand increase		**+3.3 GW**		**+6.2 GW**		**+24 GW**	
Generation							
Total	**13 TWh**	92%	**25 TWh**	132%	**58 TWh**	124%	**130 TWh**
Wind & Solar	2.5 TWh		8.8 TWh		33 TWh		100 TWh
Generation Capacity of VRE (variable renewable energy)							
To displace fossil fuels			0.1 GW		0 GW		0 GW
Wind capacity	**0.7 GW**		**2 GW**		**6 GW**		**13 GW**
To meet demand increase			1.2 GW		4 GW		6.8 GW
To displace fossil fuels			0.2 GW		0 GW		0 GW
Solar capacity	**0.4 GW**		**2.7 GW**		**4.9 GW**		**22 GW**
To meet demand increase			2.1 GW		2.2 GW		17 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 Kihara et al.'s study exploring mid and long-term power system planning for Kenya. We take demand from the high demand pathway, which is aligned with energy demand projections from Kenya's Least Cost Power Development Plan (LCPDP) based on the Vision 2030 development plan.

In this scenario, total electricity demand in Kenya grows by an average 8.2% per year, reaching 127 TWh in 2050. Demand growth is driven by population growth and increasing urbanisation, GDP growth, and the achievement of key LCPDP goals including grid-scale renewables projects and increased electrification in the transport sector.

However, there is a significant range in the studies in terms of the expected electricity generation in 2050 ranging from 62 TWh to 232 TWh. This would affect the necessary growth of wind and solar significantly. Our demand estimate is roughly in the middle of the range estimated by country-level studies.

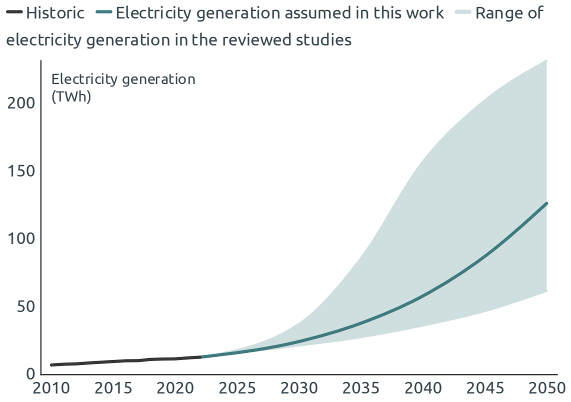


Figure 2 – Total electricity generation in TWh

Electricity generation grows 118% in Kenya, driven by electrification of end-use sectors and increased electricity access

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, where Kenya achieves a clean power system by 2045.

The only fossil fuel currently used in Kenya's power system is oil. Gas and coal have not been used as a fossil fuel for electricity production in the country. To align with 1.5°C, fossil fuels must exit the Kenyan power sector before 2045. Fossil fuel generation falls from 10% of the power sector fuel mix to less than 1% between 2023 and 2040.

Kenya's national target of 100% clean electricity by 2030, if achieved, will outpace 1.5°C benchmarks.

To align with 1.5°C, fossil fuels must exit the power sector in Kenya by 2045, even as electricity demand grows rapidly.

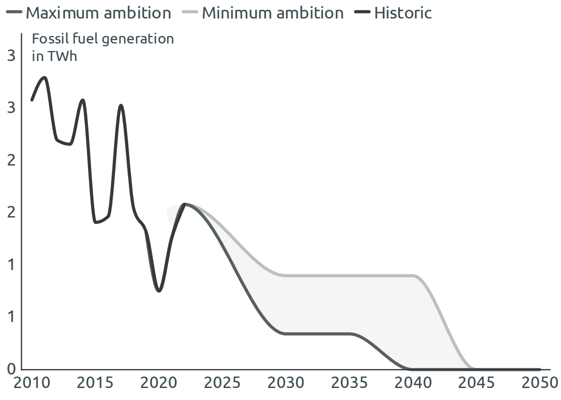


Figure 3 – Fossil fuel generation in TWh

Kenya would need to achieve clean electricity by 2045

Oil is the key fossil fuel in use in Kenya

The role of other clean electricity generation

While wind and solar will be the workhorse of the energy transition, other clean electricity generation will 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 Kenya would rise from 9 TWh in 2023 to 15 TWh in 2030 and staying at roughly 25 TWh between 2040 to 2050. This generation is provided largely from geothermal and hydropower, with a small amount of biomass. The benchmarks do not assume any deployment of nuclear in the Kenyan power sector.

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

The wind and solar rollout is then calculated by combining projected electricity demand growth, the fossil fuel phase-out necessary to align with 1.5°C, and the assumed generation from other clean technologies.

To align with 1.5°C, **wind and solar generation in Kenya would need to reach between 8 and 9 TWh by 2030**. Generation in 2023 was 2 TWh. This is therefore a 4 to 4.5-fold growth in wind and solar.

Wind and solar provides 34-36% of overall electricity generation in 2030, and 81% of overall generation in 2050. A grid powered almost entirely by wind and solar would require substantial rollout of batteries and energy storage, support from dispatchable generation such as hydro and geothermal, flexible demand and grid extension to ensure reliability of the system. Kenya is well positioned to introduce non-fossil flexibility options given its significant hydro and geothermal resources.

To align with 1.5°C, wind and solar generation would need to grow rapidly in Kenya

Wind and solar generation needs to grow 4-4.5x by 2030 relative to 2023 in Kenya

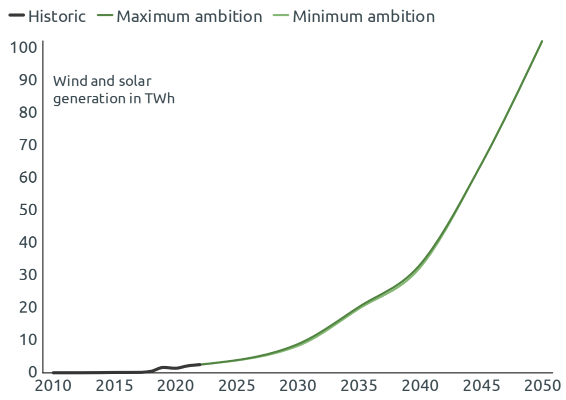


Figure 4 – Wind and solar electricity generation in TWh

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

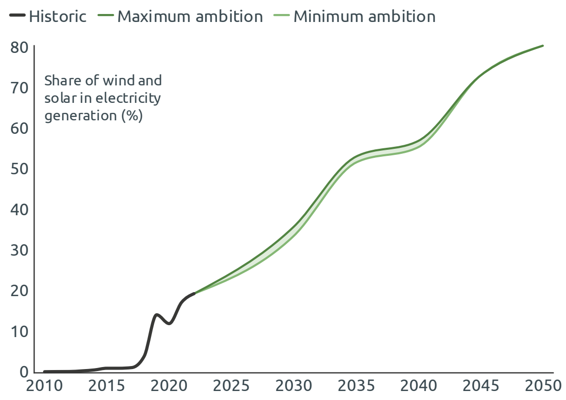


Figure 5 – Wind and solar electricity generation share (%)

* 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 almost six times 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, **Kenya would need to deploy around 3 GW of additional wind and solar by 2030 to align with the 1.5°C temperature limit**. By 2050, total wind and solar capacity would need to reach to roughly 35 GW. Wind provides more than double the electricity than solar by 2050. However, the contribution of both technologies grows rapidly towards 2050. This is enabled by the presence and further uptake of non-fossil flexibility options like hydro and geothermal in Kenya's power system.

Importantly, these are cost-optimised modelled pathways that give a useful indication of the pace and scale of wind and solar deployment needed for 1.5°C, but they cannot fully the capture real-world context, where industry development, supply chains, workforce, and infrastructure will require stable and sustained development.

Kenya needs to install around 3 GW of wind and solar by 2030 to align with 1.5°C

Solar capacity in Kenya would reach 2.7 GW by 2030 in a 1.5°C-aligned scenario

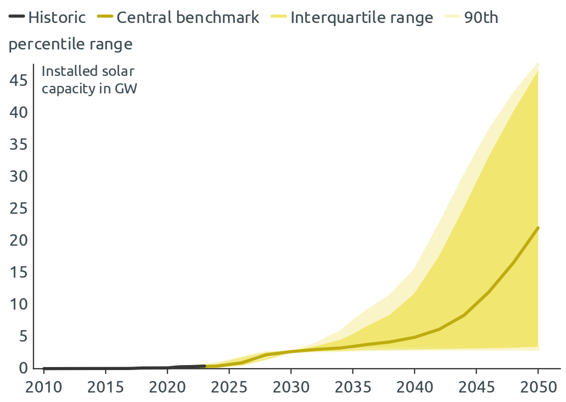


Figure 6 – 1.5°C compatible capacity benchmarks for solar in GW

Wind capacity in Kenya would reach 2 GW by 2030 in a 1.5°C-aligned scenario

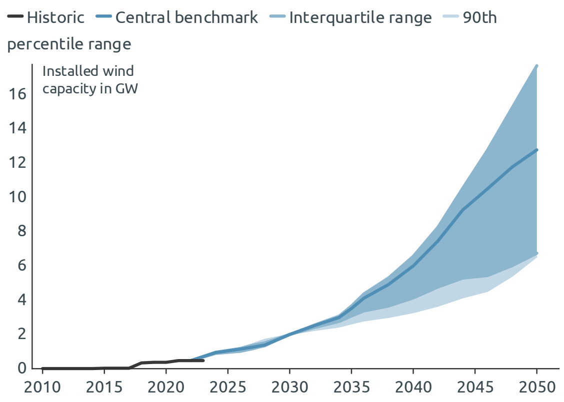


Figure 7 – 1.5°C compatible capacity benchmarks for wind in GW

The following table shows the wind and solar deployment needed to align with the central 1.5°C compatible benchmark produced. 2023 is historical data. All benchmark data from 2030 onwards is reported to two significant figures.

Table 2: Wind and solar electricity generation and capacity (2023–2050)

Scenario	Variable	Unit	2023	2030	2035	2040	2050
Central 1.5°C benchmark	Solar generation	TWh	0.4	2.8	3.7	5.4	32
Central 1.5°C benchmark	Wind generation	TWh	2.3	9	17	31	71
Central 1.5°C benchmark	Solar capacity	GW	0.4	2.7	3.5	4.9	22
Central 1.5°C benchmark	Wind capacity	GW	0.7	2	3.5	6	13

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	%	4	2	2	0	0
	Maximum	%	0	0	0	0	0
Share of renewables	Minimum	%	96	98	98	100	100
	Maximum	%	99	99	100	100	100
Share of wind and solar	Minimum	%	34	52	56	73	81
	Maximum	%	36	53	57	73	81

Comparison to current rollout and country target

Under current policies and market conditions, deployment of wind and solar PV in Kenya would not align with 1.5°C in 2030. Solar is potentially on track but threatens to fall behind without action to accelerate the pace of rollout. There would be a capacity gap of **0.7 GW of solar PV** and **1.1 GW of wind** missing in 2030 between current rollout and the 1.5°C compatible benchmarks highlighted here.

At the same time, **current deployment of wind and solar power is not on track to meet the government's 2030 wind and solar capacity targets, which are aligned with 1.5°C compatible benchmarks.**

Further action will be needed to drive wind and solar deployment in Kenya at the pace needed to align with a 1.5°C pathway.

Kenya's rollout of wind and solar needs to accelerate to align with 1.5°C

In Kenya, the pace of the solar rollout threatens to fall behind 1.5°C-aligned levels

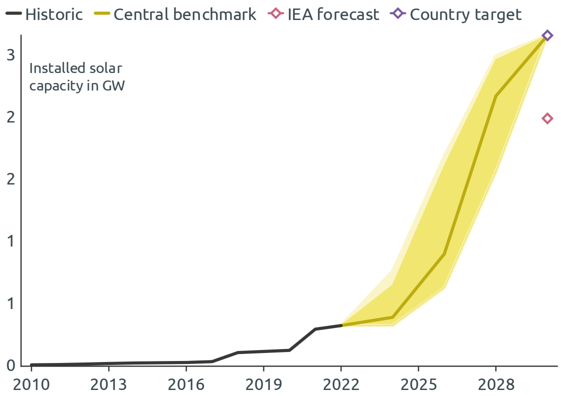


Figure 8 – Installed solar capacity in 2030 compared to targets and current policy projections in GW

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

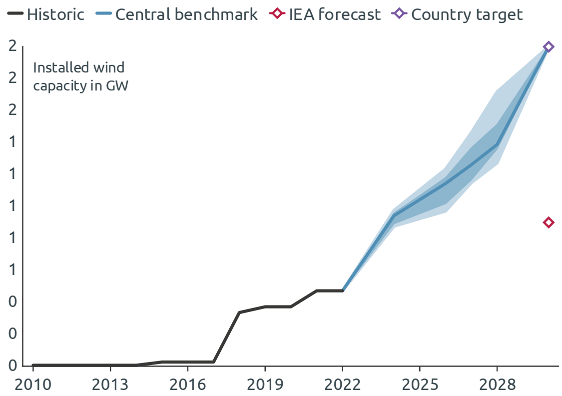


Figure 9 – Installed wind capacity in 2030 compared to targets and current policy projections in GW

Note: The target data was last pulled from [Ember] in January 2025. The current policies data was last pulled from the [IEA] in February 2026.

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

Kenya would need to add on average 0.3 GW/yr of solar capacity until 2030, and 0.9 GW/yr over 2030–2050, compared to 0.06 GW/yr from 2020–2023

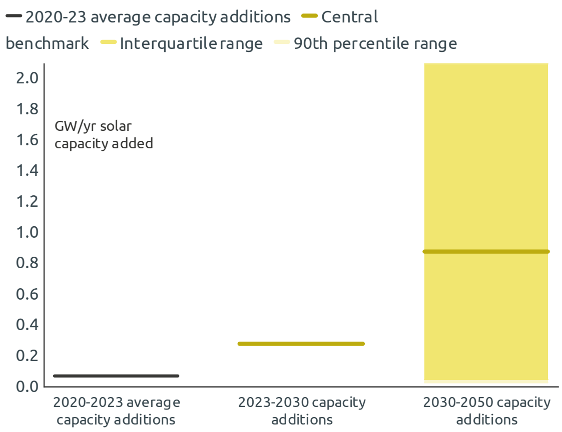


Figure 10 – Solar capacity additions per year in GW/y

Kenya would need to add on average 0.2 GW/yr of wind capacity until 2030, and 0.6 GW/yr over 2030–2050, compared to 0.03 GW/yr from 2020–2023

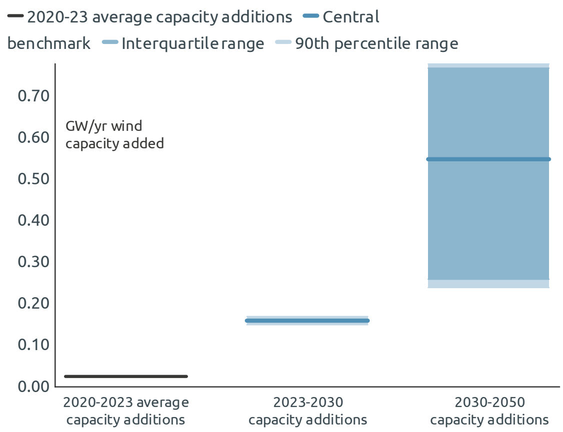


Figure 11 – Wind capacity additions per year in GW/y

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. We highlight the results of modelling from Kihara et al. (2024), where we particularly highlight the results from the *High Demand* scenario.

We see that the wind and solar generation that our method produces is broadly comparable to this modelling in 2050. The results from national studies vary widely toward 2050 due to differing underlying assumptions and uncertainties. Despite this range, our analysis remains largely comparable with the literature, particularly with Kihara et al. (2024). However, our benchmarks envisage a slightly different split of wind and solar between 2030 and 2050, showing relatively more solar and less wind. Our modelling presents a cost-optimised split of wind and solar, further details on how this is estimated can be found in the Methods.

Our benchmarks are broadly aligned with the literature

Electricity generation from solar: comparison with literature in Kenya

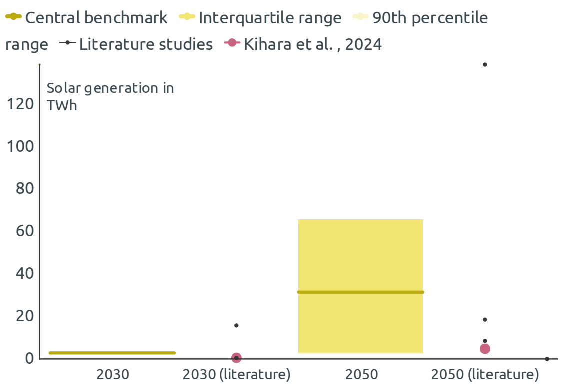


Figure 12 – Solar electricity generation in TWh

Electricity generation from wind: comparison with literature in Kenya

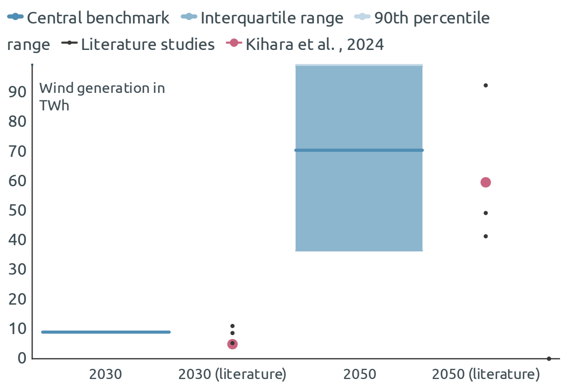


Figure 13 – Wind electricity generation in TWh

In Kenya, our benchmarks generally suggest a higher share of wind than solar

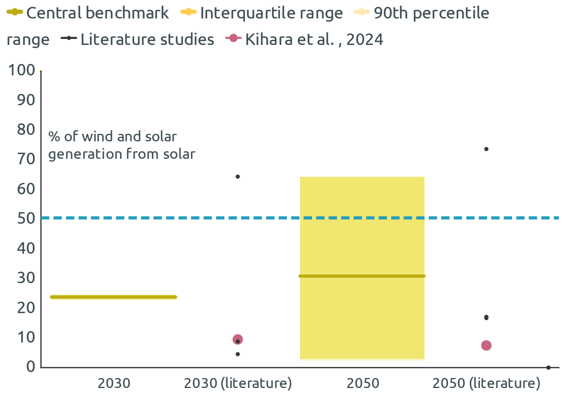


Figure 14 – Generation split between wind and solar (%)

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

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

STEP 1 **Total electricity demand** TWh

STEP 2 **Fossil fuel phase-out timeline and pathway** TWh

Method for calculating CAT 1.5°C benchmarks for wind & solar

STEP 3 **Clean electricity generation** TWh

STEP 4 **Subtract other clean fuels for wind & solar**

STEP 5 **Wind & solar split and capacity calculations** GW

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

1.5°C compatible IPCC global pathways — Link to global goal of tripling renewable capacity by 2030

High-ambition country-level studies — Used as inputs to inform key parameters of the methodology

Renewable energy potential and power system analysis — Capture local potential for wind and solar

Key global milestones — Include key global guardrails on the pace of fossil fuel phase-out and the level of electrification

Climate Action Tracker

1.5°C benchmarks for wind & solar

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 Kenya

Study	Publication	Scenario selected
Millot et al., 2024	The map behind the roadmap - Introducing a geospatial energy model for utility-scale solar and wind power buildout in Kenya	• Low demand • High demand
Kihara et al., 2024	Mid- to long-term capacity planning for a reliable power system in Kenya	High demand
Teske et al., 2025	Kenya: Energy Development Plan to Decarbonise the Economy	K-1.5

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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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.

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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.

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