KPMG

Global ambition to triple renewable energy capacity

Where are we 12 months later

October 2024

kpmg.com/in

KPMG. Make the Difference.

Table of contents

Methodology

This thought leadership report titled “Global ambition to triple renewable energy capacity: Where are we 12 months later” tracks the progress in renewable energy (RE) from 2022 and beyond. It provides a comparative view of RE in 2023 vs 2022 (2022 was the base year in “Turning the tide in scaling renewables” report). The current thought leadership report is thus an update on our report “Turning the tide in scaling renewables”.

This report aggregates market data across different RE technologies and systems and key countries to provide a status update. The report also delves into the countries and regions that are critical in driving the transition and discusses key barriers. Additionally, it touches upon the developments post COP28 that have impacted the pace of renewables penetration.

The report investigates a multitude of factors, such as legislative updates, funding landscape, actions by global bodies and strategies of private players, to examine their impact on RE adoption and scaling.

Barriers towards scaling up renewables have been identified by

- Analyzing data and data trends from different sources.
- Evaluating expert views (think-tanks and industry sources).
- Triangulating data and information from different sources to pinpoint gaps and lagging areas.
- Comparing developments of 2022 and 2023.
- Assessing views of market players.

Foreword

At COP28 in 2023, the countries committed to increase the renewable capacity by three-fold by 2030. Considering the goal is just five years away, this target calls for expedited action on all fronts across nations. However, in the global effort to drive renewable energy penetration, emerging markets and developing economies (EMDEs) are lagging due to multiple reasons. **In our report, "Turning the tide in scaling renewables", we looked at ten barriers preventing the growth of renewable solutions, with a focus on market development as of 2022.** This report tracks progress of renewable energy expansion in some major emerging market jurisdictions in 2023 and provides insights into major barriers each of these markets are facing.

It's common consensus that EMDEs hold the key to turbocharge renewable expansion, as these are the future hotspots of high energy consumption and carbon emissions. Understandably, these markets witnessed strong growth in renewable capacity in 2023, though China-centricity prevailed, thanks to its state policy and public funds. Other emerging markets recorded gains in capacity installation and generation, driven by incremental systemic improvements. This China-driven dichotomous growth raised concerns regarding the ability of the world to meet the 2030 target.

The reality of the matter is that incremental, concentrated progress is leading to longer-than-expected time to resolve the challenges these markets face. All the emerging markets studied in this report, despite their heterogeneity, grapple with challenges of a fuzzy market structure, inconsistent policy and access to capital — the foundation of creating a vibrant renewable energy system. These, together with low investments and development in grid and storage infrastructure, are making the meaningful scaling of renewables extremely challenging.

The upcoming COP's initiative to arbitrate the grid and storage problems is reflective of ambition and promise. But EMDEs would require relatively increased and synchronized intervention from policymakers, financial bodies and industry to break through the fundamental issues and make an impact.

Executive summary

It is well-known that climate transition and 2050 target depends on the adoption of a collective and coordinated, multi-faceted approach by the global community. While, arguably, the burden to finance the transition is on the developed countries, the burden to reduce the emissions is increasingly shifting to EMDEs that account for the majority share in emissions. These nations will continue to drive majority of the emissions growth in future as well due to their high economic growth, electrification of energy and cross-sectoral plans for energy transition.

The Global South was responsible for over 50 percent of the global energy consumption in 2023 and they will continue to account for the majority share[1]. As per industry sources, Asia-Pacific alone is expected to consume more than 50 percent of the global final energy demand and Africa is likely to consume more than North America or Europe by 2050. As a result, EMDEs have become the action ground to shape the climate transition. And one of the measures via which these economies are powering their efforts to reduce emissions and mitigate climate change is green transition.

26%

Share of renewables in the global energy consumption[1]

14%

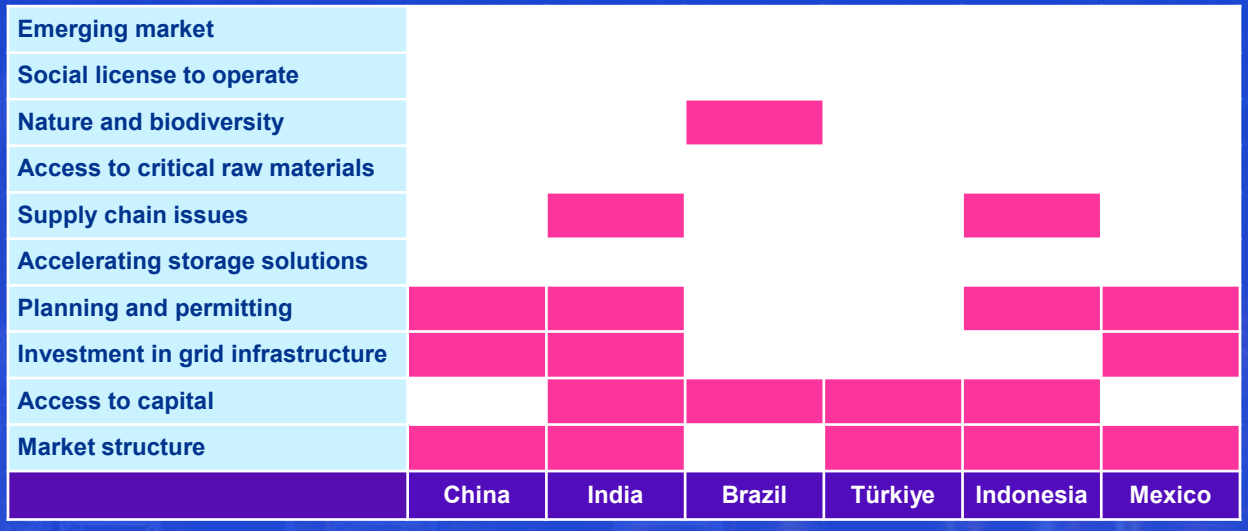
Share of renewables in total energy consumption of top 10 EMDEs*[1]

* Top 10 fossil CO2 emitting EMDEs
1 Energy Institute, "Statistical Review of World Energy", 2024

In 2023, EMDEs marked remarkable growth in renewable energy capacity and generation. Asia-Pacific recorded a 20 percent gain in capacity and 6 percent rise in generation, and the Middle East clocked in a 17 percent jump in capacity and 47 percent increase in generation. Though impressive, last year underscored China's dominance in the renewable landscape yet again. The country had a 38 percent share in global renewable capacity and 32 percent share in generation, raising concerns over this intense but concentrated growth. If the trend continues, meeting 2030 and 2050 targets will become immensely challenging.[2]

Most of the EMDEs face some inherent complexities and barriers that obstruct the wide-scale adoption of renewable energy. Two of the biggest challenges — that ripple through other aspects and create more fundamental issues — are fragmented or under-developed market structure, and insufficient and disproportionate investment to foster green transition.

Key barriers to scale renewables in EMDEs



Derived from "Turning the tide in scaling renewables" report, published by KPMG

2 IRENA, "Renewable Energy Statistics", 2024

- An unstable market structure due to poor coordination between various stakeholders (especially the governing institutions), inflexible systems and logistical challenges in renewable energy integration into the grid is a major challenge in most of the EMDEs covered in this study. A key obstacle across most of the emerging economies is non-standardized planning, and permitting systems and contractual frameworks that result in bureaucratic delays and legal hassles. Since EMDEs are at different stages in the spectrum of sketching and updating their policy frameworks, the issue of unstable, fragmented market structure amplifies. The countries need comprehensive market reforms and constant policy direction to thrust into a stable renewable development era.
- Another critical barrier in EMDEs is an under-funded renewable market. Energy transition in the emerging markets is heavily influenced by top-down approaches, with public institutions and development banks driving investments. However, except for China, most of these emerging markets do not have sufficient low-carbon investment. In 2023, EMDEs, led by China, invested heavily in their power generation capacity. But a majority part of this investment in 2024 is likely to go into fossil-based generation than renewable energy/low-carbon fuels. In fact, excluding China, investments in clean energy are likely to trail in fossil-based generation by 58 percent to meet the swelling power demand. This is in contrast to the IEA's estimates that peg annual clean energy investment needs of EMDEs (excluding China) at US$1.6 trillion by early 2030s to stay aligned with the Paris Agreement. Development financial institutions (DFIs) are increasing playing a larger role in mobilizing investments, but it is adding to debt and creating a "development vs. transition" conundrum, especially in the least-developed countries. Private participation is crucial to meet the enormous investment requirements and bridge the gap.
- Another aspect to be considered is the disproportionate investment allocation across the renewable energy system. Most EMDEs are late or slow movers in renewables and hence, unlike their developed counterparts, these economies are in the phase of building generation capacity. Hence, investment in grid and storage is a relatively overlooked area. EMDEs need to leapfrog — they need to carefully deploy their limited financial resources to simultaneously develop generation capacity and supporting infrastructure. Investors should have a more inclusive approach, focusing on all transition-related areas — generation, grid and storage — to increase the economic viability of the projects and risk-return competitiveness of the investment. COP29[3] announced initiative of "Global Energy Storage and Grids Pledge" with an aim to increase global energy storage capacity by six times over 2022 to 1,500GW by 2030 and investments (by endorsers) for grid expansion or overhaul of over 80 million km by 2040 is expected to provide a much-needed boost to infrastructure build-up and upgrade.

EMDEs showcase a lot of topical commonalities, but the varied strength of economies and different stages of energy transition make it imperative to adopt tailored strategies and interventions to tackle each country in a unique way. There is also a need for more top-driven direction till the markets become fundamentally strong and fully sustainable.

3 COP29 Baku Azerbaijan, "COP29 Presidency Launches Initiatives to Focus Global Attention and Accelerate Climate Action", 2024

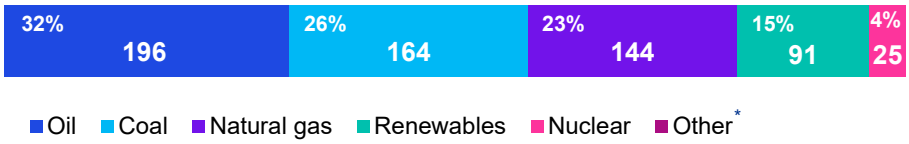
Introduction

2023 – A year in perspective

Amid the record-high primary energy consumption and electricity generation in 2023, driven by surging demand from Asia-Pacific, **renewable energy remained a subdued but bright spot overall** – with its share in consumption sitting at 15 percent, highest ever[4]. However, it still lags expectations and remains way off than what is needed to make a visible impact.

Year 2023 had many historical highs. It was the warmest year on record and exceeded the 1.5°C threshold.[5] The energy sector witnessed direct impact of the temperature rise as global primary energy consumption swelled to a record 620 exajoules (EJ), marking a 2 percent annual growth. While the contribution of renewables in the total energy demand increased slightly to 15 percent, fossil fuels maintained their dominance at 81 percent. The share of renewables in total electricity generation improved marginally from 29 percent to 30 percent, while coal retained its position as the primary energy source, underlining a slow transition away from conventional fuels.

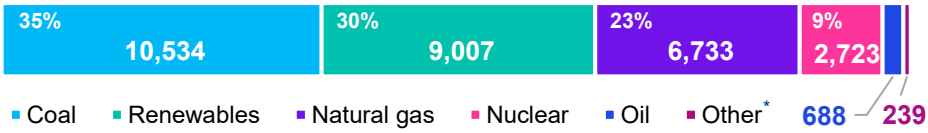
Global primary energy consumption (EJ), 2023[6]



620 EJ

2% vs 2022

Global electricity generated (TWh), 2023[6]



29,925 TWh

2.5% vs 2022

* Includes electricity generated from biomass, geothermal and other renewable sources

4 Energy Institute, "Statistical Review of World Energy", 2024

5 Climate Copernicus, "Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit", Accessed 16 Sep. 2023

6 Energy Institute, "Statistical Review of World Energy", 2024

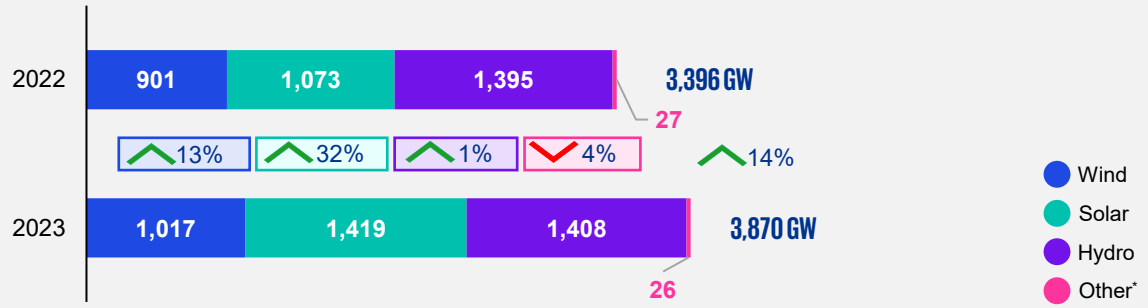
Renewable energy capacity installation and generation remains disproportionate

The global renewable energy capacity expanded from 3,396 GW to 3,870 GW between 2022 and 2023, marking a 14 percent jump. However, this expansion in capacity did not translate into proportional increases in renewable energy generation, which saw a modest increase of 5 percent during the period. This disparity reveals the complexities involved in scaling up renewable energy production to meet escalating global energy demands[7].

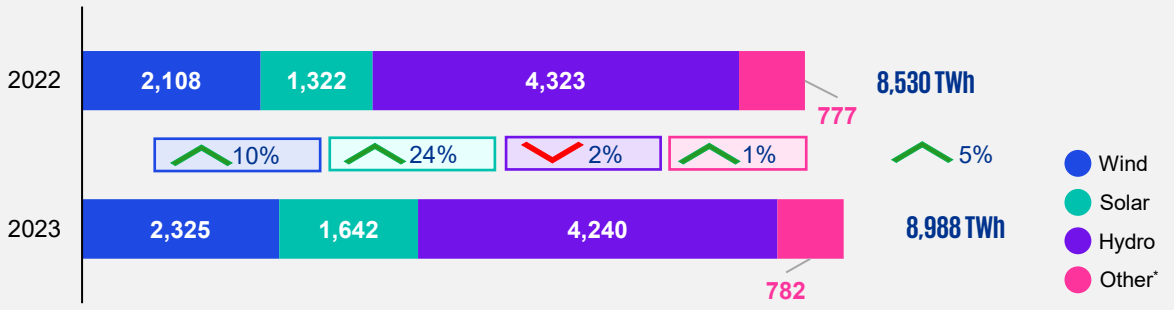
- Solar energy emerged as the front-runner in capacity addition, expanding by 32 percent to reach 1,419 GW. But growth in solar energy generation lagged, increasing 24 percent annually.
- Wind energy capacity grew by 13 percent, but its generation increased by 10 percent.
- In contrast, hydroelectric power exhibited stagnant growth in capacity, increasing a mere 1 percent while experiencing a 2 percent decline in generation.

These trends highlight the challenges in harnessing renewable energy effectively, underscoring the need for technological advancements and policy support to enhance the efficiency and reliability of renewable energy systems.

Installed capacity (GW), as of 2022 and 2023



Generation (TWh), as of 2022 and 2023

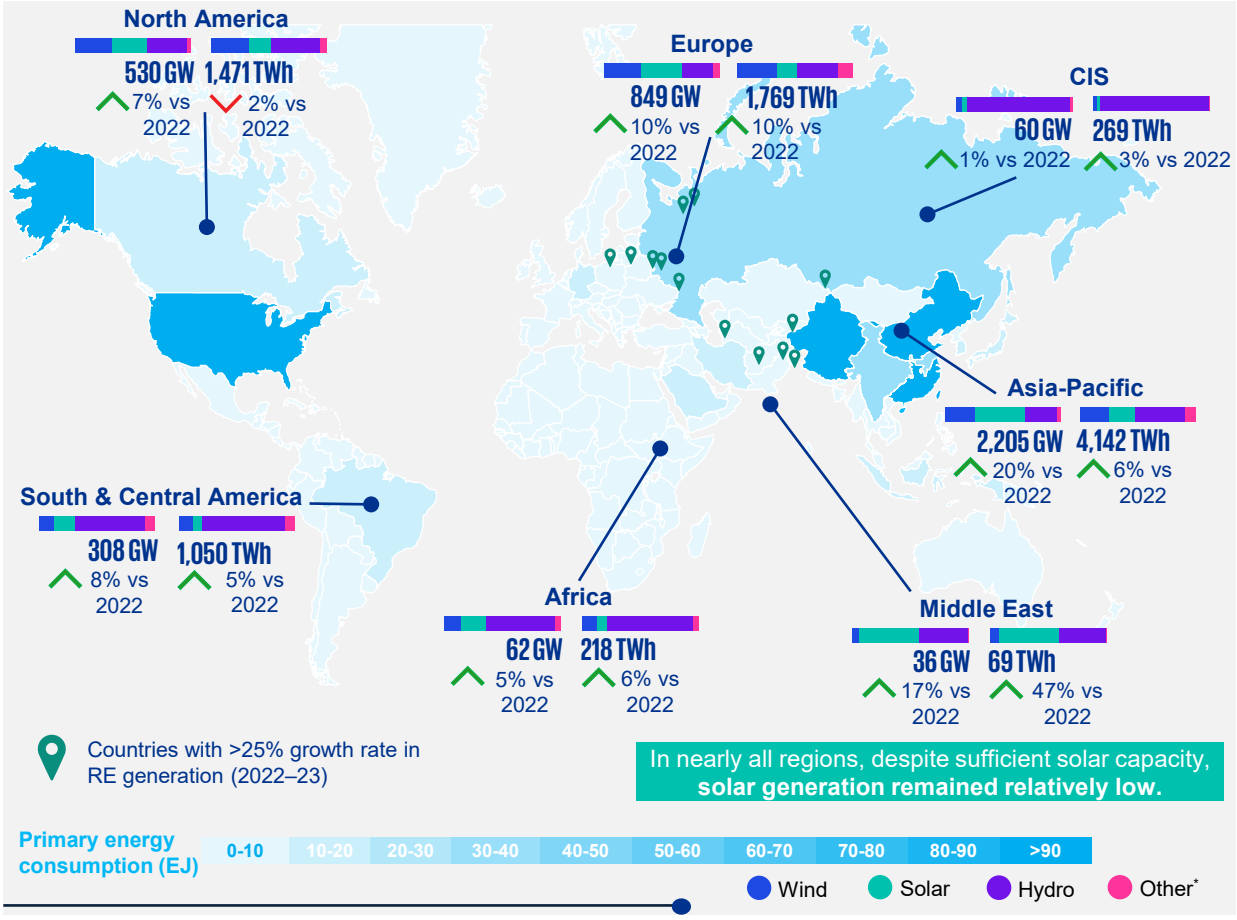


7 Energy Institute, "Statistical Review of World Energy", 2024

Global renewable expansion is accelerating...

Global renewable capacity grew the fastest in 2023, but both capacity installation and generation saw significant shifts, with regional deviations becoming more apparent. High renewable energy generation was observed in the Middle East, while a generation dip was observed in North America compared with the previous year.

Renewable energy installed capacity and generation by region, as of 2023[8]



Top countries by energy consumption, as of 2023

Energy consumption (EJ)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
China	US	India	Russia	Japan	Canada	Brazil	Iran	S. Korea	Saudi Arabia	Germany	Indonesia	France	Mexico	Türkiye
170.7	94.3	39.0	31.3	17.4	14.0	13.9	12.7	12.4	11.6	11.4	10.1	8.7	8.5	7.0

* Includes electricity generated from biomass, geothermal and other renewable sources

8 Energy Institute, "Statistical Review of World Energy", 2024

...but a deeper look tells a different story

China almost alone drove the growth in global renewable capacity addition, increasing concerns that a continuous but highly concentrated growth cannot help meet the 2030 targets. Overall, developed countries and China are leading in terms of total installed capacity and generation. However, a simultaneous accelerated focus on driving renewable penetration in EMDEs is crucial for reaching the energy transition milestones.

Capacity vs generation trends, 2023[9]

Country	Renewable energy capacity			Renewable energy generation			
	Installation — Y-o-Y change	Share in global	Share and Y-o-Y change by technology	Generation — Y-o-Y change	Share of RE in electricity mix	Share in global	Share and Y-o-Y change by technology
China	1,454 GW ↑ 25.7%	38%	↑21% ↑55% ↑1% ↑6%	2,894 TWh ↑ 8.4%	31%	32%	↑16% ↑37% ↓6% ↑9%
US	388 GW ↑ 8.7%	10%	↑4% ↑22% = 0% ↓1%	974 TWh ↑ 0.5%	22%	11%	↓2% ↑16% ↓6% ↓6%
India	176 GW ↑ 7.8%	5%	↑0.2% ↑15% ↑7% ↑1%	382 TWh ↑ 0.9%	20%	4%	↑17% ↑19% ↓15% ↓3%
Russia	57 GW ↓ (0.3%)	1%	↑14% ↑19% ↓2% ↑0.1%	209 TWh ↑ 1.9%	18%	2%	↑13% ↑10% ↑2% ↑0.9%
Japan	127 GW ↑ 4.8%	3%	↑20% ↑5% ↑0.1% ↑17%	224 TWh ↑ 4.9%	22%	2%	↑6% ↑7% ↓0.5% ↑11%
Canada	109 GW ↑ 2.0%	3%	↑11% ↑8% = 0% ↑0.3%	421 TWh ↓ (6.9%)	67%	5%	↑2% ↑8% ↓8% ↑14%
Brazil	194 GW ↑ 9.8%	5%	↑21% ↑47% ↑0.1% ↑2%	632 TWh ↑ 6.3%	89%	7%	↑17% ↑71% ↑0.4% ↑1%

Wind Solar Hydro Other*

* Includes electricity generated from biomass, geothermal and other renewable sources

9 Energy Institute, "Statistical Review of World Energy", 2024

Country	Renewable energy capacity			Renewable energy generation			
	Installation — Y-o-Y change	Share in global	Share and Y-o-Y change by technology	Generation — Y-o-Y change	Share of RE in electricity mix	Share in global	Share and Y-o-Y change by technology
Indonesia	**13 GW** ▲ 4.0%	**0%**	= 0% ▲ 83% ▲ 1% ▲ 1%	**65 TWh** ▼ (0.3%)	**19%**	**1%**	▲ 35% ▲ 61% ▼ 10% ▲ 6%
Mexico	**34 GW** ▲ 4.9%	**1%**	= 0% ▲ 17% = 0% ▲ 1%	**76 TWh** ▼ (8.2%)	**21%**	**1%**	▲ 6% ▲ 33% ▼ 43% ▲ 6%
Türkiye	**58 GW** ▲ 4.5%	**2%**	▲ 3% ▲ 20% ▲ 0.7% ▲ 4%	**138 TWh** ▲ 0.1%	**42%**	**2%**	▼ 2% ▲ 7% ▼ 4% ▲ 2%

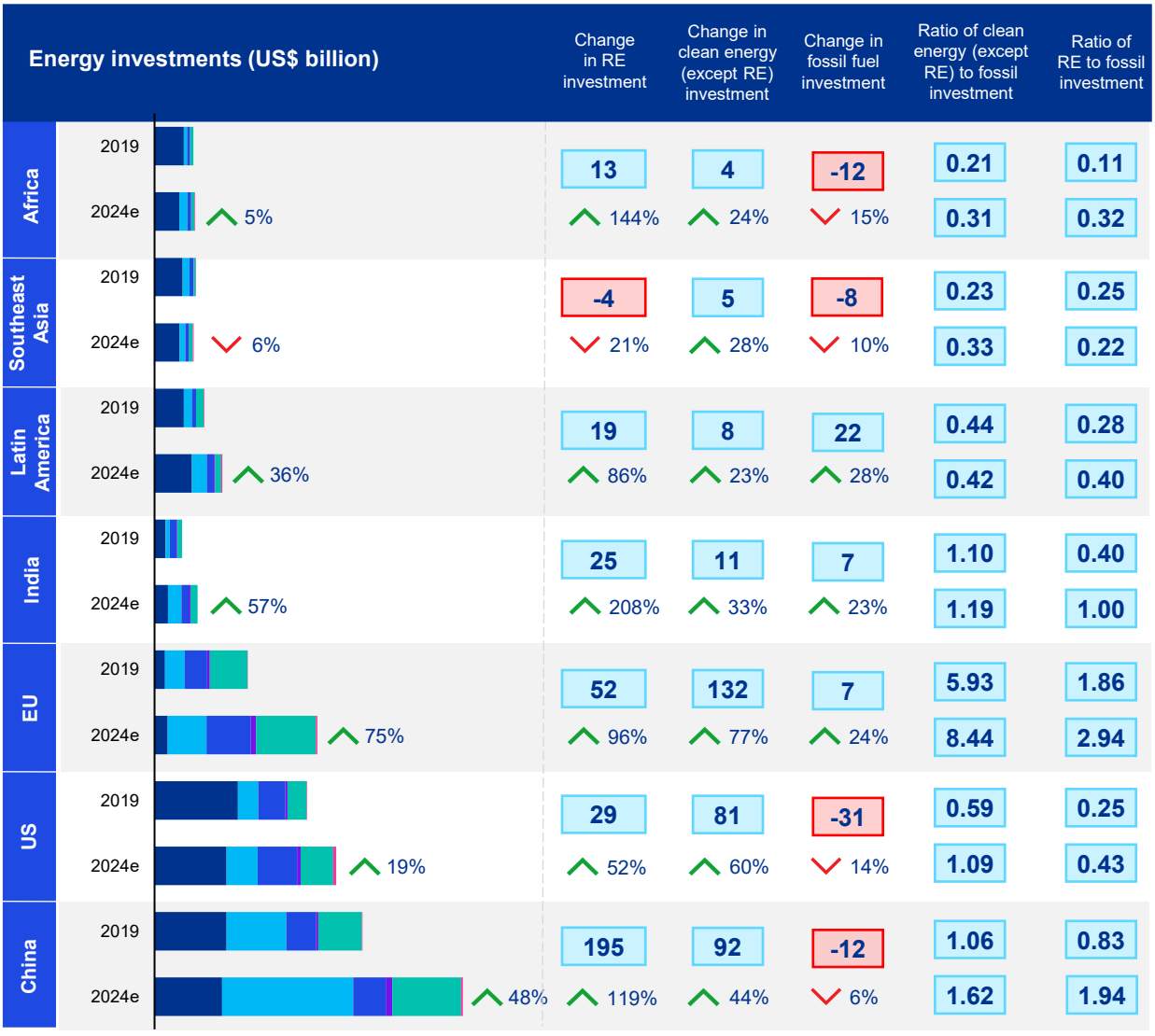
Wind Solar Hydro Other*

* Includes electricity generated from biomass, geothermal and other renewable sources

Renewable energy investments also show stark contrasts

Variation in regional capacity installation and generation reflects the investments made in energy systems globally. Overall, all regions, except Southeast Asia (probably due to dependence on developmental capital, which gets mired in long approval process, ambiguous procedures and delays), witnessed a gain in investments from 2019 to 2024. But an analysis by type of energy shows that while the EMDEs are funneling most of their investments (in terms of dollar amount and growth rate) in building generation capacity, the US and EU are investing in power grids and storage (in terms of dollar amount).

Total energy investments expected to US$2.3 trillion in 2019 to US$1.7 trillion in 2024e[10]



* Other clean power = fossil fuel power with CCUS, hydrogen, ammonia, and large-scale heat pumps. Low-emissions fuels = modern bioenergy, low-emissions H2-based fuels, and CCUS is associated with fossil fuels and includes direct air capture

10 International Energy Agency (IEA), "World Energy Investment", 2024

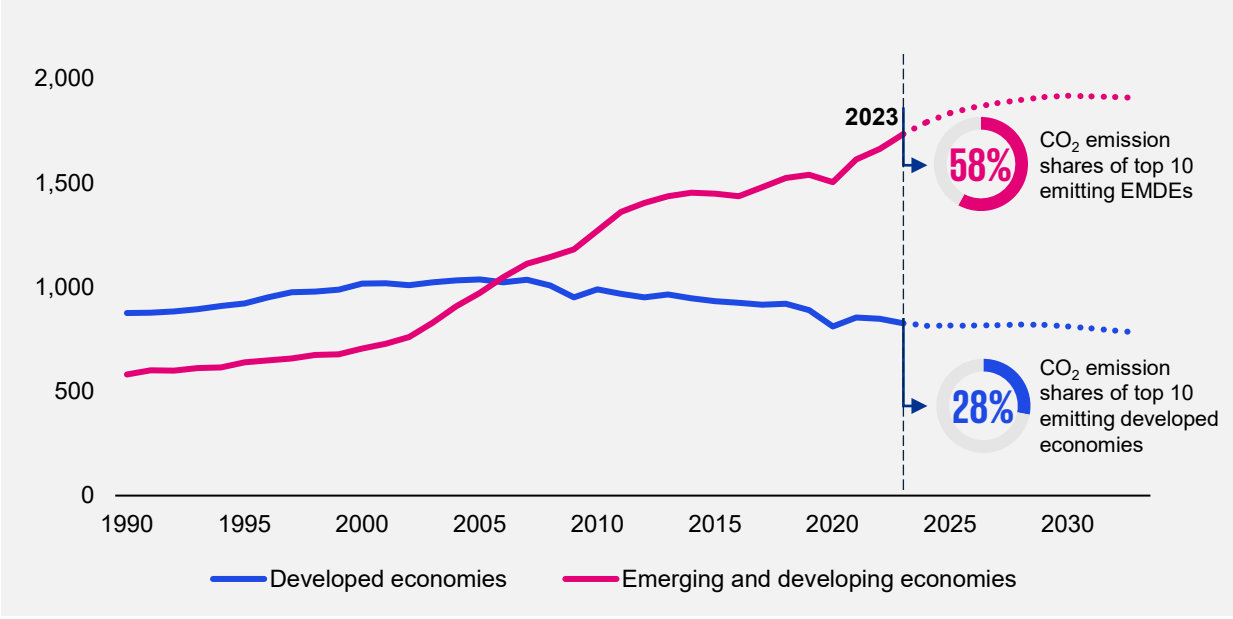
Investment allocation in EMDEs, the harbinger of climate transition, needs to be reassessed

The emissions trajectory of EMDEs shows the criticality of prioritizing efforts and reevaluating investment allocation in these countries to drive global climate transition. Accounting for ~72 percent of the global emissions in 2023 (according to the IEA), EMDEs will continue to drive majority of the emissions growth due to their rising electricity demand in the absence of significant structural shifts and interventions in their energy systems.

After 2000, emissions from developed economies have either remained largely stable or slightly declined, while EMDEs have seen consistent increases, though the rate of increase has gone down from the 1990s. EMDEs are working toward peaking their emissions, but it would require all-encompassing structural changes, serious fiscal policies and a multifold strategy that involve different low-carbon pathways, which include adopting renewable energy, enhancing energy efficiency and electrification of energy, to meet the target.

Accelerating renewable energy deployment in emerging economies offers a valuable chance to improve energy security, decrease dependence on fossil fuels, and achieve net-zero goals. However, it is concerning that most EMDEs receive only one-fifth of global investments in clean energy. This is further complicated by the disproportionate allocation of investments across the renewable energy system, with most investments concentrated in generation. Considering that EMDEs will be emissions hotspots in the future and the battle against climate change will predominantly take place in these economies, tackling emissions growth becomes critically important to meet the 2050 target.

Total CO_2 emissions from fuel combustion (Mt of CO_2)[11]



Note: The blue line represents the average CO_2 emissions of the top 10 emitting developed economies, while the pink line represents the average CO_2 emissions of the top 10 emitting EMDEs.

11 Economist Intelligence Unit, Accessed on 15th Sep 2024

EMDEs in focus[12]

Countries	China	India	Indonesia	Brazil	Mexico	Türkiye
CO_2 emissions (Mt of CO_2), 2023	9,827	2,498	593	402	402	355
Global share	33%	8%	2%	1%	1%	1%

The progress so far is reflective of barriers to renewable expansion

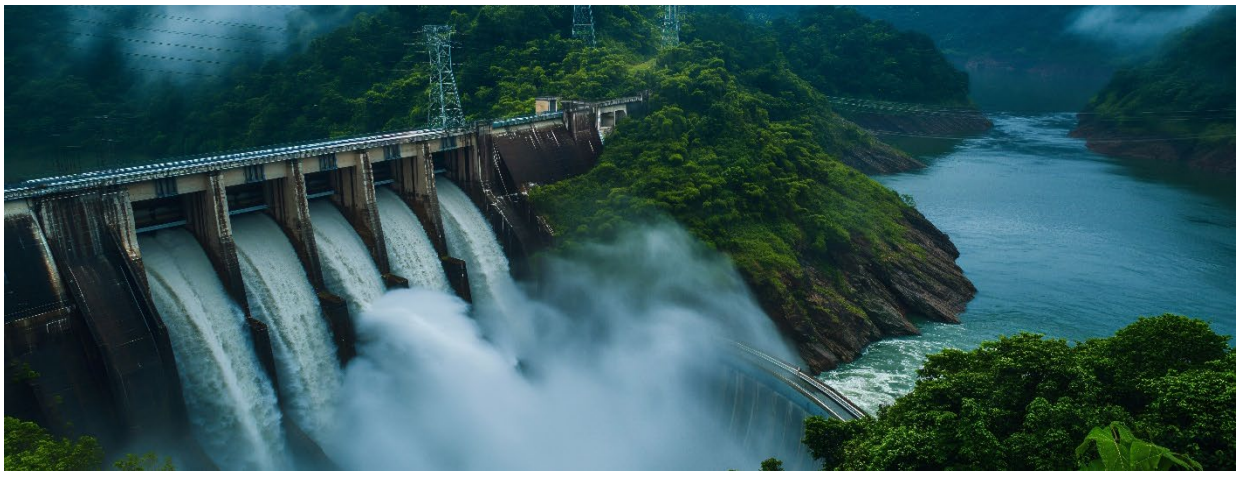
Renewable energy recorded strong progress in 2023, hitting some major milestones and becoming more prevalent. However, the barriers to scale renewable energy remain intact, especially in EMDEs. The complexity and variedness of these barriers and disparate strength of institutional frameworks and fiscal flexibility across countries are making it even more difficult to understand and solutionize them. The COP28 pledge to triple the renewable capacity has given a much-needed thrust to accelerate the development of renewable energy. But addressing these issues would require more concerted efforts at a global level and solving challenges at a local level to achieve the pledged targets.

12 Economist Intelligence Unit, Accessed on 15th Sep 2024

An account of major barriers to renewable energy scalability by geography

	Barrier 1	Barrier 2	Barrier 3	Barrier 4	Barrier 5	Barrier 6	Barrier 7	Barrier 8	Barrier 9	Barrier 10
	Market structure	Access to capital	Investment in grid infrastructure	Planning and permitting	Accelerating storage solutions	Supply chain issues	Access to critical raw materials	Nature and biodiversity	Social license to operate	Emerging market
China	■		■	■						
India	■	■	■	■		■				
Brazil		■						■		
Türkiye	■	■								
Indonesia	■	■		■		■				
Mexico	■		■	■						

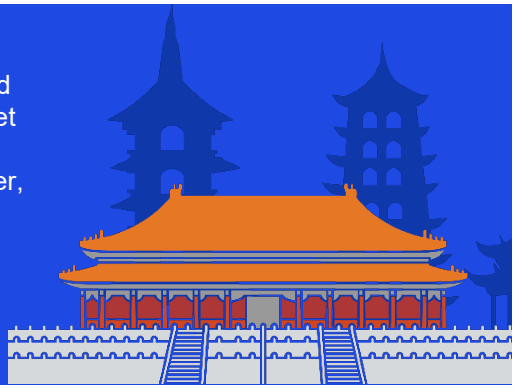
Derived from “Turning the tide in scaling renewables” report, published by KPMG



The geographic snapshot

China

China has been aggressively building its renewable energy strength, adding record-breaking solar and wind capacity, to meet its dual-carbon goals. The 2030 target of peaking emissions is leading to tighter policy integration, benefiting the country on all fronts. However, the country needs to reduce and remove the limiting factors, which include a protectionism attitude and low coordination among the provincial governments, grid bottlenecks and largely inflexible power trading agreements.



Market view[13]

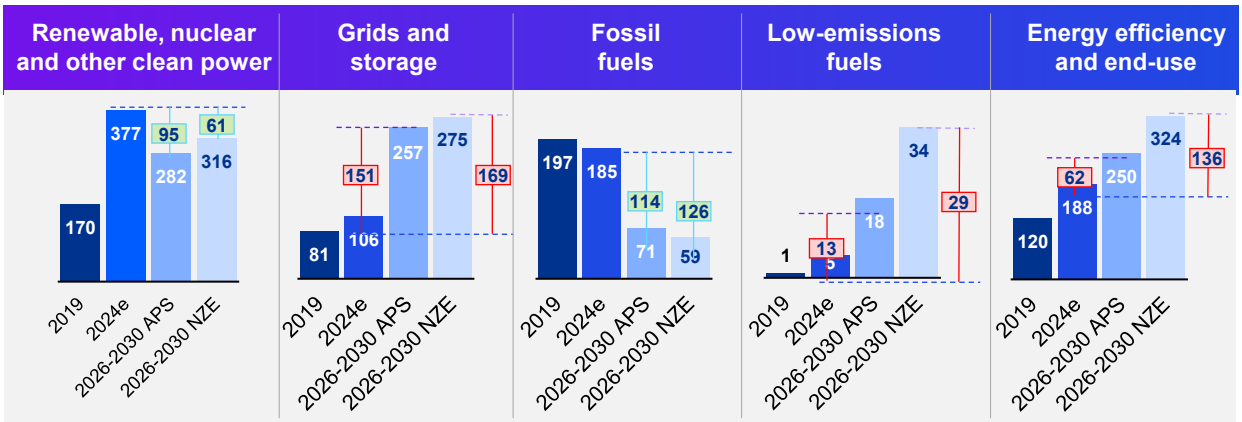
RE capacity, 2023

1,454 GW Total	610 GW Solar	442 GW Wind	371 GW Hydro	31 GW Others*
▲26% vs 2022	▲55%	▲21%	▲1%	▲6%

RE generation, 2023

2,894 TWh Total	584 TWh Solar	886 TWh Wind	1,226 TWh Hydro	198 TWh Others*
▲8% vs 2022	▲37%	▲16%	▼6%	▲9%

Investments required to align with energy and climate goals (US$ billion)[14]



Note: The green color boxes indicate investment overruns in 2024 compared with APS and NZE scenarios, while the red boxes indicate investment lags.

* Includes electricity generated from biomass, geothermal and other renewable sources.

13 Energy Institute, "Statistical Review of World Energy", 2024
14 IEA, "World Energy Investment", 2024

China has experienced significant growth in its renewable energy capacity. In 2023 alone, the country commissioned as much solar PV as the entire world did in 2022, while its wind additions grew by 66 percent year-over-year. This rapid growth is expected to propel China six years ahead of its 2030 solar and wind installation target of 1,200 GW under its climate commitments.

The scale of China's achievement is truly staggering. In 2023, the country added an estimated 200 GW of solar power capacity, more than double the record set in 2022. This demonstrates China's ability to deliver massive renewable energy capacity without significant funding barriers. China's spending on battery storage increased nearly 2.5 times in 2023 over the past year to US$11 billion, reflecting the country's commitment to supporting the integration of intermittent renewable sources into the grid.[15]

However, the market faces some fundamental challenges. China's grid and storage investments lag renewable investments, indicating infrastructure challenges. Additionally, the investment gap between APS/NZE** scenarios and current year is larger for grids and storage than for renewables, suggesting systemic barriers to grid modernization.

Key barriers to renewable energy growth in China

01 Market structure

02 Investment in grid infrastructure

03 Planning and permitting

01 Market structure

Provincial government protectionism and a lack of inter-provincial coordination hinder the development of a unified power market. This fragmentation leads to inefficient allocation of resources and creates barriers to large-scale renewable energy projects that span multiple provinces. Furthermore, **fixed, long-term power trading agreements** exacerbate the situation by limiting flexibility in the system. These unidirectional agreements may compel provinces to export power regardless of local needs, potentially resulting in power scarcity within the exporting region.

The country's energy demands are predominantly concentrated in the eastern and southeastern coastal regions, while abundant solar and wind resources are often located in the northwest and northeast regions. This **geographical mismatch** creates logistical challenges for renewable energy integration into the grid. The process of constructing ultra-high voltage transmission lines is particularly time-consuming, taking even longer than building grid facilities. These factors exacerbate the **issue of long-distance electricity transmission**, contributing to China's grid expansion lagging behind the rapid growth in renewable energy investments.

02 Investment in grid infrastructure

Without sufficient long-distance transmission lines and upgraded grid facilities, **grid companies typically curtail electricity generated from renewable sources**. This situation also happens when grid operators prioritize traditional fossil fuel-based power plants, leaving substantial excess renewable energy untapped.

The current roster of issues highlight that China needs a coping strategy that focuses on both market and policy reforms and stabilizes growing energy demand of the country to meet its transition targets.

** Announced Pledges Scenario (APS)/ Net Zero Emissions (NZE) Scenario, as defined by IEA

15 IEA, "World Energy Investment", 2024

Key barriers to renewable energy growth in China

03 Planning and permitting

Despite the growth in renewable power generation capacity, some **installed capacity remains disconnected to the grid** due to rapid renewable expansion and lengthy permit processes for grid companies. While wind and solar developers can typically obtain permits and commence operations within a year, **grid companies require over two years to secure permits** and build the necessary facilities. This disconnect between the speed of renewable energy development and infrastructure readiness has created bottlenecks, hindering the effective utilization of new renewable capacity.

One way to resolve the issue is by **streamlining and centralizing the permitting system**, specifically designed for renewable energy projects. This would involve creating a dedicated task force within the central administration to expedite the approval process for both renewable energy installations and corresponding grid infrastructure upgrades.

The government can also play a significant role by **incentivizing grid companies to prioritize renewable energy integration**, either through rewards for successful connection of new renewable capacity or penalties for underperformance.

As China continues to dominate global renewable energy expansion, addressing these challenges will be crucial to realizing the full potential of its ambitious clean energy agenda.

India

India is one of the best stories among EMDEs, as it sits on the brighter side of the renewable energy development spectrum. The country has a lot of positives in its favor, including a progressive policy landscape, evolving financial markets and funding mechanisms, and innovation that are helping it deliver a solid renewable performance. But to be able to meet its aspirational energy and climate targets and maintain economic growth, the country needs to chart out a definite pathway to move away from a hybrid fuel approach (fossil and low-carbon), enable deft process mobilization and mitigate structural challenges at speed.

Market view[16]

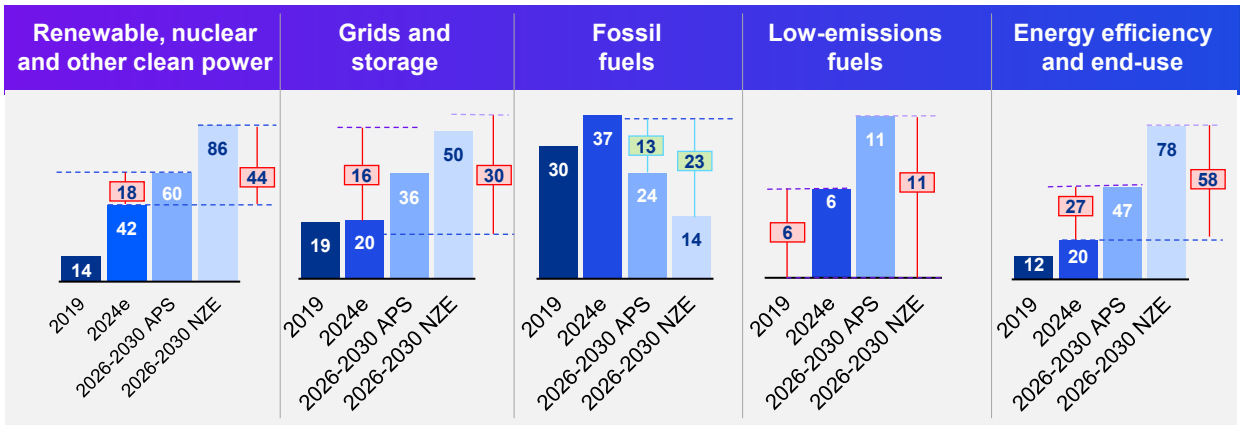
RE capacity, 2023

176 GW Total	73 GW Solar	45 GW Wind	47 GW Hydro	11 GW Others*
↑ 8% vs 2022	↑ 15%	↑ 0.2%	↑ 7%	↑ 1%

RE generation, 2023

382 TWh Total	113 TWh Solar	82 TWh Wind	149 TWh Hydro	37 TWh Others*
↑ 1% vs 2022	↑ 19%	↑ 17%	↓ 15%	↑ 3%

Annual investments required to align with energy and climate goals (US$ billion)[17]



Note: The green color boxes indicate investment overruns in 2024 compared with APS and NZE scenarios, while the red boxes indicate investment lags.

* Includes electricity generated from biomass, geothermal and other renewable sources

16 Energy Institute, "Statistical Review of World Energy", 2024
17 IEA, "World Energy Investment", 2024

India, in last few years, has sharpened its efforts to develop a clean energy ecosystem through targeted policy and reforms that are driving market participation and innovation. It has increased investments in solar and wind power, implemented measures to promote domestic manufacturing of clean energy equipment, and launched initiatives for energy efficiency and green hydrogen production. To meet its increasing electricity demand and compensate for reduced hydropower due to inconsistent rainfall, India doubled its new coal final investment decisions to 2 GW in 2023, highest since 2019. It also raised its energy subsidies to a nine-year high in FY23, with subsidies for coal, oil and gas accounting for 40 percent and those for clean energy contributing less than 10 percent in total.[18]

While renewable energy sources are being expanded, the infrastructure required to efficiently store and evacuate this energy seems to be lacking investment. The expansion of renewable energy sources is hindered by barriers such as **inconsistent policies, inadequate infrastructure, land acquisition complexities and supply chain issues**.

Key barriers to renewable energy growth in India

01 Market structure

The renewable energy sector is poised for significant growth, with market-driven procurement projected to contribute 20 percent of utility solar PV and wind capacity expansion between 2023 and 2024. Corporate power purchase agreements (PPAs) play a pivotal role in this expansion, accounting for 17 percent of global utility solar and wind growth.[19] Despite the active power exchange market in India, which has seen a steady growth rate of 16.4 percent, the **decline in PPAs** presents a major hurdle for renewable capacity expansion plans.[20]

One of the main barriers is the reluctance of distribution companies (DISCOMs) to promote direct power procurement by corporates, fearing the loss of profitable customers. This creates a bottleneck for green corporate PPAs, impeding the scaling up of renewable energy projects. Additionally, the sector faces challenges due to **frequent and arbitrary policy changes**, leading to uncertainty and deterring potential investors. Inconsistent policies, such as the shifting stance on reverse auctions in wind tenders, further add to the complexity.

Long-term policy certainty and adoption of direct power procurement by DISCOMs can help the market in managing challenges.

18 International Institute for Sustainable Development, "Mapping India's Energy Policy 2023", 2024
19 IEA, "Are market forces overtaking policy measures as the driving force behind wind and solar PV?", 2023
20 Central Electricity Regulatory Commission, 2024

Key barriers to renewable energy growth in India

02 Access to capital

India has witnessed remarkable growth in clean energy financing, driven by foreign investors and financial institutions, with an average annual investment of about US$61 billion from 2021 to 2023.[21] Despite this positive trend, the following challenges persist:

- Access to favorable financing for residential and distributed rooftop solar is hindered by collateral issues.
- High interest rates from Indian financial institutions affect open access commercial and industrial (C&I) developers.
- Renewable energy lending, while part of priority sector lending, often gets mixed with broader infrastructure, limiting funds for open access C&I developers.

Challenges such as payment delays by DISCOMs (~US$8.2 billion overdue as of October 2024)[22], rising interest rates, land acquisition and transmission infrastructure issues contribute to project delays, cost overruns and diminishing equity returns. Moreover, the depreciation of the rupee adds an additional risk for projects with foreign currency debt exposures.

The country needs multifold financial solutions and policy enablers to mitigate these challenges. Improving the financial health of DISCOMs, deepening corporate bond markets, implementing financing structures (such as InvITs) and employing risk mitigation tools (such as partial credit guarantees) can be instrumental in unlocking capital.

03 Investment in grid infrastructure

The Inter-State Transmission System (ISTS) is facing significant challenges that hinder the balanced growth of renewable energy capacity across states. Current **waivers on ISTS charges**, applicable for projects commissioned until June 2025, are crucial in sustaining the financial viability of ISTS projects. However, these **exemptions would gradually decrease** by 25 percent annually, which could eventually render such projects financially unsustainable.[23]

The **disparity between demand for ISTS substations and their availability** remains a major hurdle, causing substantial delays in the establishment of new transmission lines. This inadequate infrastructure adversely affects the efficient transmission of power generated by renewable projects to the grid, further impacting their economic viability.

The FY24 (April 1, 2023 to March 31, 2024) target of adding 16,682 circuit kilometers (ckm) of transmission lines across different voltage classes fell short, with only 9,985 ckm added in the first 10 months. This **significant gap of 6,697 ckm** highlights the need for urgent attention and investment in improving transmission infrastructure.[24] **Extending the 100 percent exemption in ISTS charges until 2030** would provide the necessary policy stability and financial certainty for renewable energy projects.

21 IEA, “World Energy Investment 2024”, 2024
22 PRAAPTI portal, Ministry of Power, Accessed on 21st Oct 2024
23 Institute for Energy Economics and Financial Analysis (IEEFA),”Achieving India’s Renewable Energy Target by 2030”, 2024
24 T&D India, “Transmission line addition meets only two-thirds of the target”, 2024

Key barriers to renewable energy growth in India

04 Planning and permitting

Land acquisition presents a significant barrier to the growth of renewable energy in India, stemming from the **scarcity of available land and the complexities surrounding obtaining necessary clearances**. Developers often find it easier to acquire private land rather than navigate the challenges associated with acquiring development rights in publicly owned land. The absence of explicit land allocation policies for renewable energy and the inadequate state of land records further compound these obstacles.

The Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR Act) was implemented to regulate land use and safeguard the rights of landowners and marginalized communities. However, certain clauses within the Act, such as the **requirement for majority consent and social impact assessments**, have proven to be cumbersome and time-consuming, impeding the acquisition of land for industrial and infrastructure projects alike. These hurdles have consequently created hindrances in the development of renewable energy projects.

The market would gain from establishing clear and streamlined land allocation policies exclusively for renewable energy, and digitizing and maintaining precise land records for enhanced transparency would provide developers with clarity and guidance, making the land acquisition process smoother.

05 Supply chain issues

The Indian solar PV manufacturing industry is witnessing remarkable growth, with about 64.5 GW cumulative capacity for PV module manufacturing and 5.8 GW for solar cell manufacturing (as of December 2023)[25]. This progress can be attributed to the effective implementation of PLIs, encouraging investments and driving expansion within the industry. However, there are still significant obstacles to overcome. One of the key challenges is the **insufficient upstream capacity**, leading to considerable disparity between domestic module manufacturing and the **availability of crucial components** such as cells, wafers/ingots and polysilicon. This heavy reliance on imports hampers the establishment of a self-sufficient and resilient supply chain within the country.

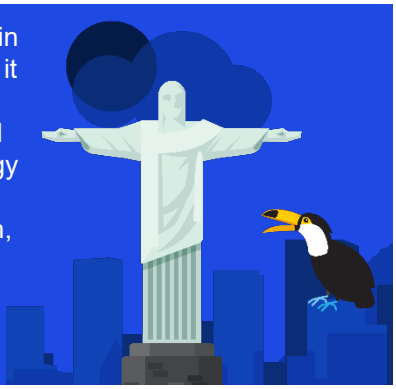
India's relatively **lower investment in research and development** (R&D) in comparison to other nations also impedes its competitiveness in the clean energy sector despite increased investment and deployment. Addressing these challenges and fostering domestic capabilities through strategic measures can help India establish itself as a global leader in solar PV manufacturing and drive sustainable and resilient growth in the sector.

Introducing distinct PLIs for **each stage of PV production**, encompassing not only module manufacturing but also ancillary component production and material recycling, can decomplex the process and establish a sustainable and self-reliant PV manufacturing ecosystem in the country.

25 Mercom, “State of Solar PV Manufacturing in India 2024”, 2024

Brazil

The Brazil model of renewable energy has been highly successful in leveraging the country's natural resources sustainably and making it a leader in clean power. Its long-standing commitment to hydropower and biofuels, fulfilled by a strong policy framework and institutional support, has positioned Brazil as a frontrunner in energy transition. But it has come at a cost. Extensive expansion of hydropower has caused biodiversity loss and habitat fragmentation, as well as impacted the financial security of some communities. However, the country is fast building its solar and wind capacity to complement hydropower, but access to financial resources might pose a challenge.



Market view[26]

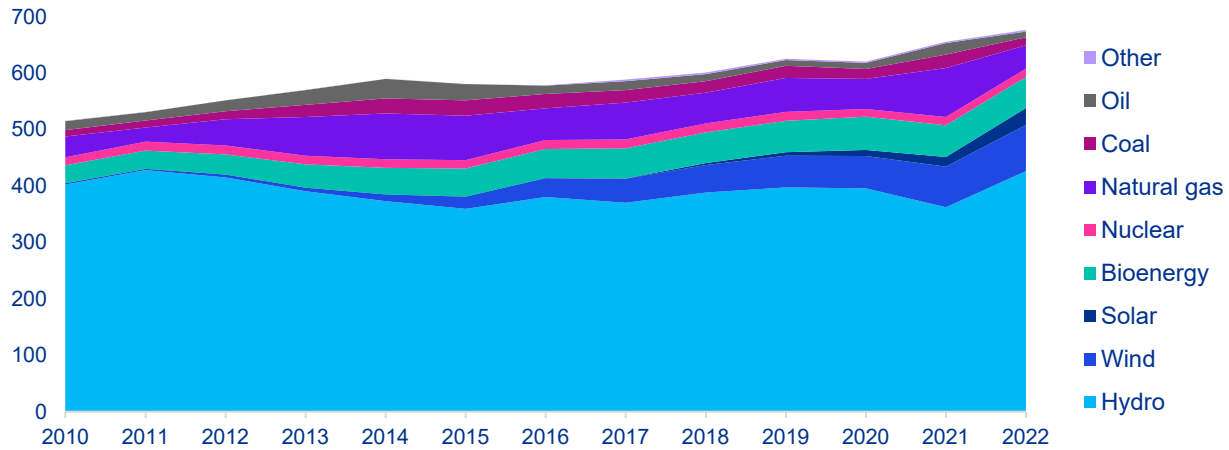
RE capacity, 2023

194 GW Total	37 GW Solar	29 GW Wind	110 GW Hydro	18 GW Others*
↑10% vs 2022	↑47%	↑21%	↑0.1%	↑2%

RE generation, 2023

632 TWh Total	52 TWh Solar	96 TWh Wind	429 TWh Hydro	56 TWh Others*
↑6% vs 2022	↑71%	↑17%	↓0.4%	↑1%

Electricity generation in Brazil (TWh), 2010–22[27]



* Includes electricity generated from biomass, geothermal and other renewable sources.

26 Energy Institute, "Statistical Review of World Energy", 2024
27 IEA, "Brazil - Electricity"

Brazil stands out as a global leader in renewable energy adoption, with its electricity mix having 89 percent share of renewable power, significantly higher than the global average of 30 percent. This strong position is primarily driven by its extensive use of hydropower, with large-scale hydroelectric plants accounting for much of the domestic electricity generation. However, Brazil is actively transitioning away from its reliance on hydropower due to environmental concerns and dependence on rainfall. This shift has led to an increasing visibility of solar and wind energy in Brazil's energy mix. The country, in fact, used its thermal and gas-fired plants as peaker plants in 2023 due to its increased renewable energy generation.[28]

Brazil's renewable energy sector is poised for further growth, with solar projects projected to represent nearly 70 percent of additional electricity generation in the coming years. The sector's growth has been driven by private investment and supported by evolving regulatory frameworks, including a crucial approval for microgeneration in January 2022. This regulatory framework set a deadline for current tax exemptions, which accelerated market growth.

Despite these advancements, Brazil largely faces challenges of **accessing funding and the need to address biodiversity-related concerns.**

Key barriers to renewable energy growth in Brazil

01 Nature and biodiversity

02 Access to capital

01 Nature and biodiversity

Hydropower has been facing material concerns in Brazil, with debates over water availability for potable use vs. power generation, and the impact large and small reservoirs have made on local biodiversity, resulting in loss to natural habitats, disturbing nutrient cycles and jeopardizing financial security of adjoining communities (who rely on fishing; dams restrict movement of migratory fishes). According to a WWF-Brazil estimate, the country is expected to lose at least US$2.2 billion (Brazilian Real 11.8 billion) in social value if it builds the complex of hydropower plants in the Tapajós River Watershed.

This, together with low rainfall, has multiplied the issues for the technology. Though Brazil continues to invest in hydropower, it has strategically brought new solar and wind capacity online to diversify away from the water-based source. But considering the share of hydropower in the total energy matrix, more innovative solutions are needed to restore and rebalance the ecological alterations and avoid further deforestation.

28 Ministry of Mines and Energy as quoted by Enerdata, “Brazil achieved 93.1% of power generation from renewable sources in 2023”, Accessed on 16th Sep 2024

Key barriers to renewable energy growth in Brazil

02 Access to capital

Brazil faces significant challenges in scaling up its renewable energy sector, particularly in terms of accessing sufficient capital to meet ambitious climate goals. According to the Bloomberg New Energy Finance's "Brazil Transition Factbook," the country needs to invest substantially in renewable energy and storage technologies to achieve net-zero emissions by 2050. The Net Zero Scenario of the country indicates that renewable energy investments will reach more than US$548 billion between 2024 and 2050, highlighting a substantial funding requirement.

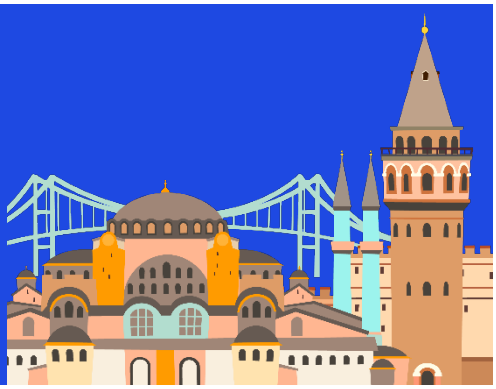
The stark contrast between the Net Zero (US$548 billion) and Economic Transition (US$245 billion) scenarios[29] further emphasizes the scale of the investment gap Brazil must bridge to meet its renewable energy targets.

Developing innovative financial instruments, such as specialized bonds tailored to environmental initiatives, could help bridge the funding gap. Brazil can also adopt best practices from other emerging economies, such as China, Colombia, and Mexico, and mobilize private funding through tailored decarbonization pathways and develop a green taxonomy specific to its conditions.

29 BloombergNEF, Brazil Transition Factbook, September 2024

Türkiye

Türkiye is committed to becoming a regional energy hub, leveraging its strategic location to drive innovation and secure its position in the global renewable energy landscape. With a commitment to net-zero emissions by 2053, Türkiye is rapidly expanding its solar and wind capacity to meet the surging energy demand. However, it faces challenges in financing large-scale projects and balancing domestic production with international relations, highlighting the complex interplay between economic development, climate goals and geopolitical considerations in its renewable energy journey.



Market view[30]

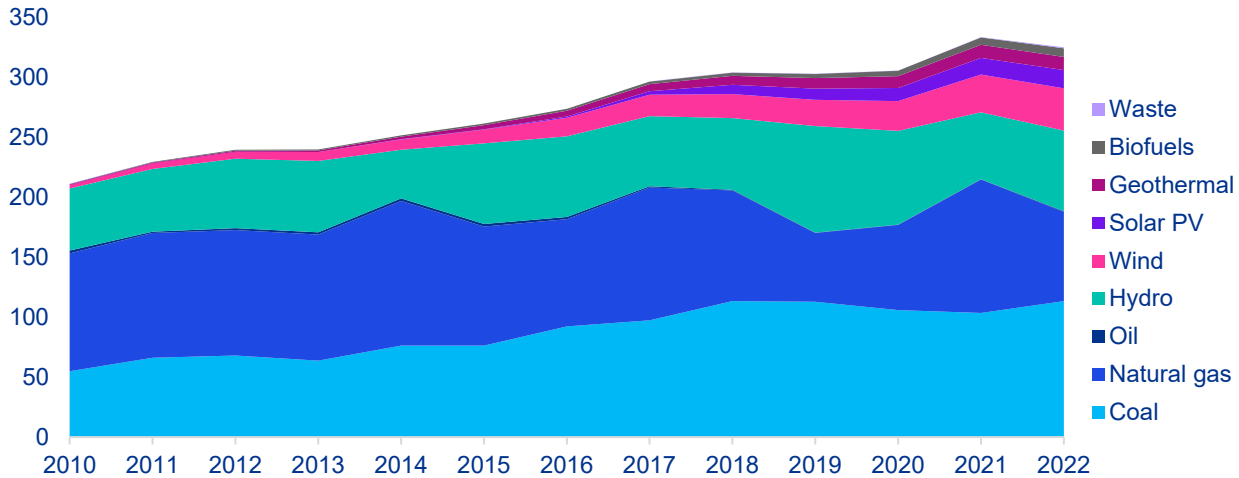
RE capacity, 2023

Total	Solar	Wind	Hydro	Others*
58 GW	11 GW	12 GW	32 GW	4 GW
▲ 4% vs 2022	▲ 20%	▲ 3%	▲ 0.7%	▲ 4%

RE generation, 2023

Total	Solar	Wind	Hydro	Others*
138 TWh	21 TWh	34 TWh	64 TWh	20 TWh
▲ 0.1% vs 2022	▲ 7%	▼ 2%	▼ 4%	▲ 2%

Electricity generation in Türkiye (TWh), 2010–22[31]



* Includes electricity generated from biomass, geothermal and other renewable sources.

30 Energy Institute, "Statistical Review of World Energy", 2024
31 IEA, "Türkiye - Electricity"

Türkiye stands out as a rapidly evolving player in the global renewable energy landscape. With the fastest-growing energy demand among Organisation for Economic Co-operation and Development (OECD) countries over the past two decades [26], Türkiye has positioned itself as a significant player in the regional energy market. The country's commitment to achieving net-zero emissions has driven substantial investments in renewable energy sources, complemented by nuclear energy projects on a build-own-operate (BOO) or build-operate-transfer (BOT) basis. Despite its ambitious goals, Türkiye faces challenges in meeting its energy demands, with 74 percent reliance on imports.[32] The country has prioritized renewable energy development under its National Energy Policy, adopted in 2017, with deep cuts in coal use and rapid renewable deployment serving as cornerstones of its energy transition strategy. However, the Turkish renewable energy market faces **financing challenges**, with stricter conditions limiting investor participation in subsequent large-capacity projects. As Türkiye navigates its path toward sustainable energy, balancing economic growth, geopolitical ambitions, and climate commitments present significant opportunities and obstacles for its growth.

Key barriers to renewable energy growth in Türkiye

01 Market structure

02 Access to capital

01 Market structure

Türkiye's reliance on foreign energy sources limits its economic and geopolitical independence, necessitating a shift towards diversified, sustainable energy strategies. Leaders face the challenge of developing policies that address both short-term domestic and regional ambitions as well as long-term challenges from climate change and global energy transition.

Türkiye’s strategic location makes it a critical transit route for fossil fuels, particularly considering recent geopolitical events. To address this, the country is increasingly focusing on renewable energy to reduce reliance on imports and mitigate environmental impacts. Initiatives such as the Green Industry Project contribute to job creation and economic growth. Despite progress in renewable energy development, obstacles remain, including the need for legislative support, financial hurdles and geopolitical complexities.

Large-scale renewable energy investments, particularly in offshore projects, carry **risks of disputes between developers and contractors**, as well as **uncertainties surrounding state subsidies and regulations**. The contractual framework commonly used for construction in Türkiye, particularly for renewable energy projects involving international investments, often follows the International Federation of Consulting Engineers (FIDIC) standard contracts. The increase in offshore renewable projects has led to the ongoing development of a fit-for-purpose FIDIC offshore contract, which may present challenges in navigating this evolving legal landscape.

32 IEA, “Türkiye - Electricity”

Key barriers to renewable energy growth in Türkiye

02 Access to capital

Türkiye's renewable energy sector faces **significant challenges in securing adequate funding** to support its ambitious growth plans. Despite recent efforts to prioritize renewable energy sources and streamline regulations, the country continues to grapple with substantial financial hurdles.

The estimated annual investment needs for sustainable energy development during 2017–40 is **US$3 trillion**[33], highlighting the pressing need for increased financial resources. While the government has implemented various initiatives to support renewable energy projects, such as the Renewable Energy Resource Zone (YEKA) tenders, subsequent large-scale projects have encountered difficulties in attracting new investors due to **stringent financing requirements**.

The lack of readily available non-recourse loans and the government's practice of securing projects against its own assets create additional hurdles. These financial constraints pose a significant obstacle to the rapid expansion of renewable energy capacity in Türkiye, necessitating innovative solutions to bridge the funding gap and align with global sustainability objectives.

The country can explore alternative financing mechanisms and potentially develop new financial instruments tailored to renewable energy projects. Fostering public-private partnerships can help mobilize the necessary resources to support its renewable energy goals.

33 Asian Development Bank Institute, “Energy Insecurity In Turkey: Opportunities For Renewable Energy”, 2019

Indonesia

Indonesia's economy is booming and aims to be the fourth largest globally by 2050. However, its progress in renewable energy lags the neighboring Southeast Asian countries. Currently, renewable energy makes up only 13.1 percent of the electricity mix, falling short of the 2023 target of 17.9 percent.[34] The government's draft proposal to lower renewable energy targets for 2025 and 2030 may indicate a lack of commitment to energy transition. Challenges in attracting investments and implementing favorable policies further hinder Indonesia's transition to renewables, prolonging its reliance on fossil fuels.

Market view[35]

RE capacity, 2023

Total	Solar	Wind	Hydro	Others*
13 GW	0.6 GW	0.2 GW	6.8 GW	5.8 GW
▲ 6% vs 2022	▲ 83%	= 0%	▲ 1%	▲ 7%

RE generation, 2023

Total	Solar	Wind	Hydro	Others*
2,894 TWh	584 TWh	886 TWh	1,226 TWh	198 TWh
▼ 0.3% vs 2022	▲ 61%	▲ 36%	▼ 10%	▲ 9%

Investment realization in the energy and mineral resources sector (US$ billion), 2017–23[36]

* Includes electricity generated from biomass, geothermal and other renewable sources.

34 Energy Institute, "Statistical Review of World Energy", 2024

35 Energy Institute, "Statistical Review of World Energy", 2024

36 IEEFA, "Unlocking Indonesia's Renewable Energy Investment Potential", 2024

Indonesia, with its vast natural resources and growing population, has enormous potential for renewable energy development. The country, in its National Electricity Plan[37], aimed to achieve a 23 percent renewable energy share in its electricity mix by 2025, but progress has been slow. The state-owned utility PT Perusahaan Listrik Negara's (PLN) Electricity Supply Business Plan aims to meet this target through new hydro, geothermal and biofuel capacities, as well as biomass co-firing in coal plants. However, the construction of these large projects has faced delays, and solar PV has been underutilized due to higher costs.

Despite the abundance of solar, wind, hydro and geothermal resources, Indonesia has struggled to attract meaningful investment in renewable energy, with only US$1.5 billion invested in 2023, largely due to **regulatory hurdles** and **market structure constraints**. To achieve its renewable energy targets and fulfill its climate commitments by 2030, Indonesia requires substantial investment (~US$285 billion), with a significant investment gap of US$146 billion.[38] By addressing regulatory uncertainties and attracting investors through clear policies and incentives, Indonesia can unlock its abundant renewable energy potential and successfully transition toward a sustainable energy future.

Key barriers to renewable energy growth in Indonesia

01 Market structure

02 Access to capital

03 Planning and permitting

04 Supply chain issues

01 Market structure

The market structure in Indonesia, with the state-owned power utility PLN holding a monopoly position, presents a significant obstacle to the growth of renewable energy in the country. The current dominance of coal in the power generation mix and the lack of incentives for PLN to invest in renewables contribute to this barrier.

Although pricing regulations are in place under the Presidential Regulation, they do not provide sufficient motivation for PLN to transition toward renewable energy sources. Ideally, these regulations should encourage PLN to offer premium prices or feed-in tariffs to attract independent power producers. However, PLN's financial constraints prevent it from paying above existing electricity supply costs, as subsidies are required to cover its deficits. Furthermore, PLN is bound by long-term coal-based electricity supply contracts, which restrict its ability to shift away from coal. The oversupply on the main grids further complicates the integration of renewables.

These structural barriers create a disincentive for PLN to divest from coal despite the decreasing global costs of renewable energy. Overcoming these obstacles and implementing more favorable policies are essential to promote the adoption of renewable energy in Indonesia.

37 Indonesia Green Growth Program, 5 Facts on Financing Renewable Energy Mix Target by 2025"
38 IEEFA, "Unlocking Indonesia's Renewable Energy Investment Potential", 2024

Key barriers to renewable energy growth in Indonesia

02 Access to capital

The slow progress in renewable energy development, particularly in solar and wind power, has made investing in renewables less attractive. Furthermore, Indonesia's plans to lower its renewable energy targets for 2025 and 2030, reducing them from 23 percent to 17–19 percent and from 26 percent to 19–21 percent, respectively, exacerbate the situation.[39]

The Government of Indonesia has issued regulations to encourage private sector investment, but these have not attracted new investors due to unfavorable policies and weak regulatory implementation. These barriers include the following:

- **Mandatory partner system** where PLN holds majority shares in renewable energy projects dampens private investor interest and creates conflicts, as PLN becomes both an owner and buyer of the generated energy.
- The government's **restriction on transferring ownership rights before the commercial operation date** limits the private sector's access to capital and technical expertise during project delivery.
- The new **'deliver-or-pay' scheme** imposes penalties on Independent Power Producers (IPPs) if they fail to meet availability or capacity requirements. This replaces the previous "take-or-pay" scheme, where PLN must either accept delivery of electricity or pay a penalty. While the new scheme may protect PLN financially, it is seen as less favorable for renewable energy projects compared to fossil fuel plants and adds to the risk factor for investors.
- Despite the push for a feed-in tariff, the introduction of a **staggered ceiling tariff** makes it challenging for investors to achieve profit targets, making auctions for new projects unappealing.
- **Local Content Requirements (LCRs)** policy increases investment costs, resulting in higher system costs compared to global averages. This, along with low tariffs, hampers investor returns and makes renewable energy investment unfeasible.
- The **complicated procurement procedures** for renewable energy projects pose significant obstacles to attracting investment. The lack of clarity on timelines and bid bond requirements further complicates matters for investors.

39 IEEFA, "The dark cloud over Indonesia's pledge to achieve net-zero emissions by 2060", 2024

Key barriers to renewable energy growth in Indonesia

03 Planning and permitting

The lack of transparency in PLN's procurement of renewable energy projects raises concerns. The process involves direct appointment or selection, with IPPs required to pre-register on a List of Selected Providers (DPT). The complicated procedure and absence of a clear timeline make it difficult for IPPs to estimate the feedback time from PLN, which can range from weeks to over a year.

Although the procurement lead time is stated as 90 days for direct appointment and 180 days for direct selection, there is no guarantee of adherence to these timeframes. The procurement process, from issuing a Request for Proposal (RfP) to signing the Power Purchase Agreement (PPA), can take longer than 180 days, and tenders may also be canceled without apparent reason.

Additionally, IPPs face challenges with unclear procedures and varying bid bond requirements, often requiring collateral of equal value. Transparent bid bond requirements are essential to attract investors.

Given the urgency and scale of Indonesia's energy transition, there is a need to reform procurement procedures to instill investor confidence and attract increased investment.

04 Supply chain issues

LCRs, implemented by the Indonesian government, aim to promote domestic inputs in industrial production and stimulate the growth of the local industry. However, these requirements have posed significant challenges to the development of renewable energy in the country.

Despite setting LCR targets, the local industry lacks the capacity to meet these requirements and heavily relies on imported materials for equipment manufacturing. The limited number of renewable energy projects further hampers the development of the local industry, making it difficult for renewable manufacturing to scale up.

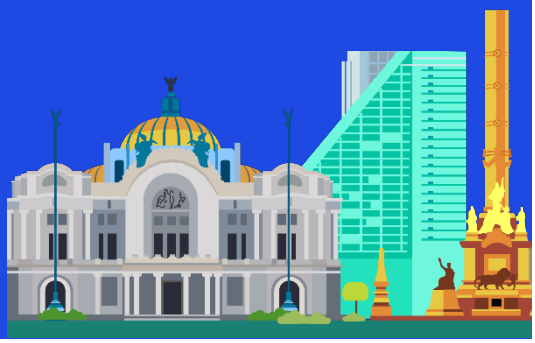
To address these challenges, the government has recently relaxed LCR provisions to encourage investment in green energy. The recent rule change provides a temporary relaxation of the LCRs exclusively for solar power plants with power purchase agreements signed by December 31, 2024, and slated to commence operations by June 30, 2026.[40]

While this relaxation shows the government's efforts to address supply chain issues, it remains to be seen how effectively the amended act will stimulate green energy investment and support the growth of the renewable energy sector in the long term.

40 Lexology, “Indonesia relaxes local content rules to energise green energy investment”, 2024

Mexico

Mexico's renewable energy landscape presents both opportunities and challenges. The country's abundant solar resources and growing wind capacity have driven impressive growth in clean power generation. However, the path forward remains uncertain due to shifting policy priorities and regulatory hurdles. To unlock its full potential, Mexico must balance economic interests with climate commitments, navigate regulatory obstacles and attract much-needed investment to drive the transition toward a cleaner, more sustainable energy mix.



Market view[41]

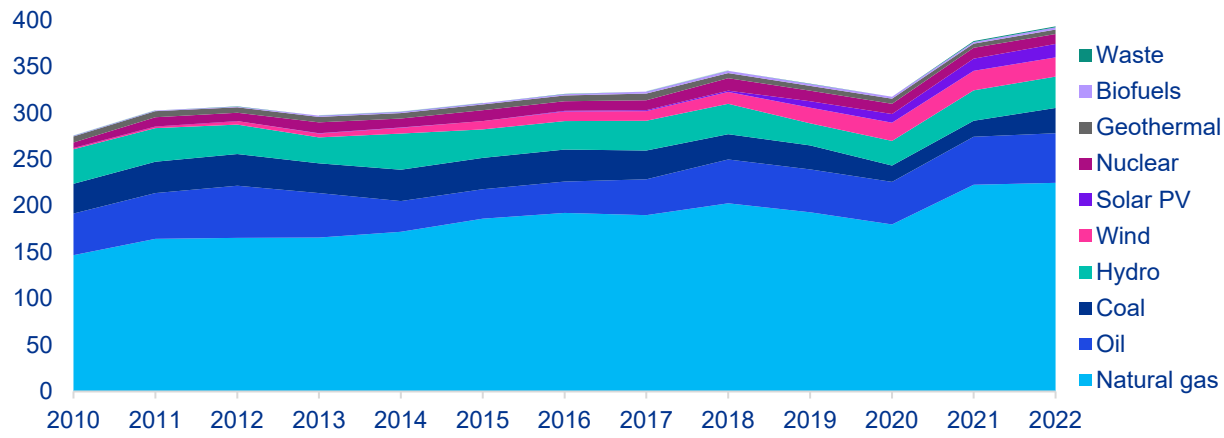
RE capacity, 2023

34 GW Total	11 GW Solar	7 GW Wind	13 GW Hydro	2 GW Others*
↑ 5% vs 2022	↑ 17%	= 0%	= 0%	↑ 1%

RE generation, 2023

76 TWh Total	27 TWh Solar	22 TWh Wind	20 TWh Hydro	7 TWh Others*
↓ 8% vs 2022	↑ 33%	↑ 6%	↓ 43%	↑ 6%

Electricity generation in Mexico (TWh), 2010–22[42]



* Includes electricity generated from biomass, geothermal and other renewable sources.

41 Energy Institute, "Statistical Review of World Energy", 2024
42 IEA, "Mexico - Electricity"

Mexico has made significant strides in clean energy adoption, with solar and wind generation nearly tripling between 2015 and 2022. However, recent policy changes under the current administration have altered the electricity market dynamics, affecting investor confidence and project development timelines. Despite these hurdles, Mexico boasts substantial renewable potential, including abundant sunlight, strong wind resources, untapped hydropower capabilities in the southern regions and geothermal sources. Mexico's resource base could support massive growth in clean generation capacity, potentially meeting the country's electricity needs many times over.

Yet the sector faces challenges related to **regulatory uncertainties, policy shifts favoring fossil fuels and infrastructure constraints**. To accelerate Mexico's energy transition, addressing grid integration issues, attracting investment for clean projects and fostering a competitive market with private sector participation are crucial.

Key barriers to renewable energy growth in Mexico

01 Market structure

02 Investment in grid infrastructure

03 Planning and permitting

01 Market structure

Mexico's renewable energy sector faces significant hurdles due to **evolving market dynamics and policy shifts.** The 2021 Electric Industry Law introduced preferences for coal and fuel oil-fired power plants over renewables, creating uncertainty for investors in large-scale projects.

President López Obrador's focus on fossil fuel alternatives and state control over the energy sector has shifted attention away from renewable energy deployment. Despite this, solar and wind energy have shown healthy growth rates, primarily driven by past policy decisions rather than current administration initiatives. The sector remains vulnerable to arbitrary policy changes and lacks long-term policy certainty, deterring potential investors and impeding the scaling up of renewable energy projects.

Key barriers to renewable energy growth in Mexico

02 Investment in grid infrastructure

Despite growing demand for clean energy, particularly in the form of renewable and sustainable power projects, private sector investment in mid-to-large-scale renewable and clean energy initiatives has stalled. Companies seeking to meet their sustainability goals are increasingly turning to "inside the fence" solutions, avoiding the challenges posed by **inadequate transmission infrastructure**. This trend is driven by concerns over congestion risks and the need to mitigate them.

The Wholesale Electricity Market (WEM) has become a crucial platform for off-takers demanding clean and renewable energy power projects. However, the supply of such projects through the WEM remains insufficient to meet this demand. Energy regulators, primarily the Energy Regulatory Commission (CRE), are working to reactivate administrative procedures, obtain necessary permits and streamline interconnection processes to address this gap. These efforts aim to support the development of private power plants, particularly those focused on clean and renewable energy. Additionally, new clean energy power plants will help meet the high demand for clean energy certificates (CELs) from private off-takers, further driving the sector's growth.

03 Supply chain issues

Private companies seeking to invest in large-scale renewable projects encounter **lengthy delays in obtaining necessary permits, creating a backlog of pending applications**. These challenges stem from policy initiatives such as the 2021 Electric Industry Law, which introduced changes aimed at prioritizing state-owned utility CFE's plants through a dispatch system. This regulatory environment has discouraged investment in renewable energy projects, hindering Mexico's ability to meet its clean energy targets.

The lack of streamlined permitting processes and inconsistent policy support creates uncertainty for potential investors, potentially slowing the transition toward a more sustainable energy mix. To overcome these barriers, Mexico needs to implement more efficient planning and permitting procedures, coupled with stable and supportive policies that encourage private sector participation in the renewable energy sector.

Key insights and conclusion

Key insights and conclusion

Global energy transition critically depends on EMDEs being able to transform their energy portfolio, thus rapidly growing the share of renewable energy. The story of renewable energy in EMDEs is that of growth, potential and confidence. However, achieving their full potential is subject to elimination of different barriers that hinder renewable expansion. Most importantly, barriers identified in this report are obstructing the speed of development of grid and storage infrastructure, which is mostly outdated, inefficient and insufficient to absorb the growing variable generation sources.

All the EMDEs assessed in this report face financial, infrastructure and policy stress that is distancing them from their renewable energy targets. While the stress factors are largely domestic, the addressal calls for synergized efforts by the local and global bodies. Emissions and climate change impacts are borderless, and the response has to overcome the limitations of political borders.

Access to affordable finance is among the biggest challenges for energy transition. Given the imperfections of financial markets of emerging economies, their existing financing models have high reliance on DFI money. Allowing increased financial flexibility, innovation and incentivization, and providing measures to de-risk investments would instill confidence amongst investors and improve the risk-return profile. Customized financial instruments, mobilizing funding through dedicated decarbonization pathways and developing a green taxonomy are some measures adopted by a few emerging markets that can be easily transferred to other such countries. Access to global finance has to be complemented by deepening of in-country financial markets and instruments. Current risk premiums of EMDE investments need to be brought down.

Role of governments in this transition is vital. Governments need to spearhead renewable development by creating comprehensive policies and concrete action plans. Targeted reforms to create robust market structures, optimize resource allocation across generation and infrastructure, and facilitate large-scale renewable energy integration can slingshot renewables in high growth trajectory. What's needed immediately is the scoping of the project lifecycle and make not only policy but administrative amendments to meet the current challenges and be prepared for upcoming issues. The report identifies distinctions between countries in government policies.

Governments, and private players, should focus equally on net-new innovation and localization of adopted technology — the critical elements to not only bring down the costs and increase efficiency, but also create a renewable energy ecosystem. It will help create employment and increase value addition, which are clear political asks in the EMDEs to support transition. This will require out-of-the-box thinking to reduce the concentration risks and high import dependence of the renewable energy supply chain in the EMDEs.

Enhancing domestic capabilities by leveraging global knowledge is the way ahead for emerging markets. They need synchronized solutions that encapsulate policy consistency (including depoliticization), stronger market structure, innovative financing and technology, and new infrastructure to create energy systems of the future and shape global transition. There is much for the EMDEs to learn from others, including each other to accelerate the transition.

Contributors:

Abirbhav Mukherjee
Anish De
Apurav Jaiswal
Ashiq Muhammed
Michael Hayes
Ruchika Chawla
Versha Chauhan
Wafa Jafri

Design Team:

Angeeta Baweja
Khushi Kansara
Shveta Pednekar

Marketing compliance:

Nisha Fernandes

KPMG contacts:

Akhilesh Tuteja
Head – Clients & Markets
KPMG in India

Anish De
Global Head
Energy Natural Resources
and Chemicals (ENRC)
KPMG International

Michael Hayes
Partner
Global Head of Renewables
KPMG in Ireland

Wafa Jafri
Partner
Energy Deal Advisory
KPMG in the UK

kpmg.com/in

Access our latest insights on
KPMG Insights Edge

Follow us on:
kpmg.com/in/socialmedia