CAPTURING GREEN RECOVERY OPPORTUNITIES FROM WIND POWER IN DEVELOPING ECONOMIES

GWEC

GLOBAL WIND ENERGY COUNCIL

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Image credits

Alexey Kornylyev

Tribute to Ntombifuthi Ntuli

20 August 1979 - 13 August 2021

As this report was in development, the CEO of the South African Wind Energy Association (SAWEA), Princess Ntombifuthi Ntuli, sadly passed away in August 2021.

Ntombifuthi steered the wind power sector in her leadership role, from her appointment to the CEO position of SAWEA in September 2019. She drew on her depth of knowledge and talents, crafted over more than 15 years in the energy and related sectors.

Ntombifuthi's leadership was defined by her charismatic yet gentle nature, resilience and determination to successfully steer the industry towards playing a central role in South Africa's energy transition, while being a uniting force.

She built strong bridges throughout the energy sector, founded on her sound logic and ability to see the bigger picture. Her lobbying efforts for the country's transition to cleaner power were underpinned by supportive government policy and smooth procurement, which will help to ensure the sector's exponential growth for years to come. Her legacy will live on not only through her successes, but also in the hearts of the people that make up this industry.

Fondly known as Ntombi, she left behind two young children and an extended family who will feel the full extent of this loss.

"Ntombi changed the face of the wind industry in our country. She made the industry relatable with her ability to engage with the most stubborn naysayer, helping them to see her point of view and winning everyone over with her charming smile and her calm strength," said Mercia Grimbeek, Chair of SAWEA.

"Our dear colleague and friend Ntombi was one of the most engaging and determined champions of wind energy in the industry, and an endless source of good humour and inspiration," said Ben Backwell, CEO of GWEC.

GWEC dedicates this report on wind power potential to her memory.

Ntombifuthi Ntuli

Foreword

Two years into the COVID-19 pandemic, the window of opportunity to build back better for a more resilient and sustainable future is closing fast. Back in 2020, when widespread lockdowns caused a dramatic reduction in carbon emissions, the wind industry joined climate scientists and concerned civil society groups to warn governments that without decisive action to phase out fossil fuels, emissions would quickly rebound to pre-pandemic levels. As we enter 2022, we are now seeing coal powered generation on-track to reach a record peak this year, natural gas prices at all-time highs and—as predicted—emissions rebounding alongside economic recovery.

To date, the action needed to deploy renewable energy and mitigate climate change has failed to match the scale and pace of the climate crisis. Investments in new energy infrastructure have not been sufficient to allow the huge amounts of private sector investment available to be deployed at pace, and for economies like the five profiled in this report, this has slowed recovery from the pandemic and increased the risk of further recessions.

However, I see reasons to be optimistic. During the last two years, governments earmarked unprecedented spending packages to safeguard jobs and economic activity, while there is a new found consensus around the role of the clean energy transition as a key enabler of sustainable growth in a post-pandemic world. The IMF announced in October 2021 that fiscal outlays to mitigate the negative impacts of COVID-19 reached an unprecedented US$16.9 trillion globally, with G20 countries accounting for 98% of the total, of which US$470 billion was allocated to supporting clean energy globally.

The landmark agreement reached at COP26 in Glasgow last year, where the 197 parties to the Paris Agreement formally recognised the urgency to rapidly scale up clean power generation globally and phase out fossil fuels, makes the pathway ahead of us clear: Governments must act in 2022, or miss the opportunities of the energy transition.

Green recovery, including targeted public stimulus and investment as well as policy reforms which improve the enabling environment for a green economy, can go a long way in putting the world on track to meet international climate targets and increasing energy system resilience. On the day GWEC publishes this report, the G20 Presidency of Indonesia hosts the Finance Ministerials in Jakarta, as well as a special meeting of the Sustainable Finance and Health Working Group under the slogan "Recover Together, Recover Stronger." As the group of countries representing over 80% of global energy-related CO_2 emissions, actions taken by G20 countries to accelerate a sustainable and just transition to clean energy will determine the pace of progress towards tackling the climate crisis.

Time and again, the wind industry is demonstrating its pivotal role in supporting thriving local economies through skilled jobs creation and the maintaining of critical infrastructure, while dramatically contributing to reducing carbon emissions and delivering clean, affordable and secure energy. GWEC will continue to work closely with governments to ensure that the world is well equipped to harness the full socioeconomic benefits of the energy transition.

Ben Backwell
CEO, Global Wind Energy Council

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Glossary

ABEEólica	Associação Brasileira de Energia Eólica
ANEEL	National Electric Energy Agency (Brazil)
BAU	Business as usual
BNDES	National Bank for Economic and Social Development (Brazil)
COP26	26th Conference of the Parties
CO_2e	Carbon dioxide equivalent
CPPA	Corporate power purchase agreement
EPE	Energy Research Office (Brazil)
ESKOM	Electricity Supply Commission (South Africa)
EVOSS	Energy virtual one stop shop
FTE	Full time equivalent
GDP	Gross domestic product
GHG	Greenhouse gases
GRS	Green recovery scenario
GVA	Gross value added
GWEC	Global Wind Energy Council
IEA	International Energy Agency
IPP	Independent power producer
IRENA	International Renewable Energy Agency
MME	Ministry of Mines and Energy (Brazil)
NDC	Nationally determined contribution
NERSA	National Energy Regulator of South Africa
PDE	Ten-Year Energy Expansion Plan (Brazil)
PPA	Power purchase agreement
PROINFA	Incentive Program for Alternative Sources of Electric Energy (Brazil)
SAWEA	South African Wind Energy Association
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

An increasing number of countries are recognising the key role of wind energy in supporting a global clean energy transition. The urgency to scale up clean power generation and shift away from unabated coal power were key elements of the Glasgow Climate Pact, endorsed at COP26 summit in November 2021 by the nearly 200 countries signed up to the Paris Agreement. Renewable energy is a component of the Nationally Determined Contributions (NDCs) for most of the Parties to the Paris Agreement, and more than 100 Parties have a quantified clean power target within their NDCs.

There is a growing mismatch between energy transition ambitions, net zero targets and market realities, however. Accelerated deployment of renewable energy, and particularly large-scale sources of clean power like wind and solar energy, are needed worldwide to limit the most harmful impacts of climate change.

To reach our shared global goal of limiting temperature rise by the end of the century to 1.5°C, the volume of annual wind energy installations must scale up roughly four times over the next decade. This is a huge challenge which will require shared vision and collaboration between governments, industry, and society. Given the urgency of the transition, it is vital that the deployment of wind energy does not face unnecessary delays due to resolvable challenges, such as bureaucratic permitting procedures and market barriers to investment.

The resources and coordination required for this scale of action have been stretched over the last two years, due to the COVID-19 pandemic. This challenge is particularly acute in developing economies, where public spending and policy response have focused on short-term protections of society and economy. As countries learn to manage the difficulties of the pandemic and economic activity returns, it is time to undertake the actions which will benefit society and economy in the long term.

The opportunities in developing economies

There is a growing body of evidence which shows that wind energy can help governments accelerate a green economic recovery, and form a bedrock for sustainable

economic growth in the future.[1] The benefits of wind energy are wide-ranging and expand beyond clean power generation – they include sustainable job creation, public health cost savings which would be spent redressing the impacts of fossil fuel generation, water consumption savings which would otherwise be used for thermal generation, and a significant capital injection in a local value chain. The sector is particularly attractive for developing economies which need to phase out fossil fuels while maintaining economic growth, meeting fast-growing electricity demand and safeguarding energy security.

Wind energy has achieved significant cost reduction and technological excellence over the past two decades, establishing it as a proven and market-ready alternative to fossil fuels. While costs might initially be higher in developing economies where the wind industry is new – due to factors such as less experienced personnel, start-up costs, initial investment uncertainty and lack of established supply chain – these costs can quickly reduce with government commitment, policy certainty and market forces.

This report reflects a study of wind energy potential in developing economies around the world over the next five years, from 2022-2026, with the aim to highlight the vast and largely unexploited socioeconomic and environmental opportunities attached to wind energy. Accelerated deployment of wind projects will not only support climate action, but help countries to realise a range of benefits from job creation to cleaner air. The study identifies three common barriers facing wind energy deployment in developing economies and provides recommendations on how these barriers can be overcome.

Five developing economies in particular were selected as country studies: Brazil, India, South Africa, Mexico, and the Philippines. These were selected because they face particular socio-political and economic challenges related to COVID-19, which threaten to slow down the clean energy transition, as well as for having significant and still largely untapped wind energy resource.

Findings of the study: green upsides of accelerated wind deployment in a green recovery scenario

The findings of this study, summarised in Table 1 below, show that a green recovery scenario of accelerated wind deployment from 2022-2026 would realise tremendous socioeconomic benefits for each country. In Brazil, for example, the potential upsides compared to a BAU scenario equate to nearly 5 GW of additional installed wind capacity, half-a-million more jobs created in the wind value chain, 8 million more homes powered by clean electricity, and more than 180 million metric tons of CO_2e saved.

For developing economies facing the difficult balance of restarting economic growth while maintaining energy security and resilience, investment in the wind sector offers a pathway to a robust and sustainable recovery.

1 *https://gwec.net/greenrecovery/*

Table 1 **Summary of wind growth impacts in business-as-usual scenario versus green recovery scenario for 2022-2026**

Country	2022-2026	New wind installations (MW)	FTE jobs created over wind farm lifetimes	Gross value added to economy over wind farm lifetimes (US$)	Homes powered by clean energy annually from 2026	Metric tons of carbon emissions equivalent saved over wind farm lifetimes (tCO_2e)	Litres of water saved annually from 2026
Brazil	BAU	11,050	775,000	14 billion	17 million	433 million	74 million
	Green Recovery	15,840	1,350,000	22 billion	25 million	615 million	106 million
	Potential Upside	**4,790**	**575,000**	**8 billion**	**8 million**	**182 million**	**32 million**
	% increase	43%	74%	57%	47%	42%	43%
India	BAU	21,500	1,500,000	11 billion	24 million	525 million	71 million
	Green Recovery	31,150	2,650,000	18 billion	34 million	754 million	103 million
	Potential Upside	**9,650**	**1,150,000**	**7 billion**	**10 million**	**229 million**	**32 million**
	% increase	45%	77%	64%	42%	44%	45%
Mexico	BAU	2,150	125,000	2.5 billion	4 million	88 million	14 million
	Green Recovery	4,335	350,000	6 billion	8 million	181 million	28 million
	Potential Upside	**2,185**	**225,000**	**3.5 billion**	**4 million**	**93 million**	**14 million**
	% increase	102%	180%	140%	100%	106%	100%
South Africa	BAU	6,460	500,000	7.3 billion	5 million	486 million	39 million
	Green Recovery	8,984	750,000	10.5 billion	7 million	676 million	52 million
	Potential Upside	**2,524**	**250,000**	**3.2 billion**	**2 million**	**190 million**	**13 million**
	% increase	39%	50%	43%	40%	39%	33%
The Philippines	BAU	1,150	47,000	700 million	2 million	45 million	5 million
	Green Recovery	1,650	80,000	1.1 billion	3 million	65 million	7 million
	Potential Upside	**500**	**33,000**	**400 million**	**1 million**	**20 million**	**2 million**
	% increase	43%	70%	57%	50%	44%	20%

While this report includes only five country studies, similar socioeconomic benefits can be achieved by other countries. The study analysed international experience of the onshore wind industry and found that typically a 1 GW/year installation rate over 5 years could unlock nearly 100,000 new jobs and $12.5 billion gross value added (GVA) to national economies over wind farms' lifetime, among other benefits.

Based on industry experience to date, a country which installs 1 GW of onshore wind energy capacity per year from 2022 to 2026 could unlock a range of socioeconomic and environmental benefits*:

A total of 130,000 jobs during the development, construction, and installation phase of the wind farms

US$12.5 billion gross value added (GVA) to national economies over the lifetime of the wind farms

12,000 local jobs annually during the 25-year operations and maintenance phase of the wind farms

28.8 million litres of water saved annually from 2026

Power 4.9 million homes with clean energy per year from 2026

240 million metric tons of carbon emissions equivalent saved of carbon emissions over the lifetime of the wind farms

The resulting 5 GW of wind energy:

Mitigates 240 million metric tons of CO_2 emissions over the lifetime of the wind farms, which is the equivalent of:

- 90 million return flights from New York to Glasgow
- Taking 53 million internal combustion engine cars off the road for one year
- Planting and maintaining 6.4 million trees for 10 years

** Assuming a cost of £2 million/MW, and 25 years of operation. Assumes all major components are sourced in country, except for the turbine, where we assume only blades and towers manufactured locally. One job is defined as full-time employment for one person for one calendar year.*

Recommendations to support wind growth in developing economies

In the course of the study and conversations with industry and investment experts around the world (see the Methodology in Appendix A), several barriers to wind energy deployment were identified that are common to developing economies. The most significant common barriers are a lack of clear policy commitment, insufficient transmission system infrastructure, limited investment in grid upgrade and expansion, and complex regulatory frameworks.

Addressing these barriers proactively, in coordination with the wind energy industry and other relevant stakeholders, can support accelerated deployment of wind energy and a green recovery in developing economies.

Policy commitment: provide clarity and ambition for wind energy

A lack of consistent and clear policy commitment to promote and enable wind energy is a barrier common to many developing economies. A clear route to market is needed to decrease investment risk and cost of capital for developers. Similarly, long-term ambitions for wind energy eases local investment in a supply chain. This brings faster and bigger benefits.

- Provide a clear vision of the government's long-term plans by stating targets and commitments which, in turn, provide confidence in the market.
- Increase the government's wind power ambition and reflect this in updated NDCs and targets, comprehensive national climate strategies, and short- and long-term energy plans.
- Make the role for wind energy and the associated enabling grid clear within wider public strategy to embed government commitment.
- Establish long-term procurement pipelines such as through regular and frequent auctions, with clear visibility of the areas most suited for development, the expected amount of generation sought, and likely timeframes.
- Take a "whole system" approach to energy and ensure that incumbent fossil fuel generation is pushed off the system and new investments in coal and other fossil fuel-based generation are avoided. Governments should

introduce measures to ensure that carbon emissions and other impacts of fossil fuel generation (such as impacts on air quality, human health, and water use) are correctly priced.

- Collaborate with industry to successfully build and evolve policy. Government policy objectives and priorities can change over time, due to administration changes, shifts in the public interest, or even externalities like the COVID-19 pandemic. Industry needs to understand the government drivers, and to be given the chance to provide feedback on government plans to ensure that objectives are reasonable and can be met. Provide industry with a stable business environment with plenty of sight of any change.

Invest to expand transmission system infrastructure

Wind energy projects rely on land availability, wind resource, and grid connection points. Greater public and private investment in secure, smart and flexible grids which enable ever-larger shares of renewable energy is necessary to meet the urgent pace of the energy transition.

- Provide developers with a clear, bankable framework to apply for a grid connection.
- Accelerate the forward-planning of transmission network expansion and investment in developing the network to increase the potential sites developers will consider for wind projects, as well as to avoid delays and grid congestion in the future.
- Coordinate transmission system planning with the planning for future wind energy development areas to ensure that the grid is efficiently strengthened and available when needed in relevant areas.
- Grid planning should include storage solutions, such as pumped hydro or utility-scale batteries, which can minimise grid congestion and support balancing.

Simplify permitting frameworks for renewable energy

Too many countries are unable to leverage the enormous interest from investors to deploy wind energy projects, due to inefficient permitting schemes. Frameworks for leasing, permitting, and power procurement can be overly complex and bureaucratic, which can delay wind energy deployment if projects cannot obtain the necessary permits and approvals in a sensible timeframe.

Policymakers must ensure that bureaucracy and red tape are not obstructions to achieving energy and climate goals. Lack of a consistent, clear bidding or auction process adds risk for investors and developers, and adversely impacts industry confidence in a country.

- Simplify frameworks related to permitting, leasing, and auctions to increase wind energy deployment.
- Consider establishing a single agency, or 'one-stop shop', to manage and coordinate all documentation and applications to greatly help simplify processes.
- Enable strong coordination between different framework administrators. This ensures that processes fit well together, and each can better cater for a greater volume of projects progressing.

- Consider, among others:
  - Mandated maximum lead times to permit renewable energy plants, such as 2 years for greenfield onshore wind projects, 3 years for offshore wind projects and 1 year for repowering projects, with additional discretionary time allowance under extraordinary circumstances
  - A structured and time-limited process for developers to provide evidence for their expected timeframes and project plans
  - A clearing house mechanism for legal disputes to prevent extended delays to critical infrastructure projects
  - Land use strategies which prioritise nature-positive energy solutions, and
  - Fast-track permitting schemes to prioritise repowering of existing wind farms where turbines are reaching end-of-lifetime.

Other recommendations

- Have a consistent and predictable bidding or auction process. This is vital to limit risk, and ensure investors and prospective developers of a country's reliability and their commitment to wind energy development.
- Ensure that the revenue stream mechanism is bankable.
- Engage with the wind energy industry to ensure that policy and regulatory frameworks are feasible and investable, and to jointly coordinate to make them as streamlined as possible.

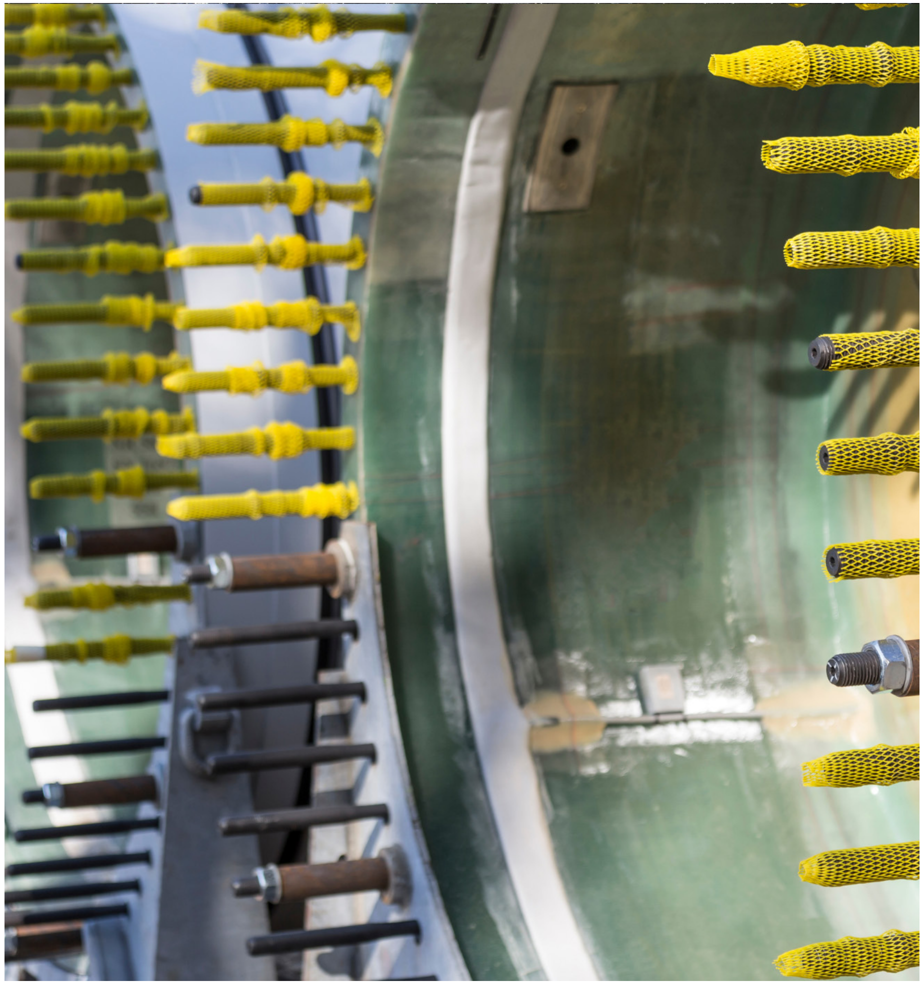
Introduction

An increasing number of countries have set wind energy targets in the coming decades, recognising wind energy's key role in supporting a clean energy transition and achieving NDCs and net zero targets under the Paris Agreement. There is also a growing body of evidence which shows that wind energy can help governments to accelerate a green economic recovery from the COVID-19 pandemic, and form a bedrock for sustainable economic growth in the future.[2]

Wind energy has achieved significant cost reduction and technological excellence over the past two decades, establishing it as a proven and market-ready alternative to fossil fuels. While costs might initially be higher in developing economies where the wind industry is new – due to factors such as less experienced personnel, start-up costs, initial investment uncertainty and lack of established supply chain – these costs can quickly reduce with government commitment, policy certainty and market forces.

The roadmaps to net zero GHG emissions by 2050, released by the IEA and IRENA ahead of the historic COP26 summit in 2021, are clear: wind energy is a major energy source which powers the global clean energy transition, and by the middle of the century, it will become the preeminent source of electricity generation worldwide.[3]

To reach our shared global goal of net zero by 2050, the volume of annual wind energy installations must scale up roughly four times over the next decade. This is a huge challenge which will require shared vision and collaboration between governments, industry, and society. Given the urgency of the transition, it is vital that the deployment of wind energy



2 https://gwec.net/greenrecovery/
3 https://www.iea.org/reports/net-zero-by-2050; https://www.irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook

does not face unnecessary delays due to resolvable challenges, such as bureaucratic permitting procedures and market barriers to investment.

This report reflects a study of wind energy potential in developing economies around the world over the next five years, with the aim to highlight the vast and largely unexploited socioeconomic and environmental opportunities attached to wind energy. Accelerated deployment of wind projects will not only support a global net zero target, but help countries to realise a range of benefits from job creation to cleaner air. It also discusses the common barriers facing wind energy deployment in developing economies, and recommendations on how these barriers can be overcome.

This report examines five developing economies in particular, as highlighted in Figure 1. These countries were selected because they face particular socio-political and economic challenges related to COVID-19, which threaten to slow down the clean energy transition, as well as for having significant and still largely untapped wind energy resource.

Figure 1 **Countries examined in this study**

Note on offshore wind

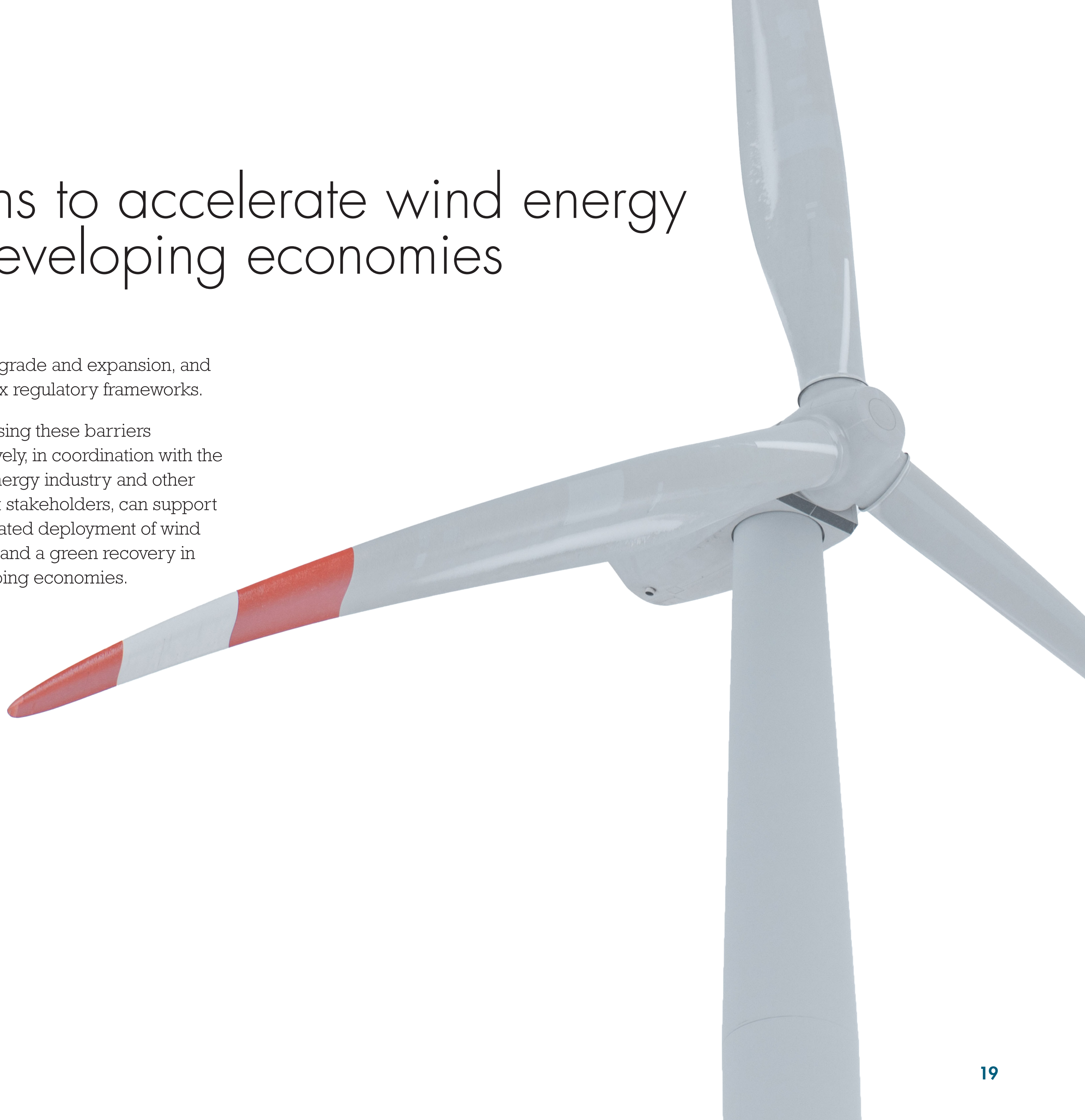
Given the five-year horizon and the countries selected for study, no offshore wind projects have been factored into the analysis of the countries discussed in this document. All capacity volumes are onshore wind only. While offshore wind makes up zero or a small proportion of the wind capacity in each of the countries discussed, all of the countries examined have significant offshore wind potential which could be realised in the coming decades. Many of the broader recommendations made in this document are relevant for offshore wind, especially for India which has a 30 GW target for offshore wind by the end of 2030, and Brazil that has a significant offshore wind potential and has recently announced its process towards its first lease auctions.

Recommendations to accelerate wind energy deployment in developing economies

Nearly 750 GW of onshore and offshore wind capacity is installed worldwide, as of 2020, and the volume of interest in wind energy from investors and project developers has never been higher. But this is just a fraction of the potential which could be realised to support the global energy transition. Given the wide-ranging benefits of wind energy, from job creation to public health cost savings, the sector is particularly attractive for developing economies which need to phase out fossil fuels while maintaining economic growth, meeting fast-growing electricity demand and safeguarding energy security.

However, there are several barriers to wind energy development which are common to developing economies around the world. Some of the most significant common barriers include lack of clear policy commitment, insufficient transmission system infrastructure, limited investment in grid upgrade and expansion, and complex regulatory frameworks.

Addressing these barriers proactively, in coordination with the wind energy industry and other relevant stakeholders, can support accelerated deployment of wind energy and a green recovery in developing economies.



Policy commitment: provide clarity and ambition for wind energy

A lack of consistent and clear policy commitment to promote and enable wind energy is a barrier common to many developing economies. In many countries, governments remain committed to conventional fossil fuel-based electricity generation. Even where the government is positive towards renewable energy and has set moderate targets for clean power generation, there can be a lack of enabling policy frameworks and regulation to adequately support investment in wind energy and other renewables.

A clear route to market is needed to decrease investment risk and cost of capital for developers. Similarly, long-term ambitions for wind energy ease pressures on local investment in a supply chain.

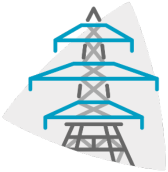
Policy must provide a clear vision of the government's long-term plans; this can be stated through targets and commitments which, in turn, provide confidence in the market. Wind energy projects, including associated infrastructure and supply chains, can take 4-8 years to develop, permit and install, which is longer than a typical political cycle. Offshore wind energy projects typically require even more project development time. Aspirations, plans, and drivers for facilitating wind deployment need to be clearly stated by governments to help the industry deliver. This is particularly important to support supply chain development and cost reduction in a global market. Setting policy also helps to shape the frameworks needed to deliver wind projects. The higher the consensus is for wind across major political parties, the more confidence the industry will have investing in that country.

Governments must increase wind power ambition and reflect this in updated NDCs and targets, comprehensive national climate strategies, and short- and long-term energy plans. The Glasgow Climate Pact called upon all Parties to COP to submit updated and strengthened NDCs by the COP27 event at the end of 2022, and several stakeholders have called for countries to update NDCs and renewable energy targets on a more frequent basis, such as each year. Beyond NDCs, national visions or policies should include concrete wind energy capacity or generation targets, with a clear, detailed timeline and a roadmap to achieve installation volumes.

The role for wind energy and the associated grid should be clear within a wider public strategy to underline government commitment. Targets and strategy should be aligned between the public bodies governing climate, environment, energy, economy, infrastructure and workforce, to ensure that the public sector is properly resourced to deliver them. This strategy can then be used to create strong policies and frameworks to support the development of wind energy.

A long-term procurement pipeline should be established, such as a pipeline of auctions, with clear visibility of the areas most suited for development, the expected amount of generation sought, and likely timeframes. This will help to give confidence to developers, local supply chain, and investors.

Collaboration with industry is key to successfully building and evolving policy. Government policy objectives and priorities can change over time, due to administration changes, shifts in the public interest, or even externalities like the COVID-19 pandemic. Industry needs to understand the government drivers, and to be given the chance to provide feedback on government plans to ensure that objectives are reasonable and can be met.



Invest to expand transmission system infrastructure

Wind energy projects rely on land availability, wind resource, and grid connection points. This means that projects can't always be developed in areas where the grid is well developed.

In many countries, development of transmission system infrastructure is coordinated by a separate organisation to that for the development and planning for electricity generation. The governance of the transmission system and generation may also be split into regions. This fragmentation can lead to the transmission system not being efficiently developed in the optimal areas or at the necessary time for connecting wind energy projects, which can delay the deployment of new capacity, raise investment risk, and hamper public efforts to meet targets.

Greater public and private investment in secure, smart and flexible grids which enable ever-larger shares of renewable energy is necessary to meet the urgent pace of the energy transition.

A clear, bankable framework to apply for a grid connection is important for developers. It can take many years before a connection to the transmission network is available, as this can involve local or wider upgrades, depending on the capacity the developer seeks to connect and the strength of the local transmission network. A robust, fair mechanism for allocating grid connections is required to determine when projects are offered connection to the transmission network. This can involve a centralised process where grid capacity is allocated to existing connection points.

Forward-planning of transmission network expansion and investment in developing the network should be accelerated to increase the potential sites developers will consider for wind projects, as well as to avoid delays and grid congestion in the future. Through pooling expertise among system operators, regulators and utilities, public authorities can undertake long-term forward-planning on grid expansion and reinforcement, electrification of transport, as well as creating regional markets for power export and trading.

Planning should be done in coordination with the planning for future wind energy development areas to ensure that the grid is efficiently strengthened and available when needed in relevant areas. Streamline connection approvals to prevent delays due to bureaucratic processes.

Grid planning should include storage solutions, such as pumped hydro or utility-scale batteries, which can minimise grid congestion and support balancing.

Simplify permitting frameworks for renewable energy

Too many countries are unable to leverage the enormous interest from investors to deploy wind energy projects, due to inefficient permitting schemes. Frameworks for leasing, permitting, and power procurement can be overly complex and bureaucratic, which can delay wind energy deployment if projects cannot obtain the necessary permits and approvals in a sensible timeframe.

These processes can cover spatial planning, environmental and social impact assessment, planning authorisation, grid connection and legal challenges to project proposals. In many countries developers must submit documents and applications to multiple national and local agencies. A lack of clarity on procedures and timelines and poor coordination between agencies and jurisdictions leads to delays, uncertainty, and inefficiencies.

For onshore wind projects, permitting can up to 8 years in Spain, Italy, Greece, Sweden, Belgium (Flanders) and Croatia, including the time taken by any legal challenges, according to WindEurope. Permitting of renewable energy projects in Mexico can take more than three years, due to local opposition or approvals from conservation authorities. Vietnam has a complex permitting environment requiring nearly 20 approvals and licenses from dozens of different authorities at national, provincial and local levels. Land acquisition in India can be a significant bottleneck, requiring up to 2 years in some states to obtain approvals. In addition, some states in India like Rajasthan lack a streamlined dispute resolution process, resulting in extended delays to wind projects from lawsuits.

Policymakers must ensure that bureaucracy and red tape are not obstructions to achieving energy and climate goals. Lack of a consistent, clear bidding or auction process adds risk for investors and developers, and adversely impacts industry confidence in a country.

Frameworks related to permitting, leasing, and auctions should be simplified to increase wind energy deployment. Consider establishing a single agency, or 'one-stop shop', to manage and coordinate all documentation and applications to greatly help simplify processes.

Strong coordination between different framework administrators is key. This includes administrators of leasing, permitting, revenue support, and other frameworks, and ministries responsible for energy and environment. This ensures that processes fit well together, and each can cater for the volumes of projects progressing.

Forming and changing frameworks takes time. It can take several years to develop and enact new legislation or to reach a stakeholder agreement on new processes. **It is important for countries to facilitate good communication with industry and to plan and implement changes within agreed timescales.** Any such changes are likely to introduce uncertainty and delay completion of wind projects, so limit the number of changes over time and be clear on the reason for any change.

The following framework measures should be considered, among others:

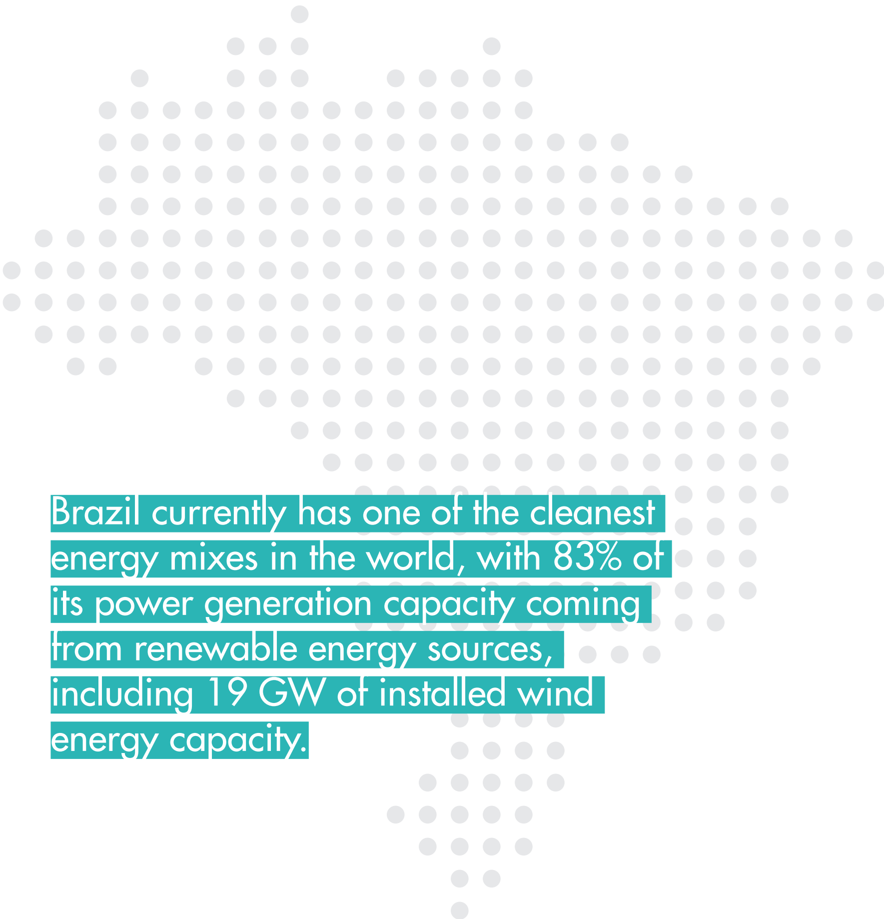
- Mandated maximum lead times to permit renewable energy plants, such as 2 years for greenfield onshore wind projects, 3 years for offshore wind projects and 1 year for repowering projects, with additional discretionary time allowance under extraordinary circumstances
- A structured and time-limited process for developers to provide evidence for their expected timeframes and project plans

- A clearing house mechanism for legal disputes to prevent extended delays to critical infrastructure projects
- Land use strategies which prioritise nature-positive energy solutions, and
- Fast-track permitting schemes to prioritise repowering of existing wind farms where turbines are reaching end-of-lifetime.

Other recommendations

- Have a consistent and predictable bidding or auction process. This is vital to limit risk, and ensure investors and prospective developers of a country's reliability and their commitment to wind energy development.
- Ensure that the revenue stream mechanism is bankable. This is important for investor confidence.
- Engage with the wind energy industry to ensure that policy and regulatory frameworks are feasible and investable, and to jointly coordinate to make them as streamlined as possible.

Brazil



Brazil currently has one of the cleanest energy mixes in the world, with 83% of its power generation capacity coming from renewable energy sources, including 19 GW of installed wind energy capacity.

Current situation

Responsible for one-third of GHG emissions in Latin America and the Caribbean, Brazil is at the centre of the global climate discussion. The largest net contributor to Brazil's GHG emissions is deforestation, followed by agriculture.

Brazil already has one of the cleanest energy mixes in the world, with 83% of its power generation capacity coming from renewable energy sources, including 19 GW of installed wind energy capacity.

Electricity demand fell in 2020 due to the Covid-19 pandemic, which led to a slowdown in construction of wind energy projects and to auctions being postponed. Demand for electricity returned to its usual levels in 2021, as the country began its rebound from the pandemic.

Energy mix and targets

Brazil ratified the Paris Agreement on 21 September 2016 and pledged an emissions reduction target of 37% by 2025 and 43% by 2030, compared to 2005 levels. This is aligned with its long-term goal of transitioning towards a low carbon energy system.

Decennial Plans for Energy Expansion (PDE-Plano Decenal de Expansão de Energia) are the primary legislative tool used to set energy targets. The most recent, PDE 2030,[4] presents the central government planning for the period up to 2030. It is considered the main government plan for the energy sector and is used as a guiding document for most stakeholders in the sector. PDE 2030 details a significant expansion of renewable sources, mainly wind and solar, as part of Brazil's national electricity matrix by the year 2030.

Table 2 below details the high level 2030 targets for renewables and wind specifically.

4 Decennial Plans for Energy Expansion | PDE 2030 - Plano Decenal de Expansão de Energia

Table 2 Brazil 2030 targets

Reduction of emissions intensity compared to 2005 levels (NDC as of November 2021)	50%
Newly installed energy capacity of which is renewable energy	88% of new capacity
Newly installed wind energy capacity	14% of new capacity

These targets are seen as realistic by ABEEólica, the Brazilian national wind association. The deregulated energy market in Brazil is expected to reduce prices further, and so renewable energy expansion will continue as it becomes even more attractive to investors and consumers in the coming years. The deregulated market has been largely independent of government support so far, and price reductions are expected to continue without any government support. However, while these energy production targets may be met, net GHG emissions reduction targets will not be met if current rates of deforestation continue.

COP26 outcome

At COP26 in November 2021, Brazil signed the Declaration on Forests and Land Use pledge to end deforestation by 2030. Brazil is a crucial signatory since the Amazon rainforest is a global carbon sink. Brazil also signed the Global Methane Pledge to reduce global methane emissions by at least 30% from 2020 levels by 2030.

In addition, Brazil has committed to zero illegal deforestation by 2028, to achieve 50% clean energy in its energy mix by 2030 compared to the previous target of 48%, and to achieve climate neutrality by 2050.

Brazil's main update to its NDCs at COP26 was increasing the reduction of emissions intensity from 43% to 50% compared to 2005 levels. This target has been criticised for lacking the ambition needed to comply with the Paris Agreement, and its NDCs in general are seen as lacking on climate change adaptation measures. It has not yet been formalised in an updated NDC submitted to the UNFCCC.

Economic stimulus for clean energy since 2020

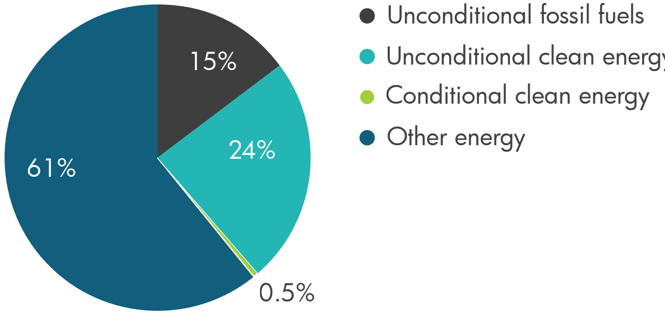
Brazil has committed at least $3.9 billion to supporting different energy types since early 2020 through government policy. This includes at least $582 million for supporting fossil fuels and $942 million for supporting clean energy. Figure 2 shows the proportions of public finance commitments to the energy sector in Brazil since January 2020.

The majority of public finance commitments are classed as "other energy", meaning they cannot be definitively split into "fossil fuels" or "clean energy". Usually this is because the legalisation packages refer to both types.

Brazil has committed $2.3 billion to these "other energy" types since January 2020. Compared to its economic peers, this is a small amount of money for supporting the energy sector, particularly renewable energy. The $3.9 billion since January 2020 is approximately the same amount as Sweden and New Zealand have committed, with populations 21 and 42 times smaller respectively. However, Brazil has committed a considerably large amount of public spending to support the economy and its population through monetary and fiscal policies throughout the pandemic, and some of that money may have indirectly supported the energy sector.

An example of a Brazilian stimulus implemented to develop the market structure for onshore wind energy is Law No. 10,438/2002, which created the Incentive Program for Alternative Sources of Electric Energy (PROINFA), with the objective of increasing the share of electricity produced by wind, small hydroelectric plants and biomass projects through Independent Autonomous Producers via public auctions. This has been important for the development of onshore wind in its first few years, however companies

Figure 2 **Public finance commitments to energy in Brazil since January 2020, % of total, as of November 2021**



no longer have access to the benefits of PROINFA – only the contracts that originally were granted continue to the access the benefits.[5]

As auctions became an increasingly popular mechanism for procurement, Brazil pioneered a long-running auction programme to procure energy, holding 82 rounds of auctions between December 2004 and October 2019. Of the 105 GW of awarded capacity, 77 GW was for renewable energy sources, of which 18 GW was for wind. Auction design, including the regulatory framework and implementation, was steered under Act 10848 of 2004 which prioritised efficiency, transparency and competition, as well as long-term contracts to reduce price volatility.

This Act further segregated the electricity market into a regulated market for distribution companies to supply captive consumers, and a free/bilateral market for energy producers, traders and consumers to directly transact. The free market has grown in popularity as a means to secure further investment in greenfield projects.

5 Brazil | Energy Policy Tracker

The national development bank BNDES has been a major source of project financing for wind energy projects that is provided at preferential rates based on projected cash flows of the project and subject to meeting specific local content rules.

Law No. 11,488/2007[6] created the special incentive regime for infrastructure development (REIDI), a project infrastructure development and incentive scheme that exempts wind equipment from national taxes. Another example is the CONFAZ 101/1997 agreement, which exempts wind turbine materials from the state sales tax and was recently extended until the end of 2028.[7]

In January 2022, Brazil issued Decree No. 10,946[8], which describes the process for assigning the use of areas of sea and inland water bodies for offshore wind leasing. The Ministry of Mines and Energy is to carry out the necessary studies, select the offshore wind zones, as well as organise subsequent auctions. This is a major development in the advancement of Brazil's offshore wind industry.

Current barriers to wind energy

Brazil faces numerous barriers to the deployment of wind energy in the country. Some of these predate the COVID-19 pandemic, and some have been caused or exacerbated by it. An overview of these barriers is given below.

Slow economic growth

Economic growth is a key driver for energy investment in Brazil, so the large and prolonged unprecedented economic slowdown due to the COVID-19 pandemic has had an impact on wind energy investment.

Adopting a green recovery approach which enables significant investment in wind energy as a priority will boost investor confidence, as well as the economy itself. Additionally, committing more government money to the energy sector, and specifically to renewable and wind energy, will drive further growth and investor confidence. Currently Brazil has a relatively very small public spending per capita on energy.

6 Law No. 11,488/2007 | Presidência da República
7 CONFAZ 101/1997 Agreement | Ministério Da Economia
8 Brazil publishes initial guidelines for offshore wind power | EV Wind

Energy market structure

A thriving deregulated market for independent power production in Brazil leads to lower energy costs, but can also cause a concern for investors, as PPAs are often awarded for shorter periods of time. There are large differences in energy prices between regions, in part due to transmission and connection bottlenecks.

Private PPAs such as corporate power purchase agreements (CPPA) have risks tied to the creditworthiness of the purchasers. Generators with many private PPAs can manage this risk by pooling the cash flows and selling to third party investors as securities.

Physical infrastructure

Physical infrastructure such as roads, bridges, and railways in wind-heavy regions in Brazil are currently not fit for purpose. They are unable to handle the large amounts of traffic and heavy goods vehicles required to set up substantial wind farm projects.

This is particularly the case in the northeast region of the country, currently home to 85% of Brazil's existing wind energy capacity due to its suitable wind conditions. The rural areas in this region do not have adequate infrastructure and physical capacity for the construction activities needed, acting as a bottleneck for a more substantial investment of wind energy in the region.

Transmission system

One of the least developed areas of the energy transmission system is in the northeast, where most wind energy projects are currently based. The lack of transmission development means wind farms struggle to begin operations due to lack of grid connection point availability.

The Brazilian energy sector is structured and overseen by the Brazilian Federal Constitution. Whilst mostly regulated by the independent National Electric Energy Agency (ANEEL), the federal government, specifically the Ministry of Mines and Energy (MME), can intervene and regulate the energy sector to set an energy price cap, ensure the necessary supply is met, and to help with expansion of the energy network to remote areas of the country.

Case study

Tucano Wind Complex

The Tucano Wind Complex is located in the interior of Bahia, in the municipalities of Tucano, Biritinga and Araci. It will have a total of 583MW of installed capacity, over two construction phases. The first stage of 322MW will comprise 52 wind turbines up to 6.2MW each, the largest wind turbines ever installed in Brazil.

The Tucano Wind Complex (both phases) will mitigate 597,300 tonnes of CO2 emissions per year. As at the end of 2021, around 30% of the project was completed; commercial operation for both phases is scheduled for the second half of 2022.

Phase 1 of the Tucano Wind Complex is a joint venture between AES Brasil and the chemical company Unipar, which has signed a 20-year PPA with the wind farm. Phase 2 has a 15-year PPA with the mining company Anglo American. The project is financed by Banco do Nordeste.

The Tucano Wind Complex works led to the hiring of approximately 300 local professionals for the different stages of construction.

The project aims to contribute to communities, respecting human rights and ethical values. During the construction of the wind farm, the developer established partnerships, hired local labour and promoted a training course for women, contributing to the generation of income for the region's residents.

The exclusive skills program for women at the Tucano Wind Farm was formed for the promotion of diversity. A Technical Specialization course in Maintenance and Operation of Wind Farms was created in partnership with Senai. The course had 28 trainees who studied over nine months, and so far, a Coordinator and an Operation Technician have been hired to work on the wind farm.

The project also has a strong focus on environmental and ecologic protection, with initiatives to sustain local flora and wildlife.

Education is one of the pillars of social investment for the project. In conjunction with the Tucano Department of Education, reading rooms will be implemented in school spaces in the affected municipalities. The spaces will be adapted and will receive a donation of more than 850 books.

Recommendations for green recovery

For Brazil to accelerate green recovery and build wind energy at a faster pace, the following actions for policymakers are recommended:

- **Enable infrastructure spending and investment**, particularly in the northeast region, to improve the quality and quantity of roads and railways and to allow for easier transportation and logistics.
- **Strengthen cooperation between the Ministry of Mines and Energy (MME) and Energy Research Office (EPE) and ONS (Transmission System Operator)** to increase the speed of transmission system development.
- **Establish a policy target for offshore wind installed capacity in a long-term horizon,** such as by 2030 and 2040, to accelerate its competitiveness and initiate planning of interconnection capacity to ensure timely development.
- **Revise the current legal and regulatory frameworks for energy to strengthen the regulated market** and reconcile the regulated and deregulated markets, especially to give greater certainty for investors.
- Explore trade agreements in the framework of MERCOSUR to take advantage of the **export potential within Brazil's wind energy supply chain.**
- Finally, **adopt a green recovery approach to public stimulus funding** which can enable significant investment in wind energy as a priority, mobilise private investment in the sector, and realise wider socioeconomic benefits of clean energy.

Project pipeline scenarios

The methodology for these scenario forecasts can be found in the Appendix A.

In the business-as-usual scenario we forecast that over 11 GW of wind capacity will be installed between 2022 and 2026.

If a green recovery is implemented, we forecast a fast acceleration of wind capacity from 2024 onwards, which would result in almost 16 GW being installed between 2022 and 2026 – an upside of around 5 GW. The greatest difference is seen in 2026, and this trend is expected continue past 2026.

Figure 3 shows the forecast pipeline in the two scenarios.

Table 3 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Impacts analysis

In the business-as-usual scenario, 285,000 direct and indirect FTE job years are created by wind energy in Brazil between 2022 and 2026 in the development, construction and installation phase. In addition, 18,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms. Figure 4 shows the annual FTE years created in the business-as-usual scenario by supply chain category. Examples of occupations across different segments of an onshore wind farm can be found in the Appendix B.

In the green recovery scenario, 390,000 direct and indirect FTE job years are created from wind energy in Brazil between 2022 and 2026 in the development, construction and installation phase. In addition, 36,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms. Figure 5 shows the annual FTE years created in the green recovery scenario by supply chain category.

The potential upside is more than half-a-million annual new FTE jobs created over the lifetime of the wind farms.

$14 billion direct and indirect gross value added is created from wind energy installed in Brazil between 2022 and 2026 in the business-as-usual scenario over the lifetime of the wind farms. Figure 6 shows the GVA created in the business-as-usual scenario by supply chain category.

$22 billion direct and indirect GVA is created from wind energy installed in Brazil between 2022 and 2026 in the green recovery scenario over the lifetime of the wind farms. Figure 7 shows the GVA created in the green recovery scenario by supply chain category. The potential upside in the green recovery scenario is $8 billion direct and indirect GVA.

Figure 3 Forecast of installed capacity in Brazil in the two scenarios

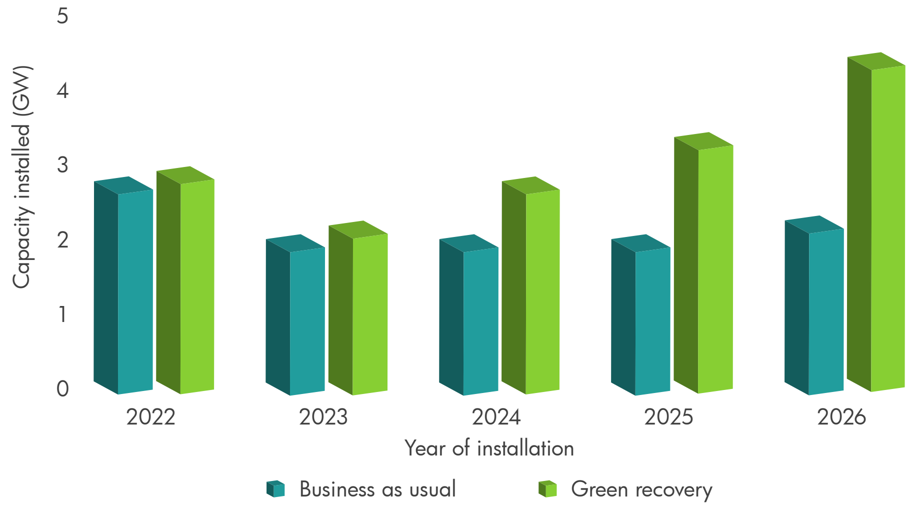


Table 3 Forecast of installed capacity in Brazil in the two scenarios

	Business as usual	Green recovery
2022	2,800	2,940
2023	2,000	2,200
2024	2,000	2,800
2025	2,000	3,400
2026	2,250	4,500

Figure 4 **FTE years created in the business-as-usual scenario in Brazil**

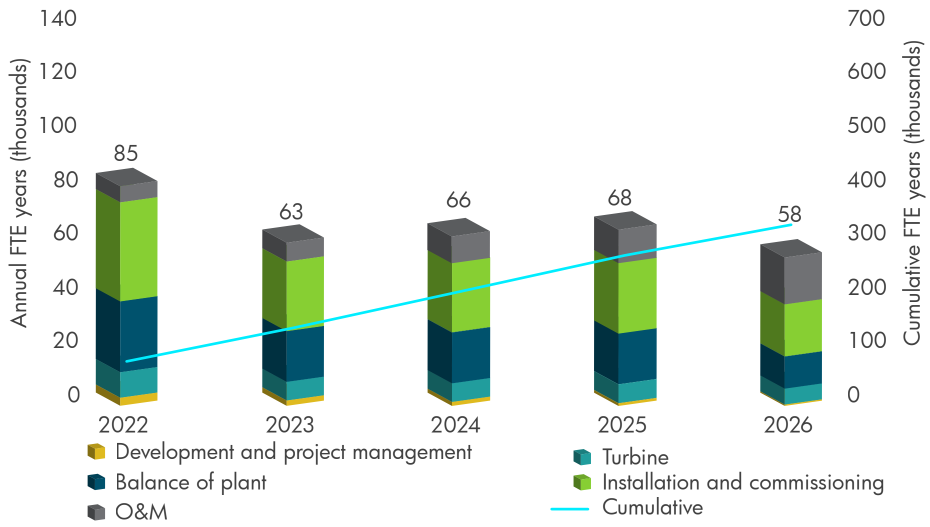


Figure 6 **Gross value added ($) created in the business-as-usual scenario in Brazil**

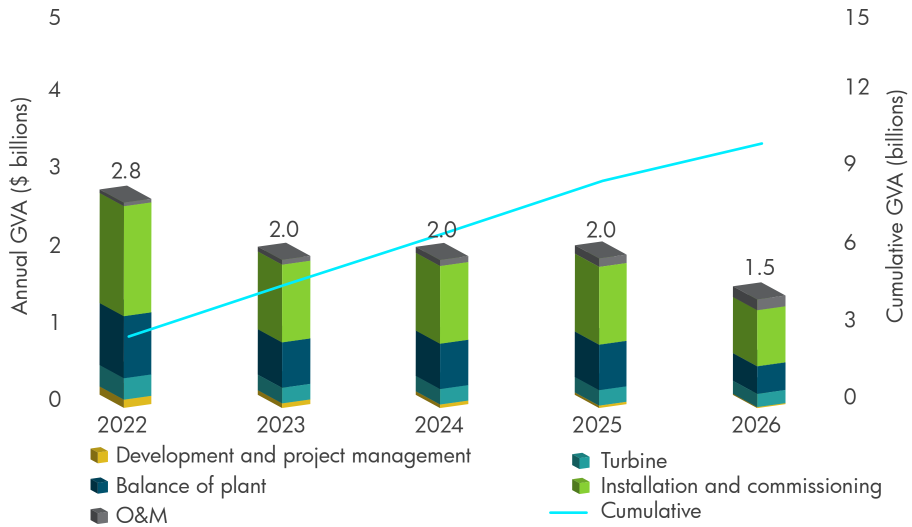


Figure 5 **FTE years created in the green recovery scenario in Brazil**

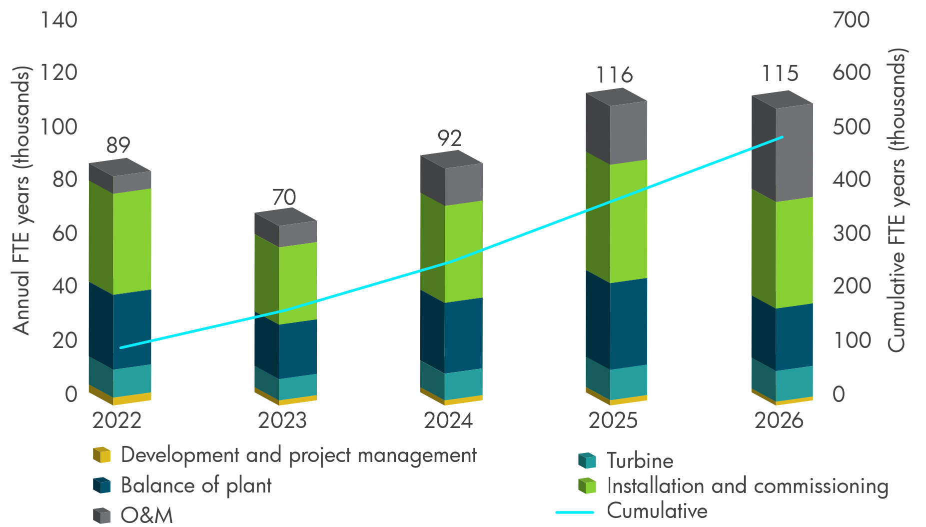
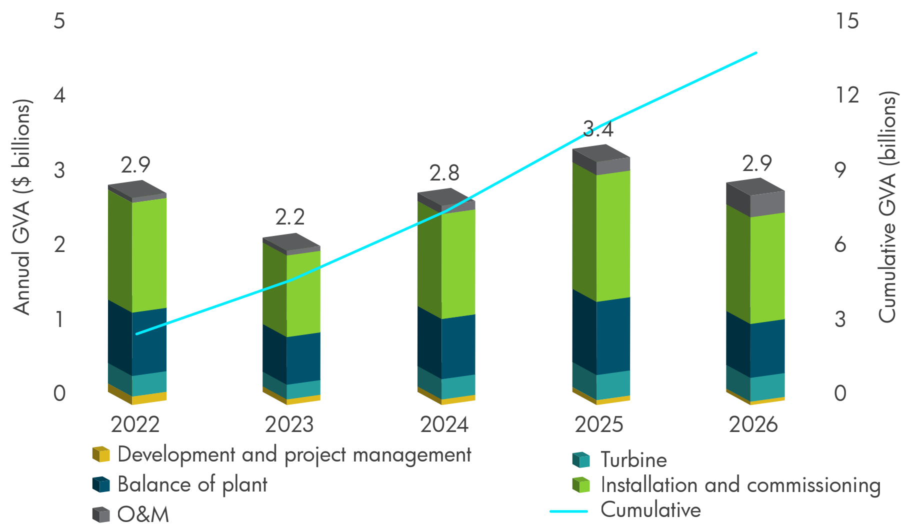


Figure 7 **Gross value added ($) created in the green recovery scenario in Brazil**



Impacts created in Brazil in the business as usual scenario

A total of 775,000 FTE job years created over the lifetime of the wind farms

US$14 billion gross value added (GVA) to national economies over the lifetime of the wind farms

39,300 GWh electricity produced per year from 2026, which is the same as

- 17 million homes powered with clean energy per year
- 11 million electric vehicles powered annually from 2026

433 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as

- 94 million cars off the road
- 164 million return flights from Brasilia to Glasgow
- Planting and maintaining 11 million trees for 10 years

74 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Impacts created in Brazil in the green recovery scenario

A total of 1,350,000 FTE job years created over the lifetime of the wind farms

US$22 billion gross value added (GVA) to national economies over the lifetime of the wind farms

56,300 GWh electricity produced per year from 2026, which is the same as

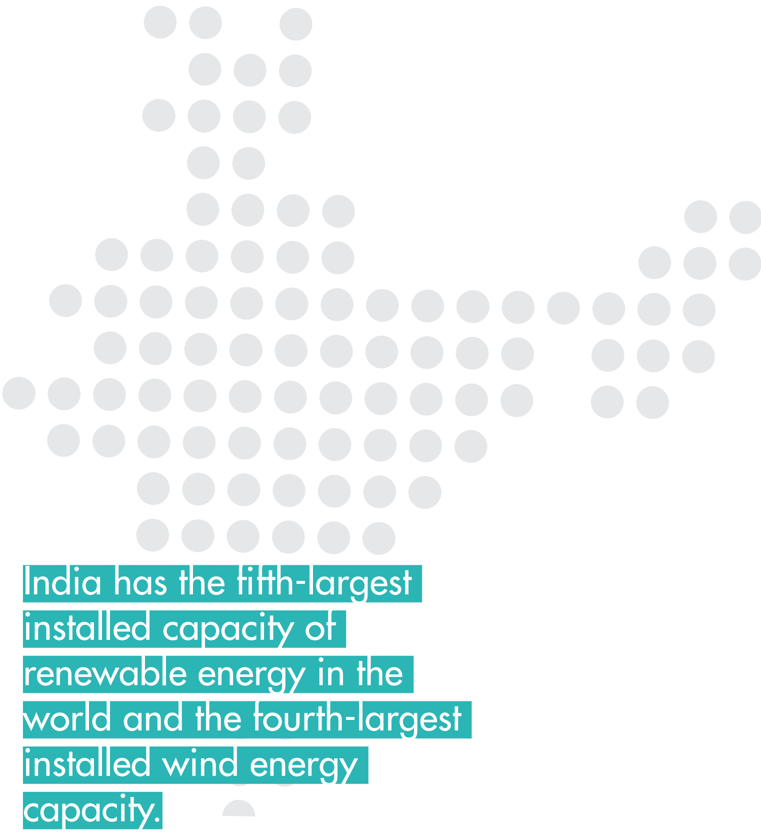
- 25 million homes powered with clean energy per year
- 15 million electric vehicles powered annually from 2026

615 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 134 million cars off the road
- 232 million return flights from Brasilia to Glasgow
- Planting and maintaining 16 million trees for 10 years

106 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

India



India has the fifth-largest installed capacity of renewable energy in the world and the fourth-largest installed wind energy capacity.

Current situation

India is among the world's top contributors to GHG emissions and has begun taking proactive steps towards climate action. India has the fifth-largest installed capacity of renewable energy in the world and the fourth-largest installed wind energy capacity. It has set a target of 140 GW installed wind energy capacity by 2030; as of 2021, it has reached 28% of this wind target.

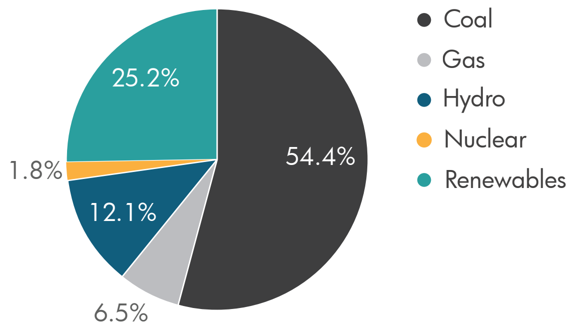
The country has ambitious plans to further expand its renewable energy, although this was disrupted by the COVID-19 pandemic and related economic and social challenges which slowed the country's economic growth. The wind industry was affected by the pandemic with difficulties in supply chain logistics, import of raw materials, and movement between states for workers.

Energy mix and targets

The majority of India's current energy mix comes from coal, with just over a quarter coming from renewables, as can be seen in Figure 8.

India has short-term targets of installing a total 175 GW of renewable energy capacity by the end of 2022 and providing power to all residents.

Figure 8 **India energy mix, as of 2021**



The 175 GW consists of 100 GW solar power, 60 GW wind power, 10 GW biomass energy, and 5 GW small hydropower. This 2022 wind power target is seen as viable by experts in India, through primarily onshore wind projects. As of September 2021, India had an installed renewable energy capacity of 101.5 GW.

India ratified the Paris Agreement on 2 October 2016, and two of its three NDCs are energy-specific targets by 2030, shown in Table 4.

COP26 outcome

India committed to net zero by 2070 at COP26 in November 2021. In addition, India set a target to source 50% of its energy from renewable resources by 2030 (totalling 500 GW). India also pledged to reduce total projected carbon emissions by 1 billion tonnes (a cut to less than 45% carbon intensity) by 2030 as well.

Economic stimulus and laws

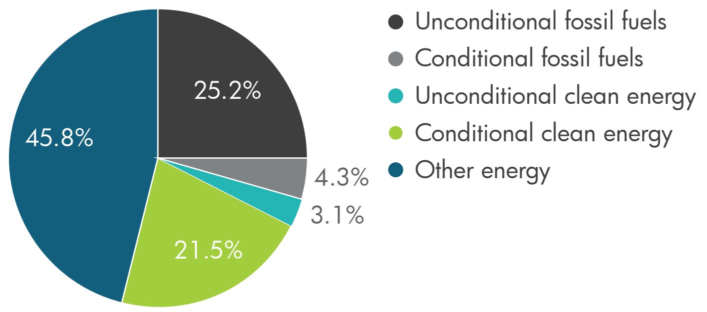
Since early 2020, India has committed at least $150 billion to support different energy types. This includes at least $44 billion for supporting fossil fuels and $37 billion for supporting clean energy. This represents the largest public finance commitment to the energy sector in the world. An overview of the different spending commitment proportions can be found in Figure 9.

In response to the economic downturn due to the pandemic, the government announced a $266 billion stimulus package (10% of GDP), one of the largest stimulus packages in the world as a share of GDP. This package is also likely to indirectly benefit

Table 4 **India 2030 targets**

Reduction of emissions intensity compared to 2005 levels (NDC as of November 2021)	45%
Share of non-fossil fuel sources in installed electricity capacity mix	50%

Figure 9 **Public finance commitments in India since January 2020, % of total, as of 11 November 2021**



different elements of the energy sector, but the benefits are difficult to quantify.[9]

Examples of wind energy investment schemes

The electrification of the transportation industry in India is being supported through national schemes, for example, the Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME). Coupling schemes like this with renewable power could maximise economic and environmental benefits.

India's Ministry of New and Renewable Energy awards various grants to the sector, covering areas such as:

- Grid interactive renewable power generation projects
- Off-grid and decentralised renewable power generation projects
- Research and development, and
- Other supporting programmes, e.g., international relations and human resources training/ development.

9 India | Energy Policy Tracker

Solar power projects are currently due to receive the highest proportion of these grants in the 2021-22 budget allocation, more than double that of wind projects.[10] India has over three decades of experience in harnessing wind power and a significant volume of both onshore and offshore potential remains untapped.

Recently, production-linked incentive schemes have been employed to facilitate the growth of certain sectors such as solar energy and battery storage cells. This has already resulted in positive outcomes, such as a decline in solar tariffs. Applying such a scheme to India's wind energy manufacturing sector will incentivise local innovation and technological advances, such as in suitable turbines for repowering wind projects nearing end-of-life in the country.

Rapid development of wind energy and local value creation in the supply chain are opportunities for amplifying economic growth and mitigating climate change.

Current barriers to wind energy

Wind energy presents vast potential for decarbonising India's national grid and for supporting ambitious cross-continental initiatives such as the Green Grids Initiative launched during COP26. However, there are a number of barriers to accelerated wind energy deployment.

Permitting and leasing processes

Permitting for wind projects in India is complex and is a mixture of centralised and decentralised. Approval for new substations, new grid connections, and land leases are all awarded by different government bodies, which makes the process complex and time-consuming.

There have also been incidences of delayed or cancelled tendering schemes, last-minute renegotiated power purchase agreements and delayed payments for developers and other stakeholders. This lack of reliability impacts investor appetite.

Streamlining permits and clearances by introducing a "single window portal" and harnessing the National Hybrid Wind Solar Policy is likely

10 Notes on Demands for Grants, 2021-2022 | India Budget

to ease issues faced by project developers.

Pipeline visibility and tendering scheme reliability

Lack of adequate pipeline of projects and auction visibility creates uncertainty for developers and investors, and hampers enthusiasm. There is no auction pipeline published in advance, which prevents wind sector stakeholders from undertaking advanced planning for resources. This also increases uncertainty for wind sector stakeholders, such as installation companies and manufacturers, as well as investors. This makes smaller developers hesitant to enter the market, flattening competition in the market.

Delayed or cancelled tenders and surrendering of projects, renegotiated PPAs, and delayed payments for developers also increase investor risk and hinder wind growth.

Grid coordination

Lack of grid visibility impacts certainty and can lead to low participation in auctions. Advanced planning between electrical grid and energy generation is challenging, leading to project delays.

For example, incidents have occurred where a new substation has been authorised by one body and subsequently built, but meanwhile the grid connection has not yet been authorised by its awarding body, causing project delays.

Increasing coordination between strategic grid development and future energy generation plans will streamline future grid connection planning for wind energy.

Land availability

Wind energy projects are largely concentrated on the western coast and in the south of the country due to attractive wind resource. In these areas though, land availability is an issue due to private land price escalation and huge demand for land in specific geographies where good wind speeds are available.

India also has cultural/social sensitivities when it comes to selling land. If the land has previously been used for agricultural purposes or has significance to the local population, the government faces significant obstacles when trying to auction it for wind project development.

Land acquisition for wind projects has previously been changed retrospectively by government authorities, undermining developer confidence. In some cases, lack of land availability and high resource potential sites around substations have resulted in grid congestion.

Encouraging investment in other parts of the country through appropriate zoning based on wind availability, and enabling repowering of high wind sites, that are currently fitted with low-capacity turbines, will go some way to help with the land availability issues India faces.

Case study

Successful bidder in SECI Tranche 6 auction

ReNew Power is developing a 300MW wind power project in the state of Karnataka. The capacity was awarded a lease in a reverse auction of wind, Tranche 6, issued by the Solar Energy Corporation of India (SECI). ReNew Power is the project owner and wind power developer, while the turbines will be supplied by Siemens Gamesa Renewable Energy. Meanwhile SECI will act as the power trader.

The wind energy project will take 2-3 years for development and construction. It is estimated to generate employment for 300-400 people during its development and construction phase, and a further 50 people during its lifetime for O&M.

The total CAPEX is about $264 million. It will cost around $3.4 million (+ 3.5% inflation) to maintain the wind farm per year of its lifetime.

The project will create lasting positive environmental impact by mitigating almost 24 million tonnes of CO_2 emissions over its lifetime, compared to the same electricity generated from fossil fuels. It will also contribute to India's goal of achieving 500 GW of renewable energy capacity by 2030.

Surrounding areas will benefit through economic activity such as setting up of guest houses, building of roads (a road network of 360km has been built during construction by ReNew Power), and other indirect jobs created during the O&M phase.

Recommendations for green recovery

For India to be able to accelerate green recovery and expand the use of wind energy, the following broad actions for policymakers are recommended:

- **Improve wind industry visibility by establishing an auction pipeline** with a 3-4 year timeframe at least. This will allow developers time to prepare their bids, increase investor certainty and increase competition in the market by de-risking the market for smaller developers. A longer-term auction framework can also support more efficient coordination with grid planning.
- **Increase the reliability and certainty of the auction process** through more rigorous terms and conditions or a robust legal framework. This will help to prevent recurring issues of delayed or cancelled tenders and delayed payments for various stakeholders.
- **Establish a nationwide policy and set of conditions for land acquisition** for wind projects. Once an overarching framework is set up, this should gain public trust in time and help alleviate the obstacles of auctioning land for wind project development. Once set up, this overarching policy should also prevent laws from being changed retrospectively by government authorities.
- In light of land availability and acquisition challenges, the government may wish to **accelerate the opportunities for offshore wind,** with most technical resource concentrated off the coasts of Tamil Nadu and Gujarat.
- **Increase coordination between strategic grid development and future energy generation plans**, to streamline future grid connection planning for wind energy projects. The planning timelines for grid connection should be aligned with the implementation of grid augmentation. Construction of additional substations should be prioritised to ensure that renewable energy can be integrated across different regions of the country.
- The government can also explore **technical improvements for forecasting and smart distribution**, which can support balancing with larger shares of renewable energy.
- **Realign public stimulus funding with energy and transition goals.** While early measures were taken by the government to mitigate the impacts of COVID-19 on construction and supply chains of the renewable energy industry, much of public stimulus spending is still directed to the fossil fuel sector. Redirecting funds into the renewables sector now can help to close the gap between current installation rates and clean energy targets by 2030.
- The Ministry of New and Renewable Energy should increase the number of **grants for wind energy generation projects, grid development, and research and development** to help stimulate the sector further. For instance, repowering frameworks for existing wind projects in sites with attractive resource should be developed, particularly as these sites are already in use and may face less friction around land and grid bottlenecks.
- **Increase dialogue between authorities and primary stakeholders** and investors in the wind industry, especially in light of unclear procurement pipelines in the future.

Project pipeline scenarios

The methodology for these scenario forecasts can be found in Appendix A.

In the business-as-usual scenario we forecast that almost 21.5 GW of wind capacity will be installed between 2022 and 2026.

If a green recovery is implemented, we forecast a fast acceleration of wind capacity from 2024 onwards, which would result in almost 31.2 GW being installed between 2022 and 2026. This results in a potential upside of 9.7 GW of wind energy installed over the five-year period. The greatest difference is seen in 2026, and this trend is expected continue past 2026.

Figure 10 shows the forecast pipeline in the two scenarios.

Table 5 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Figure 10 Forecast of installed capacity in India in the two scenarios

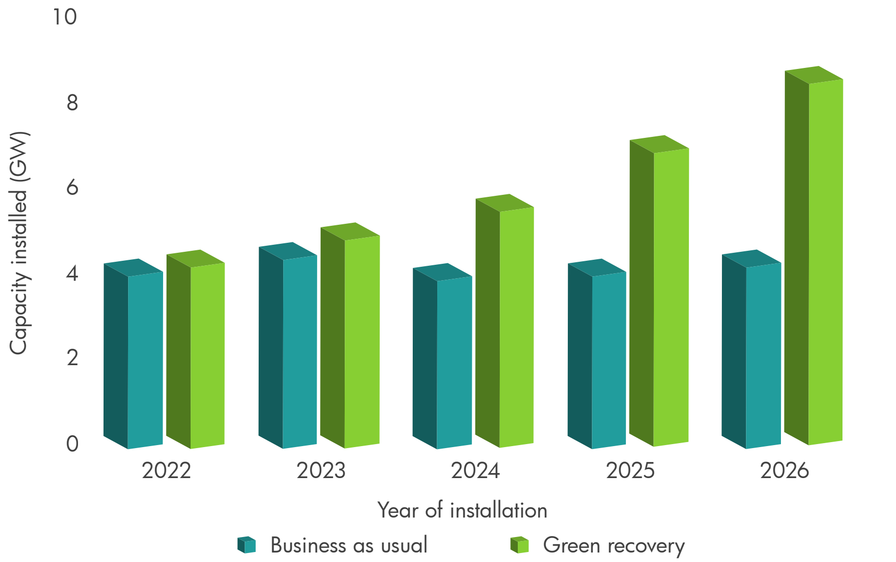


Table 5 Forecast of installed capacity in India in the two scenarios

	Business as usual	Green recovery
2022	4,200	4,410
2023	4,600	5,060
2024	4,100	5,740
2025	4,200	7,140
2026	4,400	8,800

Impacts analysis

In the business-as-usual scenario, 565,000 direct and indirect FTE job years are created by wind energy in India between 2022 and 2026 in the development, construction and installation phase. In addition, 36,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms.

Figure 11 shows the annual FTE years created in the business-as-usual scenario by supply chain category. Examples of occupations across different segments of an onshore wind farm can be found in the Appendix B.

In the green recovery scenario, 795,000 direct and indirect FTE job years are created from wind energy in India between 2022 and 2026 in the development, construction and installation phase. In addition, 71,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms. Figure 12 shows the annual FTE years created in the green recovery scenario by supply chain category.

There is a huge potential upside of 1.1 million additional FTE job years created in a green recovery scenario.

$11 billion direct and indirect gross value added is created from wind energy installed in India between 2022 and 2026 in the business-as-usual scenario over the lifetime of the wind farms. Figure 13 shows the GVA created in the business-as-usual scenario by supply chain category.

$18 billion direct and indirect gross value added is created from wind energy installed in India between 2022 and 2026 in the green recovery scenario over the lifetime of the wind farms. Figure 14 shows the GVA created in the green recovery scenario by supply chain category, a $7 billion difference from the business-as-usual scenario.

Figure 11 FTE years created in the business-as-usual scenario in India

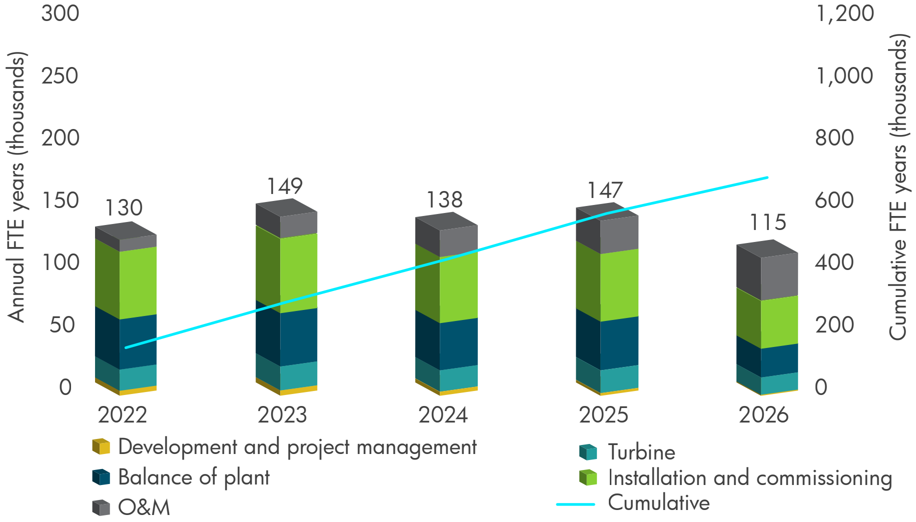


Figure 13 Gross value added ($) created in the business-as-usual scenario in India

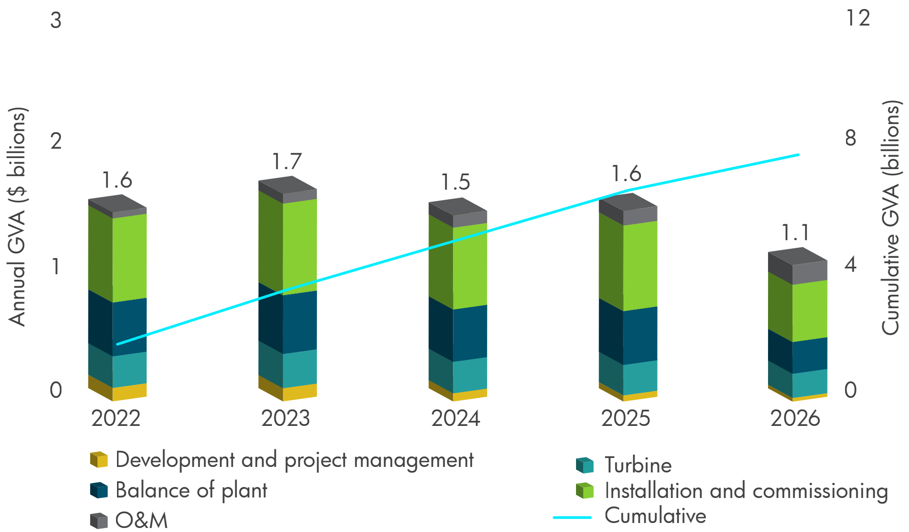


Figure 12 FTE years created in the green recovery scenario in India

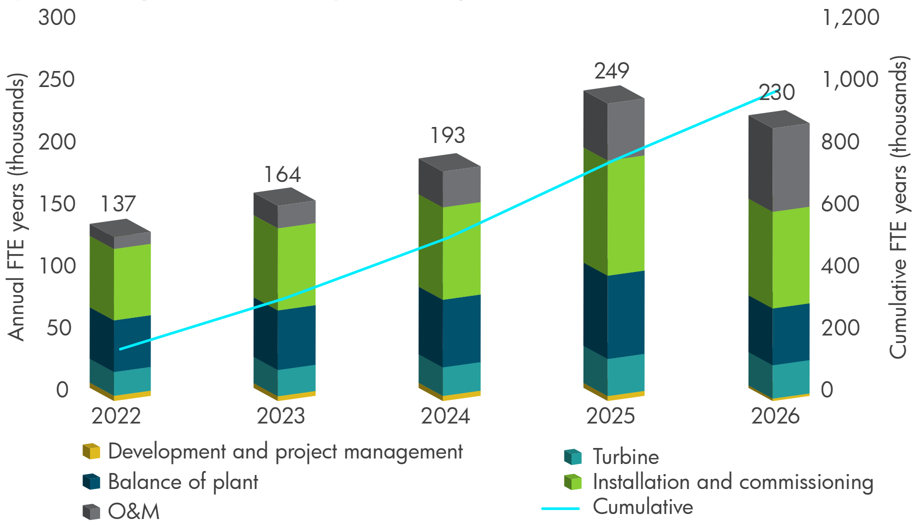
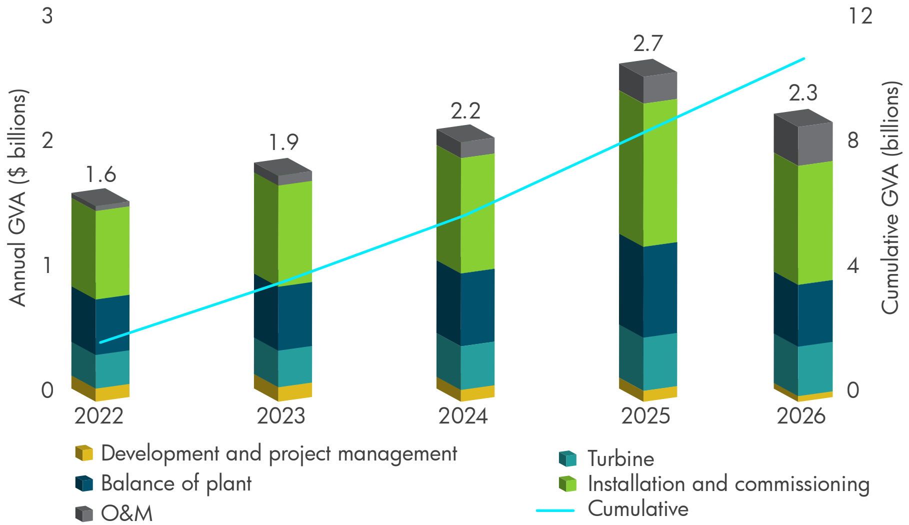


Figure 14 Gross value added ($) created in the green recovery scenario in India



Impacts created in India in the business as usual scenario

A total of 1,500,000 FTE job years created over the lifetime of the wind farms

US$11 billion gross value added (GVA) to national economies over the lifetime of the wind farms

37,800 GWh electricity produced per year from 2026, which is the same as

- 24 million homes powered with clean energy per year
- 10 million electric vehicles powered annually from 2026

525 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 114 million cars off the road
- 258 million return flights from New Delhi to Glasgow
- Planting and maintaining 14 million trees for 10 years

71 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Impacts created in India in the green recovery scenario

A total of 2,650,000 FTE job years created over the lifetime of the wind farms

US$18 billion gross value added (GVA) to national economies over the lifetime of the wind farms

57,800 GWh electricity produced per year from 2026, which is the same as

- 34 million homes powered with clean energy per year
- 15 million electric vehicles powered annually from 2026

754 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 164 million cars off the road
- 370 million return flights from New Delhi to Glasgow
- Planting and maintaining 20 million trees for 10 years

103 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Mexico

Mexico was one of the first countries to introduce climate change legislation in 2012. However, in the last few years, progress towards the clean energy transition has slowed.

Current situation

With large and diversified renewable energy resources, Mexico was one of the first countries to introduce climate change legislation in 2012. Due to various targets to cut GHG emissions and develop clean power, it has been projected as a climate leader among other developing nations not least because it has achieved record-low prices for both solar and wind energy at auction.

However, in the last few years, progress towards the clean energy transition has slowed. Significant uncertainty for existing and planned wind energy projects has been introduced due to changes in energy policy, electricity system regulation (such as removal of priority dispatch for renewable energy in 2021), and slowdowns of permitting processes, which has led to a decrease in renewable energy investment. The only sources considered for investment by the current government are fossil fuels and hydropower.

Additionally, the transmission grid is becoming increasingly congested with historical under-investments, requiring optimisation strategies and technologies to strengthen and maximise the use of current infrastructure.

Energy mix and targets

Mexico's energy mix is primarily formed of natural gas and oil, with natural gas taking up an increasingly large share over the last five years. Renewable sources have taken up a consistent proportion of the energy mix for the last three decades. This pattern can be seen in Figure 15.

Mexico ratified the Paris Agreement on 21 September 2016 and has an NDC target of reducing emissions by 22% below a BAU scenario by 2030, increasing up to 36% below BAU if it receives financial, technical, and capacity-building support from other countries. An updated NDC submitted under the Paris Agreement at the end of 2020 is generally viewed as unambitious.[11]

To help achieve its GHG reduction pledges, the country set a target of 40% zero or low-emission energy fuels in power generation by 2035, and a target of 50% by 2050. This includes renewables as well as

11 Mexico | IEA

Figure 15 **Mexico energy mix, 1990-2020**

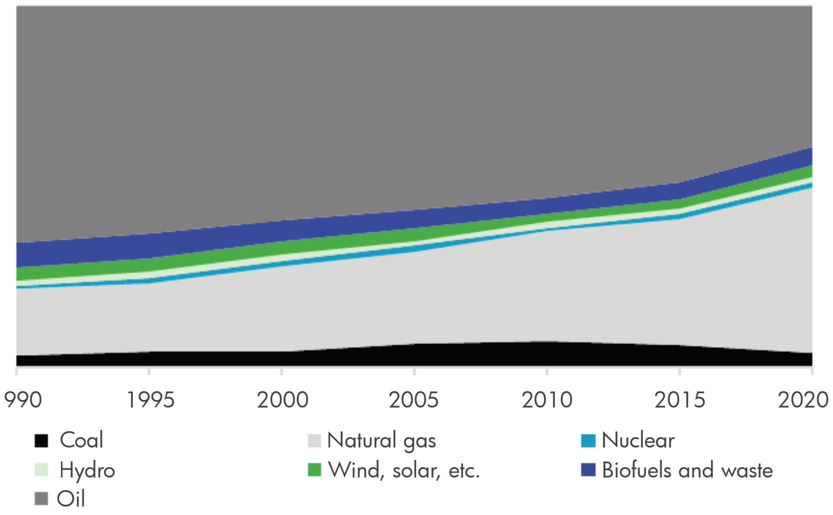
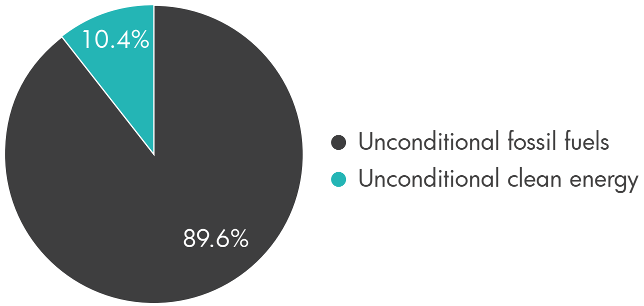


Figure 16 **Public finance commitments in Mexico since January 2020, % of total, as of November 2021**



nuclear and fossil fuels with carbon capture and storage.

Mexico has 6.5 GW of operational wind energy. Up until 2018, the forecast was an increase to 16 GW by 2024; however, due to a lack of sector expansion in recent years, this has been dramatically revised downwards to 9 GW by 2024.

COP26 outcome

At the COP26 summit in November 2021, Mexico joined the Declaration on Forests and Land Use, which pledged to end deforestation by 2030. It was also a signatory to the Global Methane Pledge, with the goal of reducing global methane emissions by at least 30% from 2020 levels by 2030.

Economic stimulus and laws

Since the onset of the pandemic in early 2020, Mexico has committed least $9 billion to supporting different energy types. This involves at least $8 billion for supporting fossil fuels and $935 million for supporting clean energy. This split is shown in Figure 16.

Recently, Mexico's government has shown reluctance to further develop renewable energy projects, including wind projects. This is reflected in public spending commitments, where the vast majority are for fossil fuels. There has been no formal commitment from the government to accelerate the energy transition in recent years. The most recent government energy planning document Programa de Desarrollo del Sistema Eléctrico Nacional (PRODESEN) recognises that energy decisions and policy put Mexico behind the goal of accomplishing their 2024 target, with clean energy forecast to make up 31% of the energy mix instead of the 35% goal. [12]

This is primarily due to a significant portion of the fossil fuel market share being state-owned. State utility companies have been historically unwilling to invest in diversifying their energy sources and as a result, renewable energy installation and production have decreased in recent years.

12 Mexico | Energy Policy Tracker

Current barriers to wind energy

Overall Mexico is well positioned to rapidly expand its wind energy production. The country was once a world leader in wind energy, having an effective auctioning process and large amounts of government investment. The following factors have since halted this process.

Policy commitment

The main barrier to wind energy expansion now in Mexico is government policy direction. This is evidenced by:

- No new wind and solar projects have been authorised in the last few years, as the focus has moved towards supporting the state utility company Comisión Federal de Electricidad (CFE) and exempting it from competing in the market. CFE predominantly depends on conventional energy sources and has no current or planned wind projects.
- Permits and assessment procedures for private projects have experienced delays, while those requested for fossil fuel projects by state-owned companies have been awarded on time. In previous years, assessments and

test trials for private wind projects took 3-4 months for completion. Recently this has ballooned to 18-24 months.

- The annual Long Term Auctions round, which previously had set record-low prices for both solar and wind, have been indefinitely paused.

These hinderances are partially due to a presidential mandate, which aimed to strengthen the state oil company PEMEX, and changes to the Power Sector Law. These reforms have restricted the room to operate and invest for private renewable projects.

Mexico is forecast to have an annual power consumption increase of approximately 3% each year for the next five years. To achieve its green energy targets while maintaining energy security, reviving a sustainable wind market in Mexico is vital. Whether this is achieved via a free market or through significant government intervention via CFE will depend on the government in power.

Legal uncertainty

There is legal uncertainty faced by all stakeholders in the wind industry in Mexico, such as private generators, large consumers, suppliers, citizens and environmental NGOs. There have been more than 700 constitutional injunctions derived from the regulatory changes that favoured the CFE and limited operations for private projects. Over 50% of these legal challenges are due to the described changes applied to the Power Sector Law in 2021 to limit renewables and private participation in the energy sector in favour of the CFE.

Transmission system

The rural areas of Mexico most relevant for wind energy lack appropriate transmission infrastructure, which impacts grid access and investor confidence. Sustained underinvestment in the grid is resulting in bottlenecks and reliability constraints. In addition, new rules grant preferential grid access to conventional electricity generation.

With Mexico's forecast an annual power consumption increase of 3%, there is an urgent need to expand and modernise the national transmission system.

Case study

Community benefits in Oaxaca

The wind industry has made substantial contributions to the state of Oaxaca in the south of Mexico. Home to world-class wind resource, Oaxaca was impacted by a devastating earthquake in 2017, which destroyed homes in many communities and left areas in need of rehabilitation.

Mexico's wind energy association, AMDEE, coordinated an industry-wide effort to promote and finance strategic projects for the development and wellbeing of communities in the Isthmus of Tehuantepec in Oaxaca. The Oaxaca Fund was supported by Enel Green Power, EDF Renewables Iberdrola México, Parque Eólico Bií – Hioxo, a subsidiary of Naturgy, Siemens Gamesa Renewable Energy, Vestas, and Zuma Energía.

A series of projects under the Oaxaca Fund, including provision of mobile classrooms, construction of school infrastructure, psychological support for local residents, and firefighting training and transport vehicles, collectively impacted more than 60,000 people within the Isthmus of Tehuantepec. The Oaxaca Fund was closed in 2019 after fulfilling its objectives.

Community benefits are integral to development of wind projects in Mexico. Acciona's

Oaxaca II-III-IV Wind Complex includes three wind farms of 306MW total installed capacity on the Isthmus of Tehuantepec, providing clean electricity to 700,000 homes. and avoiding CO2 emissions of 670,000 tons per year.

The wind complex includes an extensive socioeconomic promotion programme, with the aim of reducing impacts from the wind farms and contributing to social needs in the areas of La Venta and Santo Domingo Ingenio. This community investment plan includes projects from cancer screening for local residents to construction of educational infrastructure, and has benefited more than 20,000 people to date.

Recommendations for green recovery

For Mexico to be able to accelerate green recovery and expand the use of wind energy, the following broad actions for policymakers are recommended:

- **Restart the previously successful annual Long Term Auctions**, to help increase long term visibility of procurement targets. Given the power market in Mexico is liberalised, an auction with long-term PPAs can improve the bankability of renewable energy projects in a challenging policy environment. Auctions can also contain specific considerations for community and social benefit, to help revitalise areas of the country in need of an economic boost.
- **Develop long term legal, regulatory, and financing certainty which aims to foster large-scale project development.** Re-establishing investor confidence in the country's renewables sector will require commitment to a clean energy transition at the highest level. In addition, the CFE will require incentives to undertake wind and solar projects among its expanding portfolio of energy assets.
- **Promote diversification of the energy mix and competitive procurement processes** to ensure low-cost renewable energy supply and to meet decarbonisation commitments. This includes re-establishing priority dispatch for renewable energy generation on the grid.
- **Require regulatory bodies to restart and accelerate permit approval times for private renewable energy projects** and promote institutional strengthening to streamline permitting procedures.
- **Increase government spending commitments directed at grid modernisation and expansion** to promote a reliable operation and prevent bottlenecks, especially in rural areas, and to help futureproof the system for further low-cost wind additions. Failure to adapt market design to the needs of the future energy system may result in higher long-term costs, higher electricity prices for consumers and systematic integration challenges for clean energy.
- **Re-establish fair and open access to the grid** while promoting new wind energy supply. This can be accomplished by factoring in socioeconomic impacts into national energy planning, and assigning value to sustainable job creation, resilience, and minimising impact on public health.
- **Strengthen the dialogue between the government and renewable energy stakeholders,** including investors in the sector, IPPs and civil society organisations representing community interests. Limited channels for dialogue can make it challenging to assess investment risk in wind projects, particularly in an environment of policy variability and new institutional frameworks. Establishing a semi-permanent forum for dialogue and consultation between the government, industry and wider stakeholders would allow for more effective responses and contributions to policy changes.

Project pipeline scenarios

The methodology for these scenario forecasts can be found in the Appendix A.

In the business-as-usual scenario we forecast that almost 2.15 GW of wind capacity will be installed between 2022 and 2026.

If a green recovery is implemented, we forecast a fast acceleration of wind capacity from 2024 onwards, which would result in almost 4.34 GW being installed between 2022 and 2026.

Figure 17 shows the forecast pipeline in the two scenarios, with a potential upside of more than 2 GW over the five-year period. The greatest difference is seen in 2026, and this trend is expected continue past 2026. This is especially true for Mexico, where the business-as-usual scenario sees a decline in yearly capacity increases.

Figure 17 **Forecast of installed capacity in Mexico in the two scenarios**

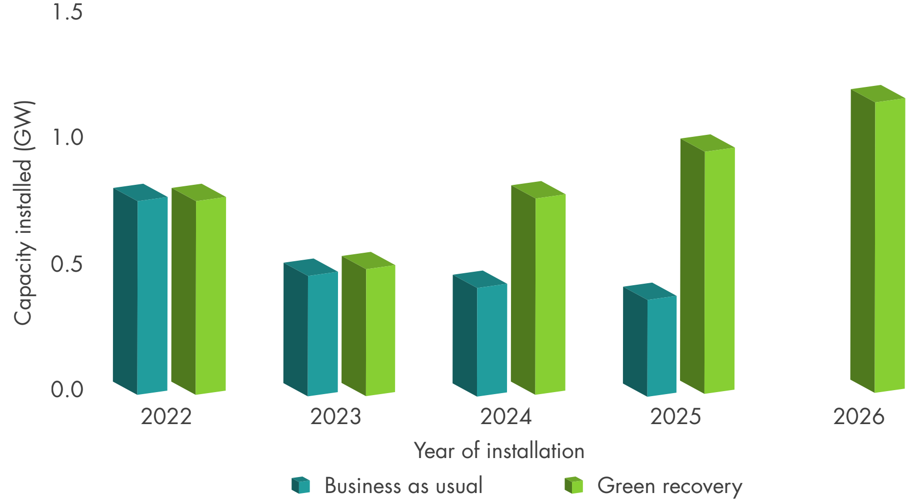


Table 6 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Table 6 **Forecast of installed capacity in Mexico in the two scenarios**

	Business as usual	Green recovery
2022	800	800
2023	500	525
2024	450	810
2025	400	1,000
2026	0	1,200

Impacts analysis

In the business-as-usual scenario, 55,000 direct and indirect FTE job years are created by wind energy in Mexico between 2022 and 2026 in the development, construction and installation phase. In addition, 2,700 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms.

Figure 18 shows the annual FTE years created in the business-as-usual scenario by supply chain category. Examples of occupations across different segments of an onshore wind farm can be found in the Appendix B.

In the green recovery scenario, 97,000 direct and indirect FTE job years are created from wind energy in Mexico between 2022 and 2026 in the development, construction and installation phase. In addition, 9,700 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms. Figure 19 shows the annual FTE years created in the green recovery scenario by supply chain category. The potential upside is 225,000 new FTE jobs created in the green recovery scenario.

$2.5 billion direct and indirect gross value added is created from wind energy in Mexico between 2022 and 2026 in the business-as-usual scenario over the lifetime of the wind farms. Figure 20 shows the GVA created in the business-as-usual scenario by supply chain category.

$6 billion direct and indirect gross value added is created from wind energy in Mexico between 2022 and 2026 in the green recovery scenario over the lifetime of the wind farms. Figure 21 shows the GVA created in the green recovery scenario by supply chain category, with a difference of $3.5 billion from the BAU scenario.

Figure 18 FTE years created in the business-as-usual scenario in Mexico

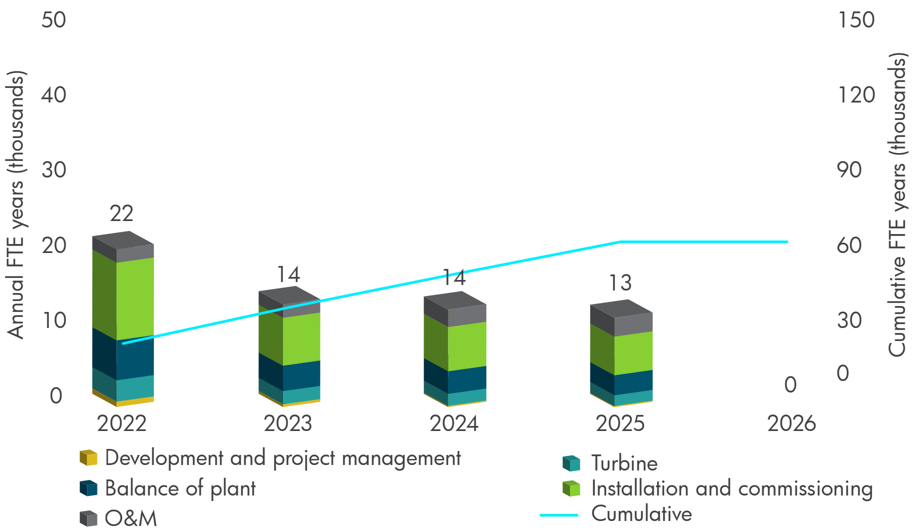


Figure 19 FTE years created in the green recovery scenario in Mexico

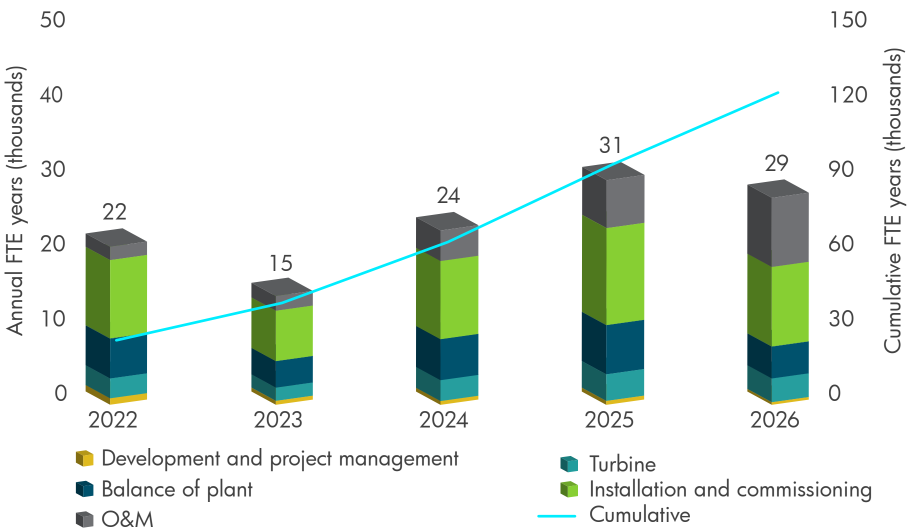


Figure 20 Gross value added ($) created in the business-as-usual scenario in Mexico

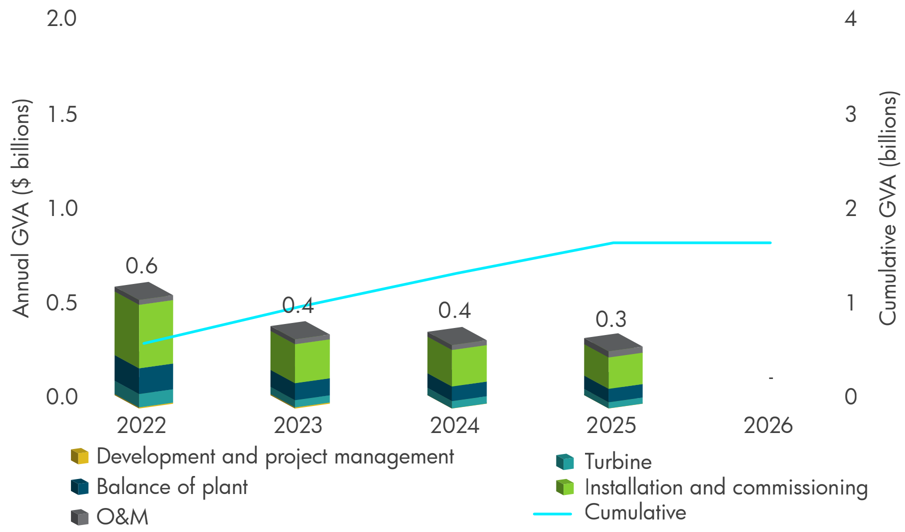
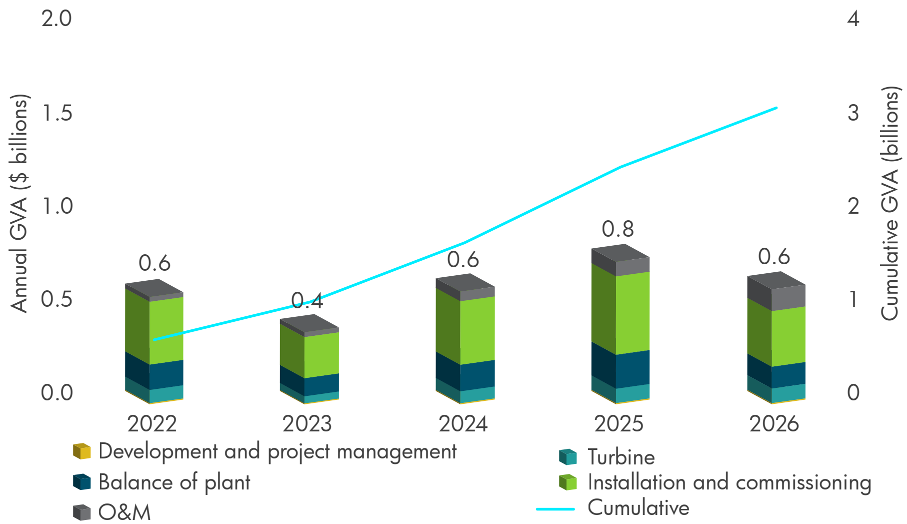


Figure 21 Gross value added ($) created in the green recovery scenario in Mexico



Impacts created in Mexico in the business as usual scenario

A total of 125,000 FTE job years created over the lifetime of the wind farms

US$2.5 billion gross value added (GVA) to national economies over the lifetime of the wind farms

7,300 GWh electricity produced per year from 2026, which is the same as

- 4 million homes powered with clean energy per year
- 2 million electric vehicles powered annually from 2026

88 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 19 million cars off the road
- 35 million return flights from Mexico City to Glasgow
- Planting and maintaining 5 million trees for 10 years

14 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Impacts created in Mexico in the green recovery scenario

A total of 350,000 FTE job years created over the lifetime of the wind farms

US$6 billion gross value added (GVA) to national economies over the lifetime of the wind farms

14,800 GWh electricity produced per year from 2026, which is the same as

- 8 million homes powered with clean energy per year
- 4 million electric vehicles powered annually from 2026

181 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 39 million cars off the road
- 72 million return flights from Mexico City to Glasgow
- Planting and maintaining 2 million trees for 10 years

28 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

South Africa

South Africa has an energy system heavily dependent on coal. The country also struggles to maintain a stable energy supply and experiences power cuts and frequent load-shedding. Wind energy can address these energy supply issues, as well as cutting emissions and adding significant stimulus to the economy.

Current situation

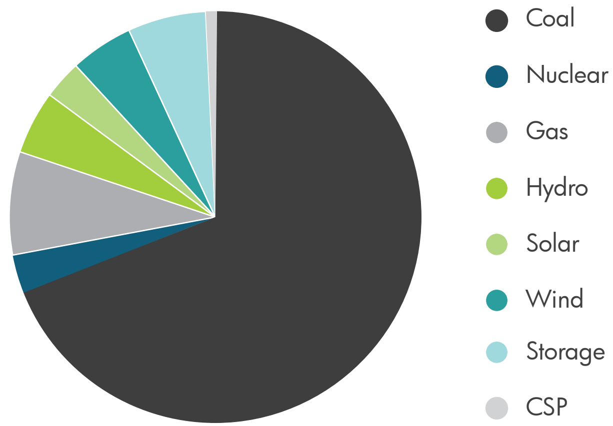
Contributing approximately a 5% share to global GHG emissions, South Africa has an energy system heavily dependent on coal. The country also struggles to maintain a stable energy supply and experiences power cuts and frequent load-shedding. Wind energy can address these energy supply issues, as well as cutting emissions and adding significant stimulus to the economy.

During the pandemic, wind energy projects under construction were impacted due to import delays and hard lockdown restrictions affecting movement for workers, especially the foreign technicians and specialists needed.

Energy mix and targets

South Africa ratified the Paris Agreement on 22 April 2016. In September 2021, South Africa launched updated versions of its NDC and updated its reduction targets to match Presidential Climate Commission recommendations of 350-420 million metric tons of CO_2e by 2030. The country also has flagged an aspiration to become net zero by 2050, and for 22.5% of the energy mix to come from wind energy by 2030 (up from 5% in 2021). To reach these targets, a rapid expansion of renewable energy capacity will be required.

Figure 22 **South Africa energy mix, as of August 2021**



COP26 outcome

South Africa is set to receive $8.3 billion to support its exit from coal in an initiative announced at the COP26 summit in November 2021. As a result of this funding, provided within the Just Energy Transition Partnership by the EU (with France and Germany providing additional funding), the UK, and the US, South Africa aims to phase out coal by the late 2030s. This is a major shift for the country, which previously aimed to become net zero while continuing to rely on coal as an energy source.

ESKOM, the main South African electricity public utility, has a climate change office (Just Energy Transition office) and this will be central to planning the country's energy future. ESKOM is looking to move away from coal, but this is politically and socially challenging.

Economic stimulus and laws

All quantifiable energy spending commitments by the South African government have been for fossil fuels, which includes $637 million of support for fossil fuel energy, mostly coal.[13] Wind energy laws and policies have been passed, but they do not have a confirmed financial figure attached. For example, in April 2021 the Department of Mineral Resources and Energy raised the licencing threshold for small-scale power generation projects from 1MW to 10MW, and thereafter from 10MW to 100MW. This improves the likelihood of small wind turbines being built privately.

Table 7 **South Africa 2030 targets**

Reduction target of metric tons of carbon dioxide equivalent (tCO_2e) (NDC as of 2021)	**350-420 million** (currently 533 million, as of September 2021)
Proportion of wind in electricity mix	**22.5%**

13 South Africa | Energy Policy Tracker

Additionally, in 2020 the government announced that 6,800MW of new generation energy capacity must be procured from renewable energy sources (solar and wind) for the years 2022-2024.This might be difficult to achieve without direct economic stimulus, however.

Another policy that could encourage more renewable energy is the use of zoning. Renewable energy development (RED) zones are areas deemed by the government to be prioritised for building renewable energy capacity. These are primarily mining regions, such as the Mpumalanga province, which will benefit from the economically stimulative effect of new industries being based there. RED zones will benefit from a faster development and approval process. However, the government faces incentive challenges shifting people and resources from areas which currently have large amounts of wind capacity, for example the Northern Cape region, to these RED zones.

In 2011, the country introduced the Renewable Energy Independent Power Producers Procurement Programme (REI4P), a renewable energy tender and bid scheme. This scheme offers state guarantees for 20 years of production and has attracted IPPs and local participants.

Current barriers to wind energy

South Africa has the potential to be a world-leading wind energy producer. The following barriers are currently hindering progress in the country.

Transmission network

One of the primary hindrances to faster wind energy development in South Africa is lack of development of the power transmission network. For example, the Northern Cape region, which currently has the best wind resources in the country, has some of the least developed transmission networks. The development of wind projects in these areas are held up by a lack of transmission capability, and ESKOM has been slow to improve the infrastructure in these areas.

It should be noted that ESKOM is now more aware of this issue and has created a roadmap to improve the speed of its internal workings as well as the development of the network. This will primarily be achieved by separating generation, transmission, and distribution into different working groups, and separating transmission as a separate entity within ESKOM.[14]

Energy regulator capability

The National Energy Regulator of South Africa (NERSA) is viewed as a reactive rather than proactive body and lacks a forward-looking strategy and technical expertise. More technical knowledge, especially of the country's transmission system, is required to help solve the transmission system issues outlined previously. Improving the resources and capabilities of NERSA will also help share the work burden with ESKOM, which has been struggling under its large remit.

Government support and local content requirements

The South African government has been mostly supportive of diversifying the country's energy grid and increasing the use of wind energy. To improve further, the government could be more interventionist, such as by implementing targeted subsidies for the wind sector.

The government has also introduced local content requirements. The requirements are complex and not aligned with current manufacturing capabilities, which leads to exemptions being granted on a case-by-case basis. In addition, a lack of tender predictability and continuity makes supply chain investment more uncertain. South Africa has recently announced preferred bidders for its most recent renewable energy bidding round, which was run after almost six years of no new renewable energy procurement.

Power purchase agreements

There have been multiple instances of long delays in signing PPAs for winning projects, and the resulting lack of predictability has led to a slowing of investment in the wind industry. Removing uncertainty around procurement by introducing binding off-taker contracts will help to attract investment.

Additionally, there are numerous regulatory and administrative barriers for IPPs to enter the energy market. For example, there is currently a requirement to obtain generation licenses for grid-connected projects above 10MW, and projects without a license requirement over 100MW. This was recently increased from 1MW, but is still a low threshold and causes administrative delays.

A 10MW solar project in the Northern Cape has recently begun generating clean power for sale to a local unit of Amazon Web Services, under a corporate PPA. This is the country's first wheeling project at this scale, with power transferred by ESKOM to the consumer. Scaling up this model would alleviate the demand-side burden for corporates facing increasing electricity costs, as well as the supply-side IPPs seeking channels for direct sale.

14 Roadmap for ESKOM | South African Government

Case study

Kangnas Wind Farm

Kangnas Wind Farm, situated outside of Springbok, in the Northern Cape's Nama Khoi Municipal area, commenced operations in November 2020. Rated at 140MW with 61 wind turbines, it generates around 513 GWh/year of clean renewable energy. This is equivalent consumption of 155,000South African homes, and eliminates approximately 550,000 tonnes of carbon emissions each year compared to traditional fossil fuel power plants.

The South African Government provided a fully indexed price of $45.3/MWh worth of economic subsidy for this wind project.

Mainstream Asset Management South Africa manage the Kangnas Wind Farm. Siemens Gamesa Renewable Energy (SGRE) supplied and installed the wind turbines, and will also conduct maintenance going forward.

This project is beneficial in addressing the ongoing and increasing need for clean electricity in South Africa. It positively impacts the country's economy and people, with a particular focus on communities within a 50km radius of the wind farm.

The project has procured $69 million within the South African local supply chain and over 200 jobs (over a 24-month period) were created during construction. For example, project activities that link to the grid system all required the development of local content.

Additionally, SGRE took into consideration during construction that GRI (a local South African tower manufacturer) did not have adequate storage space to keep up with production requirements. As a result, SGRE invested an additional capital of approximately $1.3 million to expand GRI's facilities.

The advances in Kangnas Wind Farm technology and the cost-competitiveness it brings to the South African economy, have strengthened the business case of renewables in South Africa. At the same time, the transition from coal to renewables reduces the traditional trade-off between economic growth and environmental conservation and local manufacturing. The project also provides empirical evidence that economic growth and environmental conservation are fully compatible.

The Kangnas Wind Farm has committed to spending 0.2% of revenue generated on Enterprise Development (EnD), and 2.8% of revenue generated on Socio-Economic Development (SED).

Some of the key positive economic impacts the project has implemented include:

- **Skills development** – particularly youth populations, black people historically disadvantaged by discrimination, women, and people with disabilities.
- **Enterprise development** – aims to continue to foster and support local businesses in the area, in particular those of black ownership.
- **Socio-Economic Development** – Kangnas Wind Farm has associated with or set up various community-based initiatives, such as community facilitation, early childhood development centres; primary schools; secondary and tertiary institutions; community health, as well as many more.

Recommendations for green recovery

For South Africa to be able to accelerate green recovery and expand the use of wind energy, the following broad actions for policymakers are recommended:

- **ESKOM should continue its drive to improve development of the transmission network,** particularly in the Cape regions, by separating generation, transmission and distribution into three different working entities, and into separate entities within ESKOM. This was due to be completed by the end of 2021,[15] but no announcements have been made at the time of writing, indicating a delay. A renewed commitment to the unbundling of ESKOM and a transparent timeline will help to reassure future investors in the organisation's status as a reliable offtaker.
- **Increase the power, capabilities, and technical knowledge of the energy regulator NERSA** to help develop the transmission network to further enable the development of the wind industry.
- **Improve government backing and commitment to renewable energy**, as one of the main de-risking factors in the country. If the government strengthens its renewable energy and wind energy commitments, announces ambitious targets in the coming months, and shores up the local supply chain, the wind industry in South Africa would have even stronger footing.
- **The government can further bolster the wind industry by being more proactive in its support**, at least while the industry is still young. Subsidising struggling local content suppliers in the wind industry would provide security to the local supply chain and boost investor confidence. Industrial visions and policies, including business incubation programmes and industrial clusters, can help to increase competitiveness of local suppliers and support SMEs.
- **Maintain a systematic and reliable schedule of auctions** which can create a stable pipeline of capacity procurement and installation, and encourage long-term investment in a local wind value chain.

15 Eskom unbundling proceeding | ESI Africa

- **Amend the current local content requirements** to ensure clarity, simplicity, and practicality. Simpler lists of the components subject to local content requirements will support cost and resource efficiency of project development and procurement.
- **Provide visibility of the long-term tender pipeline** to encourage and de-risk supply chain investment. Remove uncertainty around capacity procurement to attract investment by introducing binding off-taker contracts.
- **The private sector should be enabled to continue to enter into power supply agreements with IPPs**, which so far have a better track record of delivering projects. The rules for electricity procurement for corporate buyers and municipalities, including wheeling charges applied by ESKOM to private procurement, could be clarified to enable direct transactions with IPPs.
- **Simplify procedures for approvals and shorten permitting timeframes**, with a consideration to remove ministerial approval required for the signing for direct PPAs with IPPs.

Project pipeline scenarios

The methodology for these scenario forecasts can be found in the Appendix A.

In the business-as-usual scenario we forecast that almost 6.5 GW of wind capacity will be installed between 2022 and 2026.

If a green recovery is implemented, we forecast a fast acceleration of wind capacity from 2024 onwards, which would result in almost 9 GW being installed between 2022 and 2026.

Figure 23 shows the forecast pipeline in the two scenarios, with more than 2.5 GW of potential upside between them. The greatest difference is seen in 2026, and this trend is expected continue past 2026.

Figure 23 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Figure 23 Forecast of installed capacity in South Africa in the two scenarios

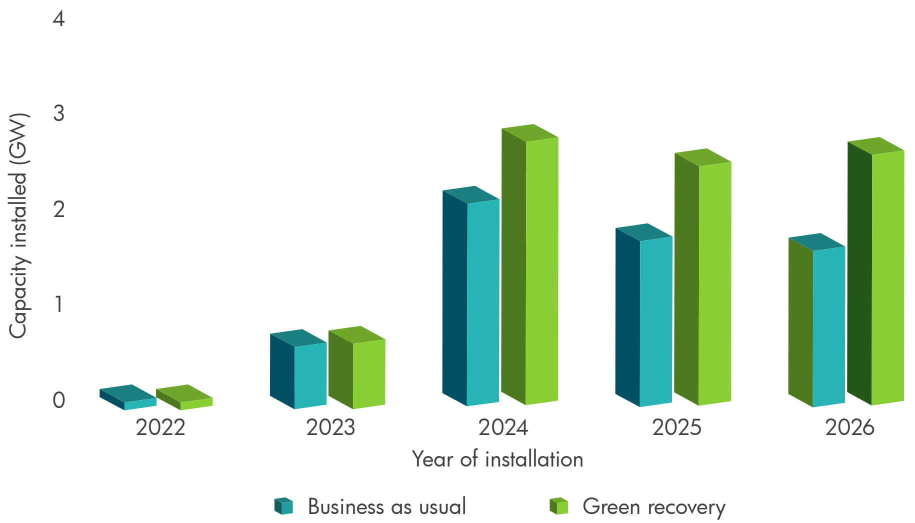


Table 8 Forecast of installed capacity in South Africa in the two scenarios

Year	Business as usual	Green recovery
2022	80	80
2023	680	714
2024	2,200	2,860
2025	1,800	2,610
2026	1,700	2,720

Impacts analysis

In the business-as-usual scenario, 130,000 direct and indirect FTE job years are created by wind energy in South Africa between 2022 and 2026 in the development, construction and installation phase. In addition, 14,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms.

Figure 24 shows the annual FTE years created in the business-as-usual scenario by supply chain category. Examples of occupations across different segments of an onshore wind farm can be found in the Appendix B.

In the green recovery scenario, 180,000 direct and indirect FTE job years are created from wind energy in South Africa between 2022 and 2026 in the development, construction and installation phase. In addition, 22,000 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms.

Figure 25 shows the annual FTE years created in the green recovery scenario by supply chain category. There is a potential upside of 250,000 new FTE jobs created in a green recovery scenario.

$7.3 billion direct and indirect gross value added is created from wind energy in South Africa between 2022 and 2026 in the business-as-usual scenario over the lifetime of the wind farms. Figure 26 shows the GVA created in the business-as-usual scenario by supply chain category.

$10.5 billion direct and indirect gross value added is created from wind energy in South Africa between 2022 and 2026 in the green recovery scenario over the lifetime of the wind farms. Figure 27 shows the GVA created in the green recovery scenario by supply chain category, with a difference of $3.2 billion in GVA over the forecast period.

Figure 24 FTE years created in the business-as-usual scenario in South Africa

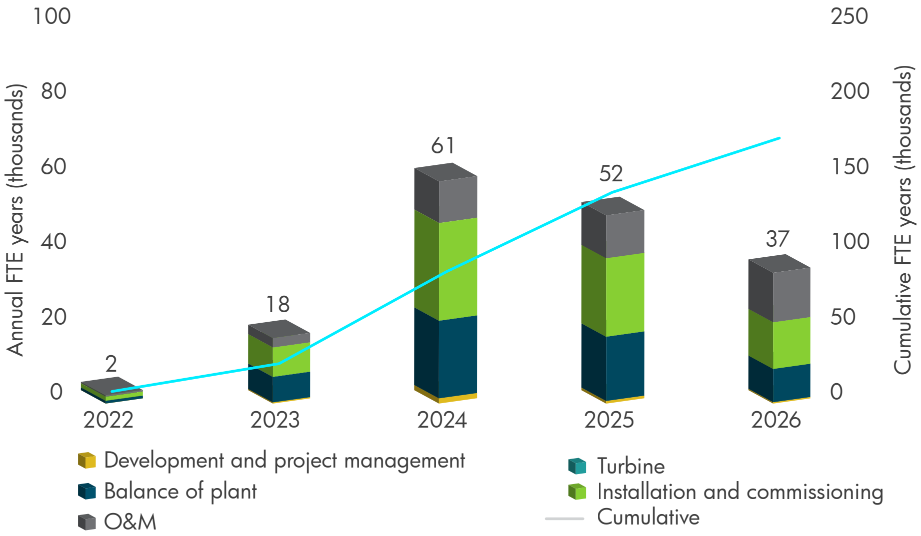


Figure 26 Gross value added ($) created in the business-as-usual scenario in South Africa

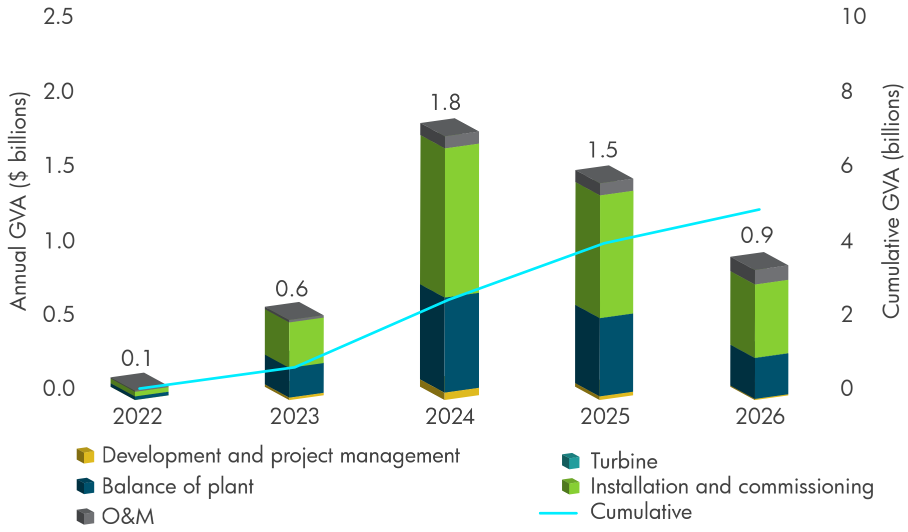


Figure 25 FTE years created in the green recovery scenario in South Africa

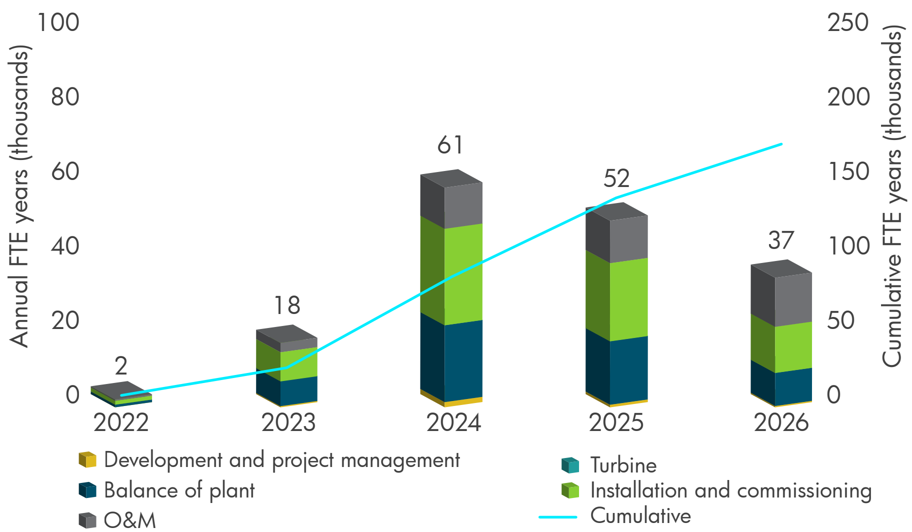
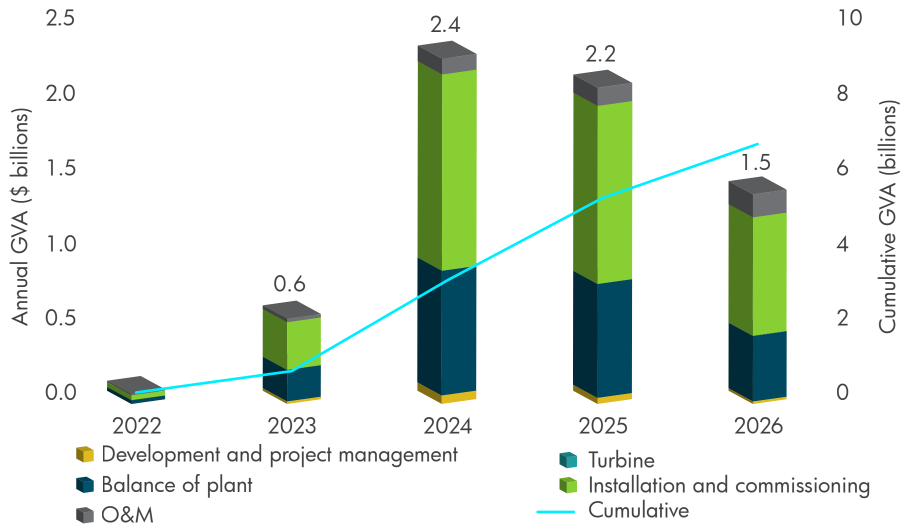


Figure 27 Gross value added ($) created in the green recovery scenario in South Africa



Impacts created in South Africa in the business as usual scenario

A total of 500,000 FTE job years created over the lifetime of the wind farms

US$7.3 billion gross value added (GVA) to national economies over the lifetime of the wind farms

20,000 GWh electricity produced per year from 2026, which is the same as

- 5 million homes powered with clean energy per year
- 5 million electric vehicles powered annually from 2026

486 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 106 million cars off the road
- 160 million return flights from Cape Town to Glasgow
- Planting and maintaining 13 million trees for 10 years

39 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Impacts created in South Africa in the green recovery scenario

A total of 750,000 FTE job years created over the lifetime of the wind farms

US$10.5 billion gross value added (GVA) to national economies over the lifetime of the wind farms

27,900 GWh electricity produced per year from 2026, which is the same as

- 7 million homes powered with clean energy per year
- 8 million electric vehicles powered annually from 2026

676 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 147 million cars off the road
- 223 million return flights from Cape Town to Glasgow
- Planting and maintaining 18 million trees for 10 years

52 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

The Philippines

The Philippines is especially vulnerable to climate change impacts and natural disasters. The government has called for increased investment in renewable energy and the bolstering of energy self-sufficiency. However, renewable project development has been limited due to technology-neutral auctions, insufficient transmission infrastructure, and concerns about variability.

Current situation

Located in the tropical cyclone belt, the Philippines is especially vulnerable to climate change impacts and natural disasters. The government has called for increased investment in renewable energy and the bolstering of energy self-sufficiency. However, renewable project development has been limited due to technology-neutral auctions, insufficient transmission infrastructure, and concerns about variability.

In 2008, the share of renewable energy in the electricity mix was close to the 2030 target of 35%, but as more coal has been introduced over the last decade, the share of renewable energy in power generation decreased to 21% in 2019. Consequently, with more imported coal instead of renewables produced domestically, energy self-sufficiency has decreased, and electricity prices in the Philippines continue to be among the highest in Southeast Asia.

The pandemic has heavily impacted the country's economy, but economic growth is expected to rebound post-pandemic, with energy demand growing alongside it. The inconsistent reliability of fossil fuel plants has further led to forced power outages and unplanned maintenance.

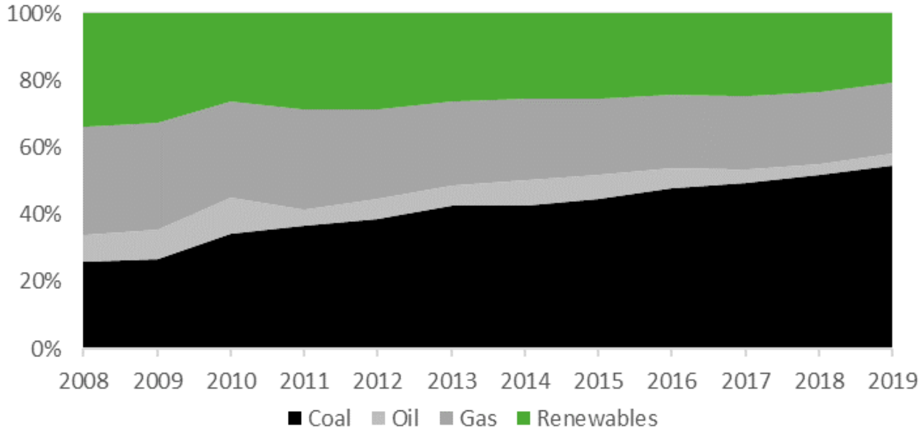
Energy mix and targets

Figure 28 shows the energy mix of the Philippines from 2008-2019. Coal use has steadily increased over the last decade, encompassing over 50% of the country's energy mix by 2019. Meanwhile, use of renewables has declined as a proportion of energy use.

Wind energy as a proportion of renewable energy has modestly increased over this same time period, as seen in Figure 29. However, the rate of increase has markedly declined over the last five years. Between 2011-2016, approximately 390MW wind capacity was installed; from 2016-2021, only 20MW was installed, the majority of which was in 2016.[16]

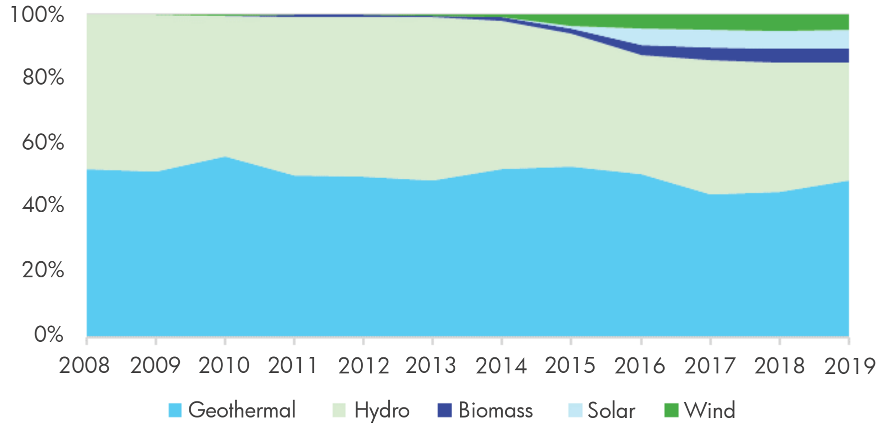
16 Philippines wind energy capacity | Statista

Figure 28 **The Philippines total energy mix**



Source: IEA

Figure 29 **Philippines renewable energy mix, 2008-2019**



Source: IEA

Table 9 **The Philippines 2030 targets**

Reduction in greenhouse gas emissions below BAU projections (72.29% conditional reduction) (NDC as of April 2021)	75%
Share of renewable energy in electricity supply	35%

The Philippines ratified the Paris Agreement on 14 March 2017 and has an NDC target of 70% reduction in GHG emissions below BAU projections by 2030, conditional on financial, technological, and capacity building support.[17]

However, in 2021, the country raised its GHG reduction target, which is primarily a conditional target, to 75% relative to 2015 levels by the year 2030 and has set out plans to announce a net zero target in 2022. To aid its ambitious reduction targets, the Philippines government declared a non-permanent moratorium on new coal power plants in 2020. There is still, however, several coal plants in development that are due to be built in the next decade.

COP26 outcome

At the COP26 summit in November 2021, the Philippines joined the Declaration on Forests and Land Use, which pledged to end deforestation by 2030. It was also a signatory to the Global Methane Pledge, with the goal of reducing global methane emissions by at least 30% from 2020 levels by 2030.

It partially endorsed the Global Coal to Clean Power Transition Statement, with an additional note reiterating that "the Philippines is not a major emitter of greenhouse gases but bears the worsening impacts of climate change, and to emphasise that energy security is foremost as energy transition is a means to improve the lives of the Philippines'

17 Philippines | IEA

people and the country's economic development.''[18]

Economic stimulus and laws

Unlike previous countries discussed, no data on The Philippines' public finance commitments to different energy types was available for the development of this report.

Under the strain of the pandemic, economic rebound has become a national priority for the country. In June 2020, the House of Representatives approved a PHP1.3 trillion ($25.2 billion) economic stimulus package to help the economy recover from the coronavirus pandemic in the next 4 years.[19] The Accelerated Recovery and Investments Stimulus for the Economy of the Philippines (ARISE Philippines) will support micro, small, and medium enterprises (MSMEs) and other key sectors affected by the COVID-19 crisis, while aiming to rebuilding consumer confidence. This will indirectly act as a stimulus for the renewable energy sector.

For renewable energy specifically, the Renewable Energy Act of 2008 is the primary economic stimulus provided to the sector. This law aims to provide fiscal and non-fiscal incentives to private sector developers and manufacturers, through schemes such as:

- 10% corporate income tax, as opposed to the usual 25%
- 1.5% real property tax cap on assessed value of equipment and facilities classified as real property to produce renewable energy
- Prioritising the purchase, grid connection and transmission of electricity generated by companies from renewable energy sources, and
- Power generated from renewable energy sources are zero-rated value added.

Current barriers to wind energy

The Philippines is well positioned to be a regional leader in wind energy. It has an appropriate permitting and auctioning infrastructure in place and was on track a decade ago to rely primarily on renewable energy. The reasons why this progress has been hindered are detailed below.

18 https://ukcop26.org/global-coal-to-clean-power-transition-statement/
19 Philippines economic package | ARISE

Policy commitment

While the current government publicly supports the push for renewables, it has historically promoted development of nuclear and LNG projects as alternatives to coal. Auctions are technology-neutral and biased towards baseload technologies, which has made it difficult for renewable energy projects to win contracts. This process has contributed to the energy mix pattern seen in Figure 28.

In addition, the Department of Energy (DoE) currently takes a passive approach to wind energy expansion, refraining from any significant steps to improve the wind energy pipeline and not actively promoting renewables as a necessary energy source.

Permitting and leasing process

The current permitting system for renewable energy is lengthy, complex and bureaucratic, with permits from approximately 15 different national agencies as well as local government. Currently the online platform set up for permitting and bidding documents, EVOSS, only includes the DoE.

The current leasing mechanism, service contracts, are viewed favourably by developers, but the terms and conditions could benefit from simplification.

Additionally, the bidding process is seen to have excessive conditions attached to it, putting off prospective developers as they have to jump through multiple hoops to meet all the conditions.

Transmission system

Availability of grid connections and transmission network bottlenecks present a considerable challenge, delaying projects and reducing investor confidence.

Case study

Camarines Sur Wind Farm

The Camarines Sur wind project is based in the region of the same name in the Philippines. It is in the development stage and is expected to generate at least 60MW of electricity once completed in late 2022/early 2023.

The wind farm is a joint venture between Mainstream and Cornerstone Energy Development, a local company.

The project has created 110 direct local jobs so far in the pre-construction phase.

Mainstream conducted multiple site visits in 2020, including various technical, geotechnical and scientific studies, the decommissioning of a fallen met mast, and the installation of a replacement mast. This required approximately 50 locals from the host community of Barangay Pag-Oring Nuevo to do construction work, including welders who dismantled the fallen met mast and a further 60 unskilled locals from the community to act as haulers for materials and supplies to the site and also acted as trail guides.

Locals have signed employment contracts containing all work details (nature or activity of the project they are hired for, the period of employment, working hours, payment, place of work), Occupational Health and Safety responsibilities, Insurance and Medial Benefits, Validity of the contract and termination of the contract. This has ensured the employment is secure for the locals.

Additionally, the project is expected to create hundreds of indirect jobs during the construction and operational phases.

Recommendations for green recovery

For the Philippines to be able to accelerate green recovery and expand the use of wind energy, the following broad actions for policymakers are recommended:

- **Commit to supporting renewable energy as the preferred energy resource in the Philippines**, and ensure this commitment remains consistent and stable regardless of changes in administration. This could include higher capacity targets for wind and renewable energy within the Philippines Energy Plan, as well as updated feasibility studies and measurement campaigns to explore wind energy potential using the latest technology.
- **Consider holding technology-specific auctions or pots within auctions** to allow the wind industry to regain a footing in the Philippines. More transparency on the design and implementation of the Green Energy Auction Program will clarify the prioritisation of renewable energy. Demand bands within this program should be based on different criteria, including technology, size, location and other factors, to determine the most appropriate energy source.
- **Expand the online Energy Virtual One-Stop Shop (EVOSS) for permitting and bidding**, so that all documents go to one agency, which manages the necessary approvals from all agencies, both local and national. This should include formalising a mechanism for regular industry input to the EVOSS task group, to provide ground-level perspectives of technical, operational, and administrative barriers which could slow down project development.
- **Streamline and simplify terms and conditions in service contracts** to allow developers to be more creative with their solutions in their project bids.
- **The Philippines DoE should be more proactive with the wind industry**, by consulting with industry leaders and coordinating wind energy and transmission network development through designating

wind energy areas for project developers to focus on.

- **Ensure that proactive grid planning and investment considers future renewable energy projects**. Planning should be aligned with the scheduled buildout of renewable energy projects under the Green Energy Auction Program.
- **Consider technical feasibility studies on forecasting and smart distribution systems** to be integrated with the national power grid, which can help to support balancing with larger shares of renewable energy. Storage systems, such as utility-scale battery systems, can also be considered for inclusion within the Philippines Energy Plan.

Project pipeline scenarios

The methodology for these scenario forecasts can be found in the Appendix A.

In the business-as-usual scenario we forecast that almost 1.15 GW of wind capacity will be installed between 2022 and 2026.

If a green recovery is implemented, we forecast a fast acceleration of wind capacity from 2024 onwards, which would result in almost 1.65 GW being installed between 2022 and 2026 – a potential upside of 500 MW. The greatest difference is seen in 2026, and this trend is expected continue past 2026. Figure 30 shows the forecast pipeline in the two scenarios.

Table 10 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Figure 30 Forecast of installed capacity in the Philippines in the two scenarios

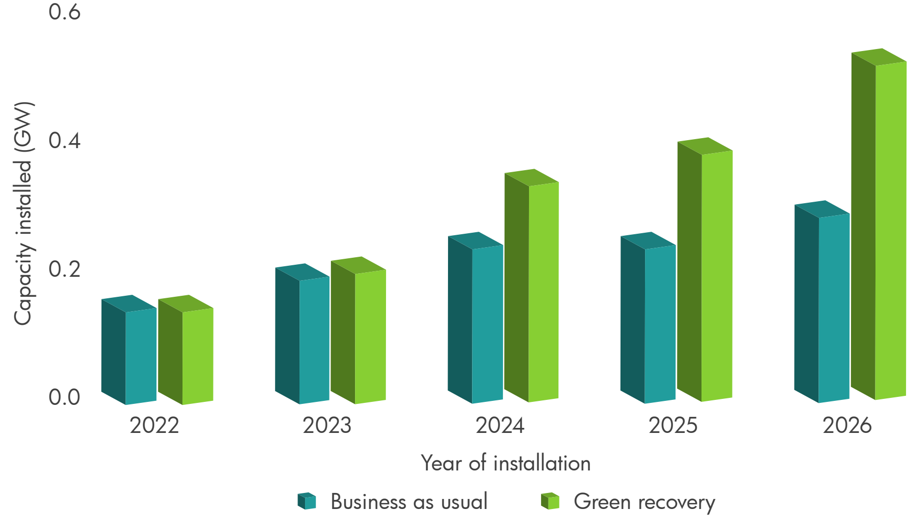


Figure 23 shows the forecast installed capacity in MW in the two scenarios between 2022 and 2026.

Table 10 Forecast of installed capacity in the Philippines in the two scenarios

	Business as usual	Green recovery
2022	150	150
2023	200	210
2024	250	350
2025	250	400
2026	300	540

Impacts analysis

In the business-as-usual scenario, 6,000 direct and indirect FTE job years are created by wind energy in the Philippines between 2022 and 2026 in the development, construction and installation phase. In addition, 1,500 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms.

Figure 31 shows the annual FTE years created in the business-as-usual scenario by supply chain category. Examples of occupations across different segments of an onshore wind farm can be found in the Appendix B.

In the green recovery scenario, 9,000 direct and indirect FTE job years are created from wind energy in the Philippines between 2022 and 2026 in the development, construction and installation phase. In addition, 2,700 annual direct and indirect FTE job years are created in O&M, which continues for the lifetime of the wind farms. Figure 32 shows the annual FTE years created in the green recovery scenario by supply chain category, with a potential upside of 34,000 new jobs created compared to the BAU scenario.

$700 million direct and indirect gross value added is created from wind energy in the Philippines between 2022 and 2026 in the business-as-usual scenario over the lifetime of the wind farms. Figure 33 shows the GVA created in the business-as-usual scenario by supply chain category.

$1.1 billion direct and indirect gross value added is created from wind energy in the Philippines between 2022 and 2026 in the green recovery scenario over the lifetime of the wind farms. Figure 34 shows the GVA created in the green recovery scenario by supply chain category, with a difference of $400 million compared to the BAU scenario.

Figure 31 FTE years created in the business-as-usual scenario in the Philippines

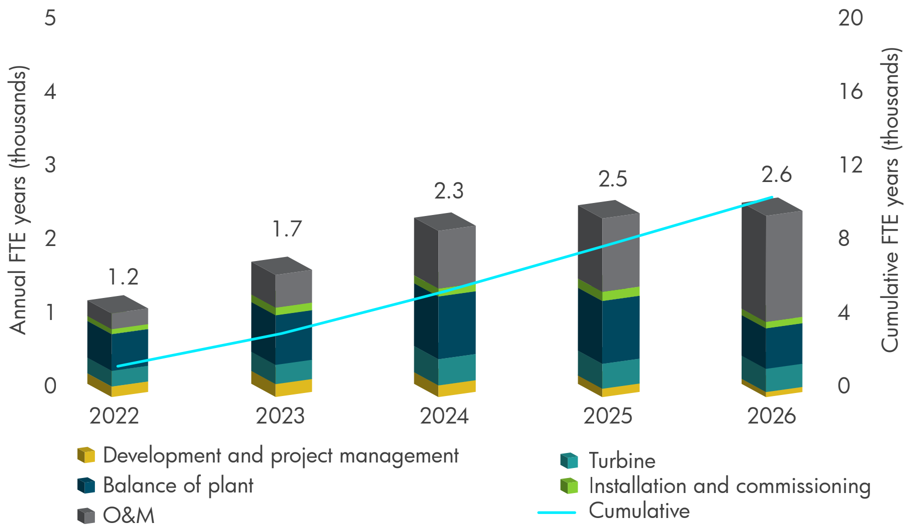


Figure 33 Gross value added ($) created in the business-as-usual scenario in the Philippines

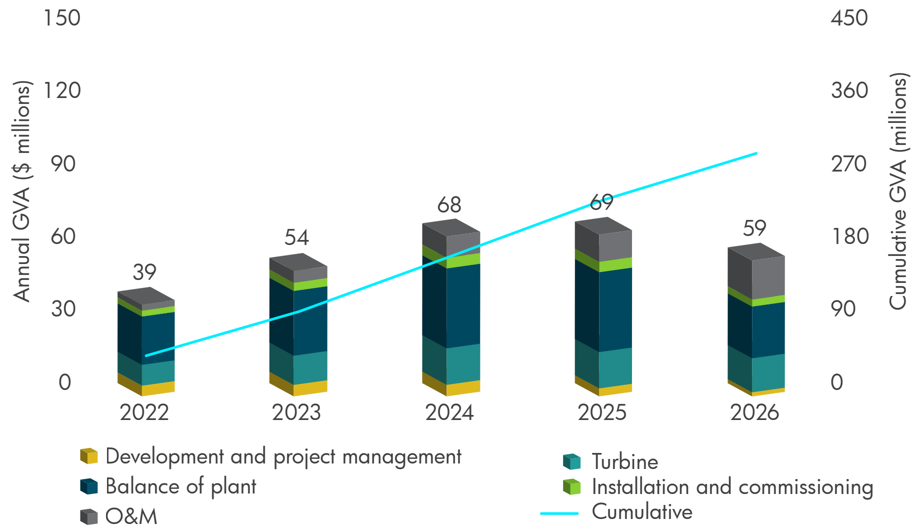


Figure 32 FTE years created in the green recovery scenario in the Philippines

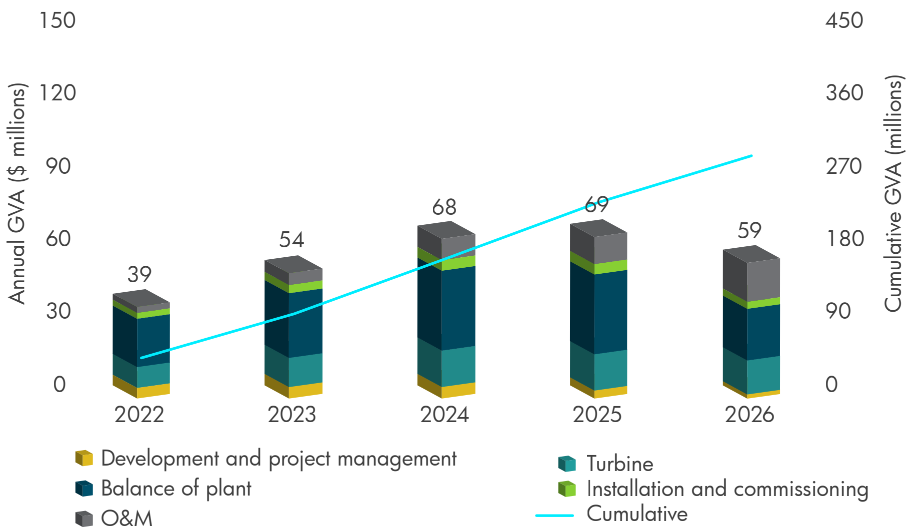
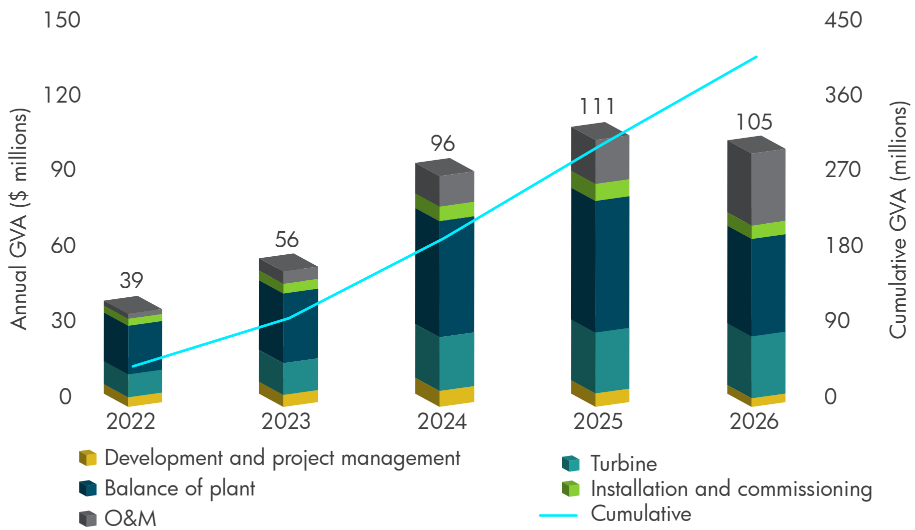


Figure 34 Gross value added ($) created in the green recovery scenario in the Philippines



Impacts created in Philippines in the business as usual scenario

A total of 47,000 FTE job years created over the lifetime of the wind farms

US$700 million gross value added (GVA) to national economies over the lifetime of the wind farms

2,500 GWh electricity produced per year from 2026, which is the same as

- 2 million homes powered with clean energy per year
- 700,000 electric vehicles powered annually from 2026

45 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 10 million cars off the road
- 14 million return flights from Cape Town to Glasgow
- Planting and maintaining 1 million trees for 10 years

5 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Impacts created in the Philippines in the green recovery scenario

A total of 80,000 FTE job years created over the lifetime of the wind farms

US$1.1 billion gross value added (GVA) to national economies over the lifetime of the wind farms

3,600 GWh electricity produced per year from 2026, which is the same as

- 3 million homes powered with clean energy per year
- 1 electric vehicles powered annually from 2026

65 million metric tons of carbon emissions saved during the lifetime of the wind farms, which is the same as:

- 14 million cars off the road
- 21 million return flights from Cape Town to Glasgow
- Planting and maintaining 2 million trees for 10 years

7 million litres of water saved annually from 2026 which would otherwise be used for thermal power generation

Conclusion

This study demonstrates that the wider socioeconomic benefits realised by wind energy can support a green economic recovery from the COVID-19 pandemic, bringing more than clean power to communities. Shifts in policy and public stimulus spending which work to increase deployment of wind energy can potentially unlock a huge scale-up of capital investment, job creation, and social and environmental gains.

The analysis of wind installation impacts in two scenarios, BAU and green recovery, in Brazil, India, South Africa, Mexico, and the Philippines, yields helpful recommendations on how to capture these benefits.

The most significant areas of opportunity centre on policy commitment, grid and transmission system infrastructure, and regulatory frameworks for permitting. Addressing these areas proactively, in coordination with the wind energy industry and other relevant stakeholders, can support accelerated deployment of wind energy and a green recovery in developing economies.

Policy commitment: provide clarity and ambition for wind energy

A lack of consistent and clear policy commitment to promote and enable wind energy is a barrier common to many developing economies. A clear route to market is needed to decrease investment risk and cost of capital for developers. Similarly, long-term ambitions for wind energy eases local investment in a supply chain. This brings faster and bigger benefits.

- Provide a clear vision of the government's long-term plans by stating targets and commitments which, in turn, provide confidence in the market.
- Increase the government's wind power ambition and reflect this in updated NDCs and targets, comprehensive national climate strategies, and short- and long-term energy plans.
- Make the role for wind energy and the associated enabling grid clear within wider public strategy to embed the government commitment.
- Establish long-term procurement pipelines such as through regular and frequent auctions, with clear visibility of the areas most suited for development, the expected amount of generation sought, and likely timeframes.
- Take a "whole system" approach to energy and ensure that incumbent fossil fuel generation is pushed off the system and new investments in coal and other fossil fuel-based generation are avoided. Governments should introduce measures to ensure that carbon emissions and other impacts of fossil fuel generation (such as impacts on air quality, human health, and water use) are correctly priced.
- Collaborate with industry to successfully build and evolve policy. Government policy objectives and priorities can change over time, due to administration changes, shifts in the public interest, or even externalities like the COVID-19 pandemic. Industry needs to understand the government drivers, and to be given the chance to provide feedback on government plans to ensure that objectives are reasonable and can be met. Provide industry with a stable business environment with plenty of sight of any change.

Invest to expand transmission system infrastructure

Wind energy projects rely on land availability, wind resource, and grid connection points. Greater public and private investment in secure, smart and flexible grids which enable ever-larger shares of renewable energy is necessary to meet the urgent pace of the energy transition.

- Provide developers with a clear, bankable framework to apply for a grid connection.
- Accelerate the forward-planning of transmission network expansion and investment in developing the network to increase the potential sites developers will consider for wind projects, as well as to avoid delays and grid congestion in the future.
- Coordinate transmission system planning with the planning for future wind energy development areas to ensure that the grid is efficiently strengthened and available when needed in relevant areas.
- Grid planning should include storage solutions, such as pumped hydro or utility-scale batteries, which can minimise grid congestion and support balancing.

Simplify permitting frameworks for renewable energy

- Simplify frameworks related to permitting, leasing, and auctions to increase wind energy deployment.
- Consider establishing a single agency, or 'one-stop shop', to manage and coordinate all documentation and applications to greatly help simplify processes.
- Enable strong coordination between different framework administrators. This ensures that processes fit well together, and each can better cater for a greater volume of projects progressing.
- Consider, among others:
  - Mandated maximum lead times to permit renewable energy plants, such as 2 years for greenfield onshore wind projects, 3 years for offshore wind projects and 1 year for repowering projects, with additional discretionary time allowance under extraordinary circumstances
  - A structured and time-limited process for developers to provide evidence for their expected timeframes and project plans
  - A clearing house mechanism for legal disputes to prevent extended delays to critical infrastructure projects
  - Land use strategies which prioritise nature-positive energy solutions, and
- Fast-track permitting schemes to prioritise repowering of existing wind farms where turbines are reaching end-of-lifetime.

For developing economies facing the difficult balance of restarting economic growth after COVID-19 while meeting energy and climate goals, these recommendations can support increased investment in the wind sector. In turn, ramping up wind energy installations can help countries chart a pathway to a robust and sustainable economic recovery.

Appendix A Methodology

The work was carried out in six stages:

- Data collection and engagement
- Country studies of five countries with developing economies
- Identify project pipeline scenarios
- Conduct economic impact analysis
- Closed-door discussion with financial institutions, and
- Deliver recommendations based on the studies and research conducted above.

Identifying and finding required data through engagement

We worked with national wind energy associations in each country to collect required data and to understand the current barriers and challenges to wind energy deployment in these countries. The associations we engaged with were:

- Brazil: Brazilian Wind Energy Association (ABEEolica).
- India: GWEC India
- Mexico: Asociacion Mexicana de Energia Eolica (AMDEE)
- South Africa: South African Wind Energy Association (SAWEA)
- The Philippines: Developers of Renewable Energy for AdvanceMent, Inc (DREAM)

Five country studies

Based on the engagement and the data collected, we provided a brief overview of the energy transition situation in the country and any challenges to wind energy and general renewable energy deployment.

The energy transition summary included a brief overview of the current energy mix and a brief overview of public targets and commitments, and what is needed still to get there. This summary was then shared with the relevant country associations.

Project pipeline scenarios

We developed a 2022-2026 project pipeline forecast under a business-as-usual scenario and a green recovery scenario.

The business-as-usual scenario is the current 2022-2025 GWEC forecast, that was extended to 2026. We assumed that the build rate from 2025 grows at a steady rate to 2026, except for Mexico. Consenting new projects has stopped in Mexico for the last few years, and in the business-as-usual scenario they will run out of already consented projects to build before 2026, so we have therefore assumed that no capacity is installed in 2026.

In the green recovery scenario, we applied an annual % increase to the business-as-usual forecast, arrived at by looking at the potential impact of following the recommendations in this study.

The barriers that we assume are overcome in each of the five countries were:

- In **Brazil** we assumed that the transmission and transport infrastructure was improved and that the regulated market was strengthened due to modernised policies.
- In **India** we assumed that permitting frameworks are streamlined, a pipeline of auctions was established, the grid coordination was improved and there was more reliability around auctions and PPA.
- In **Mexico** we assumed that the government showed more commitment to renewable energy, policies and frameworks were changed to accelerate the consenting of projects, permitting was streamlined and the transmission system was upgraded.
- In **South Africa** we assumed that the transmission system was upgraded, regulator resource improved, local content requirements were amended to be less stringent, permitting was streamlined and there was increased certainty around PPAs.
- In the **Philippines** we assumed that the government was more committed to supporting renewable energy, permitting was streamlined, and the transmission system was upgraded.

Because the measures we assumed the countries put in place to overcome the barriers take time, including upgrading transmission systems, it is not until 2024 we started seeing a significant difference in the scenarios. Significant impact will continue beyond 2026.

Economic impacts analysis

For the analysis of economic impacts, we used a supply chain breakdown as a framework to help identify where local jobs in the supply chain will arise in the five countries.

We received input from the local wind energy associations to arrive at a local content percentage in each of the categories, and the typical costs for wind farms in each country.

Based on known data from onshore wind energy projects we modelled the typical number of jobs created per MW for each supply chain category and multiplied this with the annual installed capacity and local content percentage for each country to arrive at the number of full time equivalent (FTE) job years created.

We then used country specific multipliers derived from the differences in project costs between the countries to arrive at the gross value added (GVA) created in each country per year.

Environmental impacts analysis

We used a country-specific capacity factor to calculate the annual power production from the two scenarios for each country. We then divided this by the annual household electricity consumption in each country to arrive at the number of households powered.

We calculated the reduction in the carbon footprint of the energy production in the five countries, using the annual energy mix and associated emissions in each country and accounted for what the extra wind energy generation would displace.

Closed-door expert discussion

We discussed with relevant international finance institutions (IFIs), development finance institutions (DFIs) and multilateral development banks (MDBs) the risks related to investment and finance, and to understand how this could be de-risked.

Recommendations

Based on the findings in our analysis and engagement we provided broad recommendations, as well as country-specific recommendations for each of the five countries, to accelerate green recovery by clearing implementation and investment barriers to ensure long-term growth and sustainability of the sector.

Appendix B Example Jobs at an Onshore Wind Farm

Table 11 Example Jobs at an Onshore Wind Farm

Segment of the Wind Value Chain	Example Activities	Example Jobs
Development and Project Management	• Site selection • Feasibility studies • Environmental impact assessments • Community engagement • Engineering design • Project development	• Legal, property and tax experts • Financial analysts • Engineers • Environmental and geotechnical scientists
Manufacturing / Balance of plant	• Manufacturing and assembly of nacelles, blades and towers • Manufacturing of monitor and control systems • Design specifications • Sourcing	• Factory workers • Quality control • Marketing and sales Engineers Management • Sourcing specialists Engineers
Installation	• Project site preparation • Civil works • On-site assembly of components • Transport of components	• Construction workers • Technical personnel • Engineers • Health and safety experts • Logistics and quality control experts • Drivers • Logistics experts • Technical personnel
Grid connection and commissioning	• Cabling and grid connection • Project commissioning	• Construction workers • Technical personnel • Engineers • Health and safety experts
Operation and maintenance (O&M)	• Ongoing O&M over project lifetime (typically 25 years)	• Operators • Engineers • Construction workers • Technical personnel • Lawyers • Management • Asset management • Accountants
Development and Project Management (Decommissioning)	• Planning decommissioning or repowering • Dismantling the project on-site • Disposal and recycling of components • Site clearing	• Construction workers • Technical personnel • Drivers • Engineers • Environmental scientists • Health and safety experts

Credit: "Renewable Energy Benefits: Leveraging Local Capacity for Onshore Wind." IRENA, Abu Dhabi.

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