Energy Transition Review for Enhancing Co-operation

The Philippines' power sector

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Abstract

This report is part of ongoing IEA collaboration with Asia Zero Emission Community (AZEC) partners to better understand the particular challenges these partners face in their energy transition and to provide a platform for co-operation among the AZEC partners. The report seeks to build a shared understanding of the challenges and opportunities facing the Philippine power sector, and to identify practical pathways that can help to strengthen its energy security, improve affordability and enable the country to achieve its long-term clean energy goals.

This review has been prepared in collaboration with the Department of Energy (DOE) of the Philippines, the Economic Research Institute for the Association of Southeast Asian Nations (ASEAN) and East Asia (ERIA), and Japan's Ministry of Economy, Trade and Industry (METI). It examines trends, supply and demand dynamics and the evolving regulatory environment. It also highlights key risks and vulnerabilities for the power sector arising from factors such as rising demand, reliance on imported fuels, the need for grid modernisation, access and affordability constraints, financing challenges and growing exposure to extreme weather events.

In alignment with priorities set out by the DOE of the Philippines, the report provides a detailed analysis of three key areas: the potential for nuclear power, for energy resilience and for grid modernisation in the Philippines.

Acknowledgements, contributors and credits

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The main authors of this study (in alphabetical order) are Adrian Gao, former IEA intern, Lan Huong Hoang, IEA intern, Natalie Kauf, Energy Analyst and Peerapat Vithayasrichareon, Senior Energy Analyst, all from the IEA Regional Cooperation Centre in Singapore. Key contributions were received from Federico Callioni, Energy Efficiency Policy Analyst (fuel import), Insa Handschuch, Climate Resilience and Energy Policy Analyst (risk index level of natural hazards), and Isaac Portugal, Energy Analyst (phase assessment). John Moloney, former Junior Energy Analyst at the IEA, and the Electricity Systems and Markets Team provided essential input for this report in relation to the electricity forecast.

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Executive summary

The Philippines has clear targets and strong potential to advance towards a resilient, affordable and sustainable power system

The Philippine power sector is undergoing a period of significant transformation, with rapidly rising electricity demand and evolving policy priorities. Electricity demand is projected to grow at an annual average of 5.4% between 2026 and 2030, driven by sustained economic and population growth, industrial development and electrification of end uses. Fossil fuels are currently the dominant source of power generation, reflecting existing resource endowments and infrastructure, but also exposing the system to global price volatility and import dependence.

Renewable energy presents major opportunities for the Philippines to diversify its power supply and meet growing demand. Government targets aim to increase the share of renewables in the power generation mix to 35% by 2030 and 50% by 2040 – up from the 22% achieved in 2024. These objectives are articulated in the Philippine Energy Plan (PEP) 2023-2050, Volume II: Transitioning to Reliable, Clean, and Resilient Energy (hereafter "Philippine Energy Plan") and the Power Development Plan (PDP) 2023-2050, which emphasise renewable deployment, energy efficiency, grid modernisation and resilient infrastructure. Natural gas is being positioned as a transition fuel that supports the shift from coal towards higher shares of renewables, while nuclear energy is being reconsidered as a stable, low-emissions source of electricity. Achieving these targets will require sustained investment in generation, transmission infrastructure and market enhancement to effectively integrate variable renewable energy (VRE), including solar photovoltaics (PV) and wind energy, while maintaining system reliability.

Key considerations for achieving these policy ambitions remain, including energy security, affordability, import dependence, system integration and investment mobilisation. More than half of the country's primary energy supply is imported, which can increase exposure to global price volatility and external supply constraints. The recent conflict in the Middle East has further highlighted this vulnerability, impacting the supply and pricing of imported fuels and contributing to increased volatility in Asian energy markets. Electricity prices in the Philippines are already among the highest in Southeast Asia, with household electricity expenditure averaging 11% of monthly income in 2023. Achieving universal electricity access by 2028 remains a government priority. As of December 2024, approximately 3.08 million households remain without access to electricity in the Philippines, corresponding to an electrification rate of 94.8%. Access to clean cooking stands at around 64%.

At the same time, solar PV and wind power penetration is projected to reach 16% by 2030, reflecting progressive renewable energy targets. Integrating this level of variable generation would benefit from continued enhancements relating to system flexibility, including storage deployment such as pumped-storage hydro and battery energy storage systems, demand-side response and grid reinforcement. Overall, achieving the ambitions of the PEP and PDP will require substantial and sustained investment, alongside policies that continue to encourage private sector participation. The cost of capital and currency risks also remain important factors influencing investment decisions.

Modern grids and regional interconnection – both domestically and through the ASEAN Power Grid – can support security of supply and the integration of renewables. The Philippines' electricity system is divided into three main island grids – Luzon, Visayas and Mindanao – each with distinct infrastructure and system characteristics. The completion of interconnection between these three grids in 2023 marked a significant milestone, improving security of supply through enhanced resource sharing. Continued reinforcement of the transmission infrastructure and strengthened inter-island connections – including potential links to Palawan and Mindoro – could further optimise resource allocation and system reliability across the archipelago, while facilitating further cross-border interconnections.

The Philippines is at an important juncture in the evolution of its power sector. As demand rises and renewable deployment accelerates, the reliance on imported fuels highlights the importance of strengthening energy security, grid flexibility and system resilience.

Diversifying baseload generation, modernising grids and enhancing energy resilience can help align power sector development with national ambitions

In co-operation with the Department of Energy (DOE) of the Philippines, this report identifies three priority areas for more extensive analysis to support ongoing policy implementation and strategic planning:

First, diversification of stable and low-emissions capacity, for example through nuclear energy. The potential development of nuclear power would require robust regulatory frameworks with long-term policy stability, institutional readiness, access to financing, supply chain development, skilled personnel, appropriate market design and international co-operation. Ensuring operationalisation of the Philippine Atomic Energy Regulatory Authority (PhilATOM) with functional and financial independence consistent with international best practices will also be important.

Second, grid modernisation and system flexibility. Rising demand has increased the importance of co-ordinated, forward-looking grid planning. Strengthening transmission backbones, enhancing inter-island interconnections and expanding storage solutions can improve reliability and facilitate higher shares of VRE. Microgrids are a key opportunity to enhance electrification by offering reliable and lower-carbon solutions for remote and island communities.

Third, energy resilience. The Philippines ranks among those countries most exposed to extreme weather events. Strengthening climate resilience by integrating climate risk assessment into system planning, hardening critical infrastructure, and developing community-based resilience solutions can support both power sector stability and long-term economic resilience. Developing financing mechanisms and promoting private sector participation for mitigation and adaptation efforts can also support energy resilience.

International case studies are presented as illustrative examples throughout this publication to offer relevant insights, while at the same time recognising the Philippines' unique geographic, institutional and market context. Experiences such as Japan's phased nuclear restart, climate-resilient infrastructure planning in Viet Nam's Mekong region, Japan's "islandable" microgrids and South Australia's integration of storage and interconnections for high VRE shares provide helpful insights for these priority areas.

Enhanced co-operation with Asia Zero Emission Community partners can support implementation and capacity building

The Asia Zero Emission Community (AZEC) provides a practical co-operation platform that supports countries in pursuing a tailored energy transition pathway, focusing on strengthening collaboration in areas aligned with national priorities. This report offers a structured analytical foundation to inform AZEC co-operation with the Philippines, identifying practical areas where technical collaboration, capacity building and financial partnerships could deliver measurable impact.

An AZEC Task Force on Energy Resilience could facilitate the exchange of best practices on infrastructure planning, disaster risk management and cross-border co-operation. Working groups that include development partners, regulators, system operators and financial institutions could support knowledge transfer on grid modernisation, system flexibility and renewable integration. Curated study tours and institutional exchanges with Japanese regulators, operators and research institutions could contribute to capacity building in areas such as nuclear governance, workforce development and advanced grid technologies.

By aligning national priorities with AZEC co-operation mechanisms, the Philippines can leverage regional expertise while contributing its own experience in renewable integration, disaster response and island grid management.

Using evidence-based analysis and international experience, this report aims to support the Government of the Philippines and AZEC partners in identifying practical pathways to enhance security of supply, affordability, resilience and sustainability, consistent with national development objectives.

Introduction

The Energy Transition Review for Enhancing Co-operation report was conducted by the IEA at the request of the Asia Zero Emission Community (AZEC) as set out in the 3rd AZEC Ministerial Meeting Joint Statement. The initiative recognises the importance of enhancing the overall understanding of the challenges each country faces in its respective transition pathway, encourages the exchange of best practices and experiences in energy policy development and identifies areas for co-operation among AZEC partner countries. AZEC partner countries include Australia, Brunei Darussalam, Cambodia, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, the Philippines, Singapore, Thailand and Viet Nam.

The Philippines is the focus of the first Energy Transition Review for Enhancing Co-operation under the AZEC initiative. This work was undertaken in close collaboration with national and regional partners in the Philippines through peer-review discussions and joint scoping with the Department of Energy (DOE) of the Philippines. The IEA led the review in collaboration with the DOE of the Philippines, the Economic Research Institute for the Association of Southeast Asian Nations (ASEAN) and East Asia (ERIA), and Japan's Ministry of Economy, Trade and Industry (METI). The report draws on robust IEA analysis across the energy sector and on the IEA's global expertise to identify case studies and international best practices, as well as key insights for enhancing co-operation.

The objective is to build a shared understanding of the challenges and opportunities for the power sector in this country's transition. It is also to facilitate the exchange of best practices between AZEC partners and highlight areas where enhanced co-operation could strengthen energy security, improve affordability and support the Philippines in achieving its long-term clean energy goals.

Like many other economies in Southeast Asia, the Philippines is entering a critical phase of its energy transformation. The country's aim is to achieve a clean energy transition that is affordable and equitable, while ensuring a secure and resilient energy supply. These priorities correspond to the Philippines' objectives in terms of access to affordable energy; reliability and resiliency of the energy supply; and clean and sustainable energy (ARC), as introduced in the Philippine Energy Plan (PEP) 2023-2050.

These long-term ARC objectives are consistent with the AZEC concept of a "triple breakthrough", which acknowledges the need to simultaneously advance climate mitigation, economic competitiveness and energy security. While the community shares the long-term goal of achieving net zero emissions, the AZEC principles emphasise that the pathways to achieving this goal will differ from country to country ("one goal, various pathways") given their distinct national circumstances, industrial structures and geographies.

For the Philippines, these differences are particularly notable. As a vast archipelago with high level of exposure to climate change and natural hazards, the country's circumstances are distinct. Factors such as system security, regional accessibility and the robustness of critical infrastructure have therefore received greater consideration in the country's energy transition planning. The conflict in the Middle East has disrupted supply flows and put pressure on fuel prices and trade, underscoring the need for a continued focus on energy security and affordability. In response to the energy crisis, the Philippines declared a national energy emergency and implemented a range of measures, including demand reduction policies, subsidies and relief to ease affordability pressures, as well as initiatives to diversify supply sources.

This review focuses on the Philippine power sector and the policies required to achieve a decarbonisation pathway with a secure energy future. An overview of the power sector highlights demand trends and drivers, as well as sources of supply. The review then explores the policy and regulatory landscape of the power sector and continues with an overview of key energy security risks and opportunities. Three priority focus areas, identified in collaboration with the DOE will be analysed: Nuclear energy, grid modernisation and energy resilience. Nuclear power is being considered to help meet rapidly expanding electricity demand with a stable and low-emissions power source. Grid modernisation and system flexibility, as well as the resilience of the power system infrastructure, are key to ensuring energy security and affordability. Finally, the review provides a set of policy recommendations and co-operation opportunities that can help strengthen energy security, enhance affordability and facilitate the Philippines' long-term energy transition.

Power sector overview

Electricity demand in the Philippines is rising

In 2022, electricity consumption made up almost 22% of the total final energy consumption in the Philippines. Electricity demand is rising rapidly, with a compound annual growth rate of 4% from 2018 to 2025. According to the DOE, in 2024, electricity consumption was primarily concentrated in the residential (32%), industrial (24%) and commercial (22%) sectors. The transport sector accounts for a negligible share, reflecting slow electrification of the transport fleet in the Philippines. The electricity demand of the Philippines is expected to grow at an annual average of 5.4% y-o-y in 2025-2030, driven by sustained economic and population growth, industrial development and wider electrification.

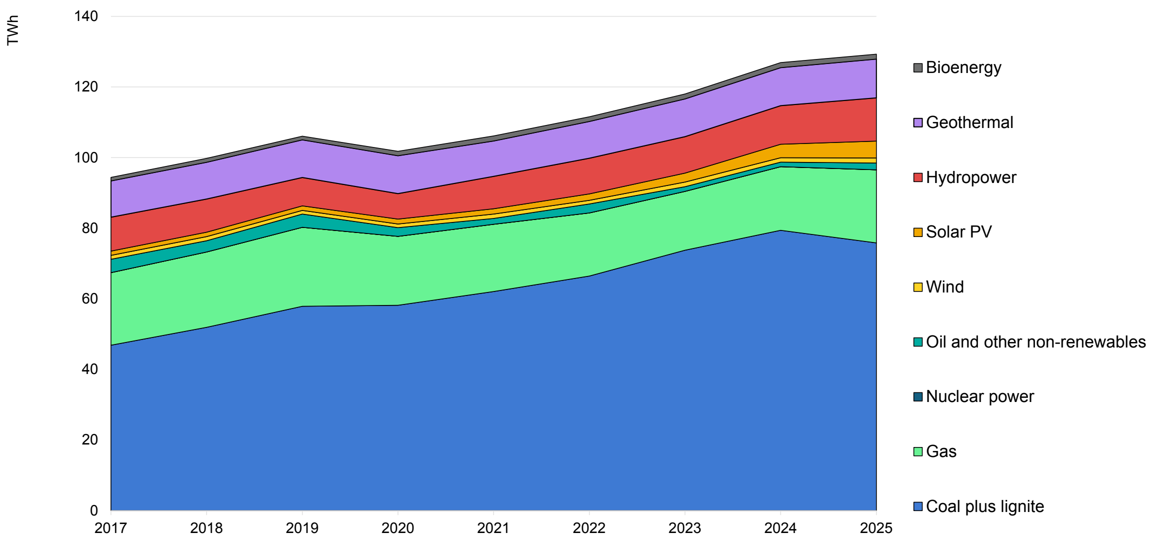
Total non-coincidental peak demand in the Philippines increased by over 5% annually on average between 2015 and 2024, rising from around 12.2 GW to almost 19.3 GW. This overall rise included a 11% increase between 2023 and 2024 alone. Cooling demand is low in the Philippines, but is expected to grow significantly as rising incomes, population growth and rising temperatures drive the increased adoption of cooling systems.

While fossil fuels continue to dominate supply, renewables are expanding rapidly

The Philippine power generation capacity has grown steadily, totalling 29.7 GW of installed capacity in 2024. Fossil fuels account for most of the electricity generation in 2025, with coal at 59%, gas at 16% and oil at 1%. It is expected that coal will remain the dominant source of electricity generation in the Philippines, declining from 59% in 2025 to around 54% by 2030. Natural gas is also expected to continue playing an important role in electricity generation, although average annual growth is anticipated to be moderate at 3.5% per year until 2030, down from 15% in 2025. Before 2025, domestic gas production came entirely from the offshore Malampaya field, where production has been declining. To meet the rising demand, the country began importing liquified natural gas (LNG) in 2023, with imports expanding in both 2024 and 2025. However, given new gas discoveries in January 2026 at Malampaya East-1, the decline in domestic gas production is expected to reverse temporarily in the coming years. Taken together, coal and gas are expected to continue accounting for the majority of electricity supply in the short and medium term, while renewables may see rapid expansion in the longer term, aligned with Philippine Energy Plan (PEP) 2023-2050 targets. Over the longer term, coal and gas are nevertheless likely to continue playing a supporting role in maintaining the reliability and flexibility of the power system. Reflecting this ongoing demand for fossil fuels, emissions intensity in the Philippines reached 703 grammes of carbon dioxide per kilowatt hour (g CO_2/kWh) in 2025, the third highest in the region.

As of 2025, renewables made up 24% of total electricity generation. In 2025, renewable electricity generation grew by a record 9.5% y-o-y, up from 7.2% growth in 2024. This growth was driven by a substantial y-o-y growth rate in solar PV (25%), wind (17%) and hydropower (12%). Among renewables, hydropower and geothermal provided by far the largest generation in 2025 at 12 TWh and 11 TWh, respectively, while variable renewable energy (VRE) accounted for 5% – around 6 TWh of total generation. In terms of installed capacity, according to the DOE, renewables accounted for 32% in 2025, at 10.6 GW, a 11% y-o-y growth from the 2024 capacity of 9.5 GW. Solar recorded the most significant growth among renewables, with installed capacity growing 31% y-o-y from 2024 to 2025.

Electricity generation by source in the Philippines, 2017-2025



Notes: Solar PV = solar photovoltaics; TWh = terawatt hour.

To help meet growing electricity demand and enhance energy security through diversification, the Philippines is planning a rapid scale-up of renewables. The PEP 2023-2050 targets aim to achieve a 35% share of renewables in the power generation mix by 2030 and 50% by 2040 – more than twice today's levels. Between 2025 and 2030, the country is projected to add nearly 15 GW of new renewable capacity, with solar PV and onshore wind accounting for almost 90% of the expected additions.

As of December 2025, the Philippines had only 518 MW of installed wind capacity, all onshore. However, with 17 000 kilometres of coastline, there is excellent untapped technical potential for offshore wind, estimated at over 178 GW. By 2024, there were 92 offshore wind service contracts representing 65 GW of awarded capacity. The DOE launched its Fifth Green Energy Auction (GEA-5) in June 2025, offering 3.3 GW of fixed-bottom offshore wind capacity. By 2030, the total installed capacity of wind power in the Philippines is forecast to reach 3.9 GW.

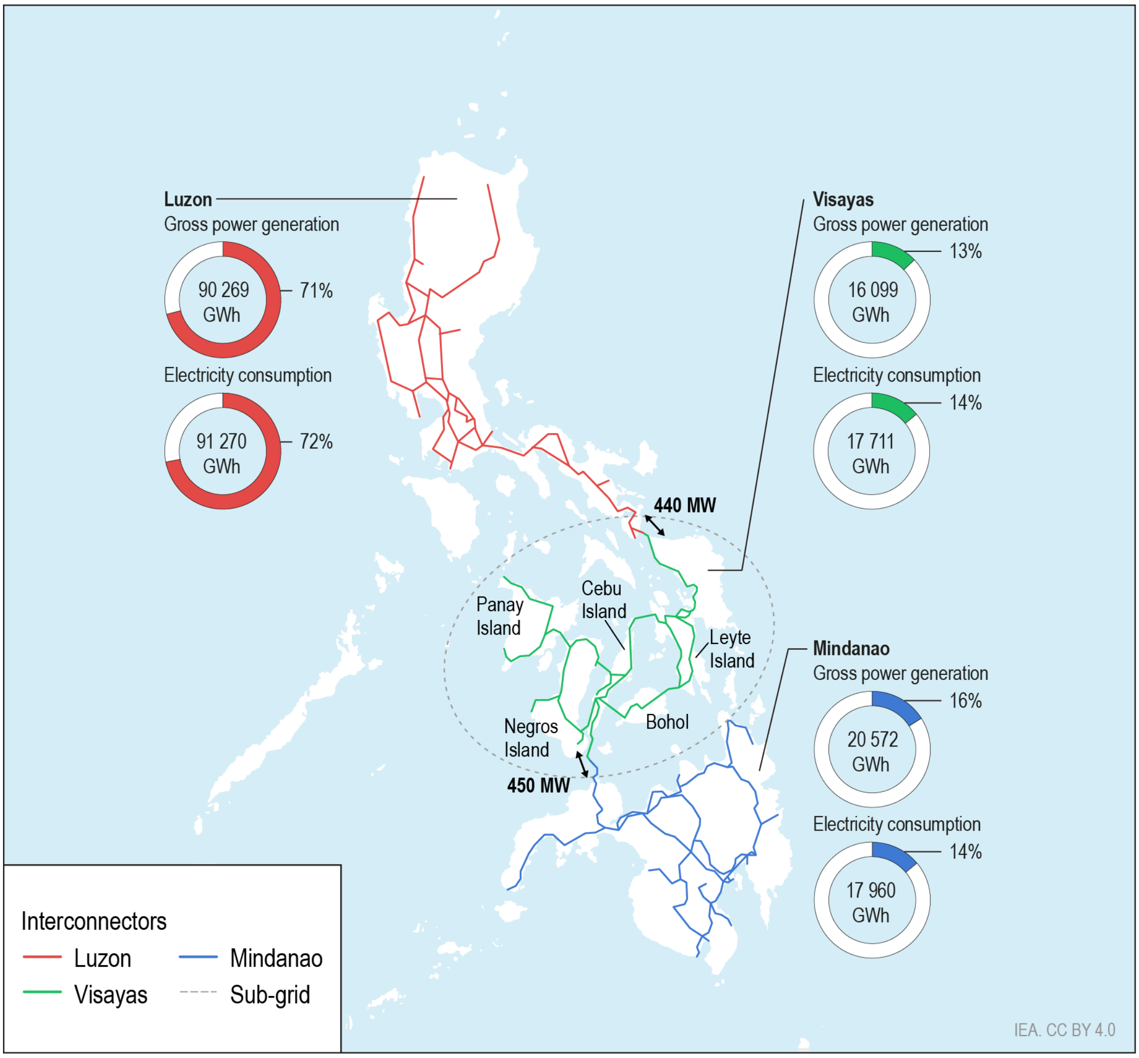
To support grid reliability and the integration of solar and wind, the Philippines is planning to expand its battery energy storage systems (BESS). The National Grid Corporation of the Philippines (NGCP) Transmission Development Plan 2025-2050 reported 1.9 GW of committed BESS projects and 2 .5 GW of indicative BESS projects.

The Philippines sits on the Pacific Ring of Fire and holds considerable potential for the development of geothermal resources in terms of both heat/cooling supply and electricity. It is one of the top ten largest geothermal consumers today at 11 TWh in 2025, contributing 9% to total electricity generation. Geothermal power generation is expected to grow by 0.9% y-o-y in the period 2026-2030.

The Philippines' three main grids have different energy systems and needs

The electricity system in the Philippines is divided into three main grids: Luzon, Visayas and Mindanao, all of which have different infrastructure and operational needs. The Visayas grid consists of five interconnected sub-grids. Interconnection between the three main grids was achieved in 2024 with the completion of the 350 kilovolt high-voltage direct current (kV HVDC) 450 MW Mindanao–Visayas Interconnection Project. These interconnections have improved security of supply by allowing the regions to share generation resources. The Philippines aims to achieve 100% electricity access by 2028. While access challenges remain to promote electrification in unserved and underserved areas – particularly in the rural and remote island barangays of Mindanao –, the government is leveraging microgrids as a key strategy. According to the DOE, a microgrid system is a group of interconnected loads and a generation facility or decentralised power generation with clearly defined electrical boundaries, which acts as an integrated power generation and distribution system, whether connected to a distribution or transmission system. The government has developed guiding regulations, such as the 2021 Microgrid Systems Act, and launched microgrid system auctions.

Existing Philippine network topology



Notes: GWh = gigawatt hour; MW = megawatt.

Source: IEA analysis based on National Grid Corporation of the Philippines (2025), Transmission Development Plan 2025-2050; Department of Energy Philippines (2025), Energy Statistics.

Performance statistics of the three main grids, 2024

Grid	Renewable shares in installed capacity	Electricity access rates	System peak demand	% of country peak demand
Luzon	27%	98.8%	14.0 GW	73%
Visayas	51%	95.2%	2.7 GW	14%
Mindanao	32%	83.2%	2.6 GW	13%
Philippines	**31%**	**94.75%**	**19.3 GW**	**100%**

Source: Department of Energy Philippines (2025), Energy Statistics, List of existing power plants, Philippine Energy Plan and Transition Strategies presentation, Philippine Energy Transition Dialogue 2025.

Cross-border interconnections can support energy security, but progress is uneven

In addition to domestic grid interconnections, cross-border interconnection has been a cornerstone of regional energy co-operation since the ASEAN Power Grid (APG) was included in the ASEAN Plan of Action for Energy Cooperation in 1997. The Lao PDR-Thailand-Malaysia-Singapore Power Integration Project, initiated in 2022 as the first multilateral power project in ASEAN, entered Phase 2 in January 2026, increasing total capacity of traded electricity to 200 MW.

In 2023, the Brunei Darussalam-Indonesia-Malaysia-Philippines Power Integration Project (BIMP-PIP) was launched, aiming to channel low-cost hydropower and other renewables from Borneo towards demand centres in Malaysia and the Philippines (Palawan/Mindanao), and helping to strengthen regional adequacy, reduce dependence on fossil fuels and improve system flexibility. Under the BIMP-PIP, the Philippines-Sabah interconnection, connecting Malaysia to Palawan in the Philippines, is among the priority projects, with projected installed capacity of 196 MW by 2040.

The BIMP-PIP serves as a pilot framework for the Philippines to participate in broader APG co-operation and regional electricity trading. The development of interconnection projects could be supported by addressing financing challenges, cross-border regulatory alignment and the need for domestic grid improvements in the Philippines. Connecting Palawan to the main transmission backbone in Mindoro and Luzon could help in particular to increase reliability and security of supply.

The Philippines electricity market

The Philippines' power industry is structured into four sectors, according to the 2001 Electricity Power Industry Reform Act (EPIRA), as follows:

- Generation – This sector is largely privatised and competitive. It consists mainly of privately-owned generation, but some facilities remain government-owned and are operated mainly by private companies. Generators sell electricity via bilateral contracts or via the Philippines Wholesale Electricity Spot Market (WESM).
- Transmission – This sector comprises a regulated natural monopoly of high-voltage grids that connect generation facilities to the grid. The transmission assets are owned by the government but franchised to the NGCP, which operates and maintains the grids, and oversees grid planning under the regulation of the Energy Regulatory Commission (ERC).
- Distribution – This sector represents a regulated monopoly of low-voltage grids that connect the grids to end users. Distribution utilities operate in franchise areas and include private companies that are operating in urban areas and electric co-

operatives that are operating co-operatives in rural areas. According to the World Bank, electric co-operatives provide electricity to 55% of the country's households.

- Supply – This sector consists of licenced retail electricity suppliers selling directly to eligible contestable customers. Distribution utilities supply the electricity to captive consumers. Retail tariffs and price adjustments are regulated by the ERC.

EPIRA mandates the ERC to promote competition, foster market development, allow consumer choice and penalise the abuse of market power by establishing a level playing field in the competitive retail electricity market.

The liberalised electricity market is in transition to facilitate the integration of renewables and new technologies

The Philippines is the only liberalised electricity market in Southeast Asia apart from Singapore, and it is still undergoing development. The WESM is a centralised venue for power trading where spot prices are determined on the basis of a competitive process. The WESM began commercial operations in Luzon in 2006, in Visayas in 2010 and in Mindanao in 2023. Key stakeholders in the WESM include the Philippine Electricity Market Corporation (PEMC), which is responsible for governing the WESM and ensuring market competition, and the Independent Electricity Market Operator of the Philippines (IEMOP), which operates the market and day-to-day trading.

Liberalisation plan of electricity market in the Philippines

Philippine electricity market

Short term
2023-2024

- Full commercial operation of the WESM in Mindanao
- Commercial operation of the initial reserve market (Phase 1)
- Policy support to Renewable Portfolio Standard compliance
- Electricity derivatives market study (contract for difference)

Medium term
2025-2028

- Implement the enhanced reserve market (Phase 2)
- Implement electricity derivatives market (contract for difference)
- Improve market design and rules
- Study market design to allow higher RE penetration and EV demand response

Long term
2029-2050

- Continue the improvement and enhancement of the electricity market design and rules
- Enhance market design to facilitate integration of RE and EVs in the electricity market

2050 Objective: Transparent and fair playing field in the power industry

Notes: EV = electric vehicle; RE = renewable energy; WESM = Philippines Wholesale Electricity Spot Market.
Source: Department of Energy Philippines (2025), Power Development Plan 2023-2050.

In terms of dispatch, WESM uses a sophisticated market dispatch optimisation model that co-optimises energy and reserves every five minutes to determine dispatch targets on the basis of offers and bids from market participants. This model is comparable to those in developed electricity markets, such as that in Australia or in California. Generating units are categorised according to dispatch order on the basis of technology type and unit size. Renewable generating units are given preferential (must or priority) dispatch to the grid. Generators also have the option to sell electricity through bilateral contracts, with the prices determined and settled outside the WESM. Bilateral trading accounts for the majority of electricity transactions, representing around 77% to 88% of total transacted quantities in 2025.

Generating unit categories in the Philippines Wholesale Electricity Spot Market

Generation category	Fuel and technology types included
Must-dispatch unit	VRE, primarily solar PV and wind (including VRE eligible feed-in tariffs)
Priority dispatch unit	Other renewable energy technologies, such as geothermal, hydropower and biomass
Self-scheduled dispatch unit	Must-dispatch units and priority dispatch units, as well as other small or special-category generators operating outside the market schedule
Scheduled generating unit	Large conventional thermal plants, including coal-, oil-, and gas-fired generation. Price bids are submitted and dispatches are made in order of merit, forming the market clearing price

Notes: Solar PV = solar photovoltaics; VRE = variable renewable energy.

The recent modifications in electricity market mechanisms, particularly the introduction of the reserve market and the continued development of the Green Energy Auction (GEA) program, support investment in renewable generation projects and in the system flexibility resources required for effective renewable integration. Further market design improvements are ongoing, including optimisation of energy and reserve markets, refinement of ancillary service products and updates to the GEA design, all of which aim to increase investor confidence in bankable renewable projects. The reserve market and the GEA are discussed in more detail in subsequent sections.

Ancillary services in the Philippines are evolving to meet growing flexibility and reliability needs

The Philippines has been developing an ancillary services procurement framework to support the reliability, stability and operational efficiency of the grid. The NGCP, as the transmission system operator, is responsible for determining and procuring ancillary service products, which are divided into three major types: 1) frequency control ancillary services composed of regulating reserve, contingency reserve and dispatchable reserve; 2) reactive power support for voltage control; and 3) black start services for system restoration following a system-wide blackout (see Annex B for the required level of ancillary services).

Frequency control ancillary services can be sourced through bilateral contracts under the Ancillary Services Procurement Agreement and through the Reserve Market, which was launched in January 2024 to increase competition. Currently, at least half of frequency control ancillary service needs (regulating, contingency and dispatchable reserves) must be met by firm contracts, with the remainder being met by spot market transactions. Reactive power support and black start services continue to be entirely contracted.

Policy and regulatory landscape

Key institutions manage the power sector in line with energy policy priorities

The Department of Energy (DOE) is responsible for long-term energy planning and for the establishment of national energy policies. These policies include the Philippines Power Development Plan (PDP) 2023-2050 and the Philippine Energy Plan (PEP) 2023-2050. The Energy Regulatory Commission (ERC) serves as the independent market regulator to enforce market rules, grant permits and approve grid tariffs, with the costs passed on to consumers. Since the unbundling of the Philippines' power market, the National Power Corporation (NPC) is now responsible for the off-grid electrification of remote islands and the operation of state-owned hydropower generation. The electrification of islands that are unable to attract private investment is conducted through the Small Power Utilities Group (NPC-SPUG). Since the 2001 Electricity Power Industry Reform Act (EPIRA), the Philippines' generation capacity has been mostly privatised, and new generation is created almost exclusively by private independent power producers. The Power Sector Assets and Liabilities Management Corporation, tasked with managing the privatisation of public assets, retains ownership of some older oil-fired power plants and hydropower facilities. With increasing generation capacity coming online, the share of public ownership will most likely continue to diminish over time.

The National Grid Corporation of the Philippines (NGCP) has functioned as the transmission system operator since 2009. After a competitive bidding process in 2007, the NGCP – a private consortium of three companies – holds a 25-year concession contract and a 50-year franchise to operate the power transmission network in the Philippines. The NGCP has the right to construct, maintain, operate and expand transmission assets and related facilities in the country. These assets and facilities are owned by the National Transmission Corporation, a government-owned and controlled corporation. Both the transmission system operators and the distribution system operators are subject to the ERC regulations and electricity rate. Operators are able to recover operating and maintenance costs, tax other than income tax, and an approved return on capital, in accordance with the performance-based regulation framework.

Policy directions aim to achieve energy security, resiliency and affordability

Government policies are guided by the PDP 2023-2050 and the PEP 2023-2050.

The PDP highlights the need for reducing electricity costs, co-ordinating public-private investments in energy infrastructure, optimising the fuel mix by diversifying away from imported fossil fuels, strengthening demand-side management and investing in clean energy. The PEP is a comprehensive energy strategy to develop a secure, affordable and sustainable energy system. It outlines targets and policy directions that will lead to cleaner energy through increased renewable energy deployment, energy efficiency, grid modernisation and investment in a resilient power infrastructure. The PEP also sets out a phased roadmap for the electricity market which uses electricity market reform as a key lever to achieve renewable generation targets. Over the long term (2029-2050), the roadmap emphasises refinement of market design to accommodate higher renewable penetration and emerging loads, such as electric vehicles and the introduction of a capacity market.

The PEP consists of two main scenarios. The reference scenario targets a 35% share of renewable energy in electricity generation by 2030 and 50% between 2040 and 2050, in alignment with the National Renewable Energy Program. The clean energy scenarios are more progressive with a target of more than a 50% share of renewable energy by 2050, including the deployment of offshore wind up to 50 GW by 2050 and nuclear power starting in 2032. The PEP supports the country's long-term AmBisyon Natin 2040 vision to become a prosperous, predominantly middle-class society by 2040. The vision also emphasises universal access to reliable and affordable energy, encouraging investment in renewable energy and energy efficiency to help meet growing energy demand without increasing emissions.

Power sector policies support renewable energy development

Beyond the PEP and PDP, a range of policies relating to the power sector are in place to guide generation development, and more particularly to stimulate renewable energy (see the detailed overview in Annex A). The Renewable Energy Act, for example, was passed in 2008 to promote the development, utilisation and commercialisation of renewable energy resources. Different renewable energy policy mechanisms were mandated in this Act, which was later expanded through the DOE Circular on Implementing Rules and Regulations. The DOE Circular includes support measures such as feed-in tariff systems and net metering. In June 2022, the government updated the National Renewable Energy Program, building upon the Renewable Energy Act from 2008 and the country's commitments in terms of its 2021 Nationally Determined Contributions (NDCs).

The renewable energy market was established by virtue of the 2008 Renewable Energy Act to trade renewable energy certificates. Renewable portfolio standards (RPS) were implemented in 2017 for on-grid areas and in 2018 in the case of off-grid areas, mandating that a specified share of electricity should come from renewable energy. The full commercial operations of the renewable energy market was launched on December 2024. The Energy Regulatory Commission also set a price cap on renewable energy certificates in 2024 of 241.56 PHP (Philippines pesos) per megawatt hour, or around 4 USD/MWh to avoid pushing up retail tariffs.

Since 2021, the Green Energy Auction (GEA) has been introduced as a national mechanism to accelerate renewable energy capacity development in the Philippines. More than two-thirds of capacity growth in renewables is set to come through the GEA, supplemented by bilateral contracting under RPS. The regulator sets a ceiling price for the competitive bidding process. The winning independent power producers are given 20-year power supply contracts at the awarded strike price, which is called the Green Energy Tariff.

Auction rounds in the Green Energy Auction

Round	Year	Capacity	Technology	Delivery
1	2022	1.9 GW (awarded)	Solar (ground-mounted), onshore wind, hydro, biomass	2023-2025
2	2023	3.4 GW (awarded)	Solar PV (ground-mounted, rooftop, floating), onshore wind	2024-2026
3	2025	6.7 GW (awarded)	Impounding hydro, pumped-storage hydro, geothermal	2025-2035
4	2025	10.2 GW (awarded)	Solar PV (ground-mounted, rooftop, floating), onshore wind, integrated solar with BESS	2026-2029
5	2025	3.3 GW (target)	Offshore wind	2028-2030

Notes: BESS = battery energy storage systems; GW = gigawatt; solar PV = solar photovoltaics.

Source: Department of Energy Philippines (2022), GEA-1 Notice of Award; Department of Energy Philippines (2023), GEA-2 Notice of Award; Department of Energy Philippines (2025), GEA-3 Press Release; GEA-4 Press Release; GEA-5 Notice of Auction.

Executive Order No. 21 underlines the need to streamline and expedite the approval process through the creation of a unified permitting system to develop offshore wind. Accordingly, to accelerate progress and encourage investments in offshore wind, the DOE launched a guidebook to facilitate the deployment and permitting processes relating to offshore wind. This guidebook provides a practical roadmap for developers and agencies.

In addition to promoting new renewable energy capacity, the DOE also recently introduced a mandate for prospective variable renewable energy (VRE) power plants with an installed capacity of 10 MW and above to integrate energy storage systems with a capacity of at least 20% of the plant's installed capacity as part of project development and grid integration. The draft revised Philippines Grid Code 2026, under public consultation since January 2026, includes proposed revisions to recognise utility-scale solar PV, (BESS) and hybrid power plants as active participants in grid operations rather than as passive electricity sources. Such changes could help strengthen grids and system reliability, while further integrating renewable capacity.

To accelerate the deployment of renewable energy and meet environmental targets, the Department of Energy (DOE) implemented a coal moratorium in 2020 for new coal-fired power plants. In the PEP reference scenario, coal capacity will only increase to 14.7 GW by 2027 and plateau until 2050. However, in 2025, a clarification on the non-coverage to the coal moratorium policy was issued, exempting coal-fired power projects used for the mining and processing of critical minerals, for industrial own-use and for off-grid areas. This exemption allows for around 2 GW of new coal capacity.

Supporting policies focus on demand-side factors

With quickly rising demand, energy efficiency remains a priority for the Philippines. By 2040, the Philippines is targeting an energy intensity reduction of 3% across all sectors compared to 2024 levels, and at least 10% electricity savings by 2040 compared to 2016 business-as-usual levels. The Philippines' energy efficiency policies are anchored in the framework of the 2019 Energy Efficiency and Conservation Act (Republic Act No. 11285) and the National Energy Efficiency and Conservation Plan and Roadmap 2023-2050, which mandate energy audits, minimum energy performance standards, labelling for appliances, energy management and incentives for energy efficiency.

Improvements in energy intensity were made at almost 2% per year in the Philippines between 2010 and 2019, and yet recent improvements have dropped to almost zero from 2019-2023, lower than Viet Nam at 3% and Malaysia at 0.3%. Under the Economic Research Institute for ASEAN and East Asia (ERIA) business-as-usual scenario, the annual energy intensity improvement is expected to reach an average rate of 1.3% for 2019-2050.

Recognising the potential for demand-side management and digitalisation to reduce the load on the electricity system, the Philippines aims to transition its power system into a smart grid by 2040. In 2025, the Philippines updated its

Advanced Metering Infrastructure Rules, which will ensure real-time data on electricity consumption, outage detection and remote management capabilities.

The country's climate-related targets also shape power sector planning. The Philippines is one of two ASEAN member states without formal net zero emission or carbon neutrality targets. However, low-carbon transition is highlighted under the PDP to address both climate change and disaster resilience. The first NDC submitted by the Philippines in 2021 includes an economy-wide target to reduce emissions by 2.71% by 2030 compared to the business-as-usual scenario between 2020 and 2030, with a commitment to reduce emissions by up to 75% by 2030, conditional on international support. The Asian Development Bank has estimated that the total costs to implement this NDC will be over USD 72 billion. While the NDC does not specify from where the emissions reduction would emanate, electricity, heat producers and transport were the highest emitting sectors in 2023.

Challenges and risks

Risk profile by power generation source

Energy source	Share of generation mix (2025)	Main risks
Coal	59%	High import dependence with more than 95% of imports coming from Indonesia. High energy security risk due to generation share and import concentration.
Natural gas	16%	Low risk given new discoveries, increasing to medium risk over the medium term if LNG imports expand. Execution risk around the proposed LNG-to-power project.
Hydropower	9%	Extensive droughts could threaten hydropower output. Uncertainties concerning the impact of climate change on El Niño-Southern Oscillation cycles. Moderate risk to generation output driven by climate-related factors.
Geothermal	9%	Large initial investment and high upfront risk for exploration and drilling. Overlapping permitting and multi-agency approval results in delays in development. Low operational risk but moderate project development risk. New technologies may enable access to untapped resources.
VRE (wind and solar PV)	5%	Low risk given low current shares, but the variability of solar PV and wind, difficulties relating to land acquisition and grid connection bottlenecks require proactive measures to accommodate the planned growth of VRE.
Biomass	1%	Low system-wide energy security risk given very low share. Scalability challenges due to transportation cost. Risks of biodiversity loss and risks to public health.
Oil	1%	Low system-wide risk given low share but high price volatility risk for remote and off-grid areas dependent on diesel. Oil consumption is dependent on imports.

Notes: LNG = liquified natural gas; solar PV = solar photovoltaics; VRE = variable renewable energy.

Fuel supply has high import dependence with supplier concentration

In 2023, more than half of the total primary energy supply in the Philippines was imported. In the case of coal in particular, it represents 34.5% of the total primary energy supply, of which 66% is imported. Coal import supply is highly concentrated, with Indonesia accounting for more than 95% of imports.

Though the share of oil in the power sector is low, overall net imports are equal to 95% of crude oil supply and more than 80% of oil products final consumption in the Philippines. In 2023, crude oil imports to the Philippines were sourced almost solely from the Middle East, namely from Saudi Arabia (50.8%), the United Arab Emirates (30.7%) and Iraq (12.6%). Furthermore, 97% of liquid petroleum products and 91% of LPG are imported from Asian refineries.

The Philippines began importing LNG in 2023 with an estimated 0.4 billion cubic metres (bcm) that year, initially through two existing import terminals with a combined capacity of 6.1 bcm/yr. The PEP estimates that LNG imports will accelerate by 8.3% per year in 2023-2050 to offset the declining production of the country's primary gas field, Malampaya, which was projected to be depleted by 2027. The Philippines plans to develop seven LNG projects in the period 2022-2050, with total capacity at 16.2 bcm/yr. However, as of 2025, the country was only using 60% capacity of the existing two terminals, which represents a decrease in momentum in terms of future developments. In addition, in early 2026, two significant domestic gas discoveries were achieved under the Malampaya Phase 4 drilling campaign, both with initial testing flow at 60 Mcf per day. The first reservoir, Malampaya East 1, has estimated reserves of approximately 98 Bcf of gas, as well as condensate. The second reservoir, Camago-3, has estimated recoverable gas volumes that are around 2.5 times greater than those of Malampaya East 1. These volumes are believed to be high-productivity resources that can boost the previously declining domestic gas output, thereby reducing LNG import needs over the next few years.

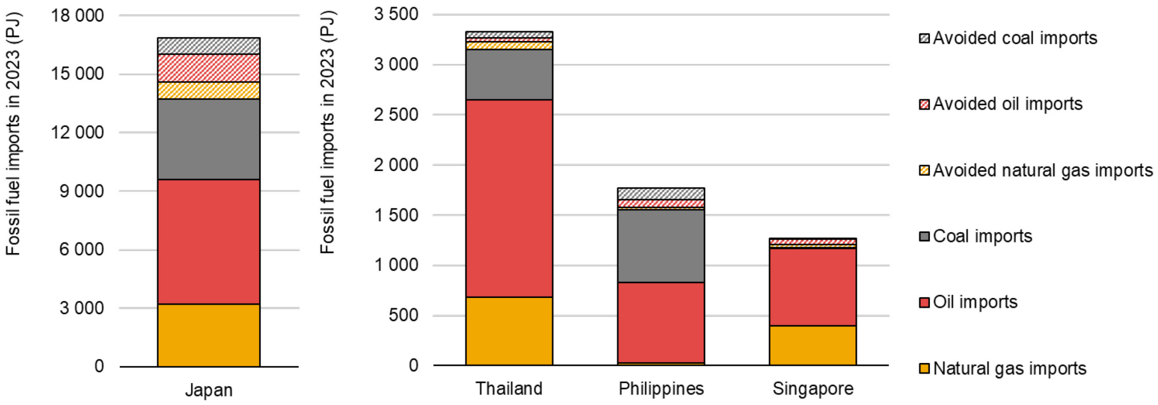
According to the 2025 ERIA price volatility index, the Philippines is the second most exposed country in ASEAN, reflecting its heavy dependence on imported fossil fuels. This dependence has already led to supply challenges, such as the electricity supply crunch in 2022, when falling domestic gas production coincided with Indonesia's temporary coal export ban. Adding to this challenge, in 2026, the Government of Indonesia is considering imposing a 1-5% tax on coal exports.

The Philippines, along with other countries in Southeast Asia, face fresh uncertainty from the 2026 conflict in the Middle East, which disrupted oil and gas supply flows through the Strait of Hormuz. Following the conflict, energy markets across regions, including Asia, experienced heightened price volatility, highlighting the importance of stable maritime trade routes for import-dependent economies. The Philippine Information Agency reported that these disruptions have translated into domestic fuel price increases.

Dependence on imported fuels is particularly challenging for low-income households and off-grid areas. The National Power Corporation (NPC) Small Power Utilities Group (SPUG) operates 272 power plants in off-grid islands, most of which rely on diesel. In 2023, 8 120 million litres of diesel were imported, covering 73.2% of total domestic diesel demand. To reduce the risks of curtailment and to diversify and reduce fuel imports, in 2023 the Department of Energy directed the NPC to stop procuring new diesel gensets. Hybridisation and the integration of renewable energy to NPC-SPUG areas could help reduce energy security risks resulting from the diesel dependence of communities where grid connections are unlikely in the short to medium term.

Energy efficiency measures can contribute to a rapid response in the case of a supply crunch in an effort to help balance energy markets. During the 2022 energy crisis, efficiency actions accounted for two-thirds of gas demand savings in European households. Higher prices and supply constraints in 2026 have prompted interim demand-side adjustments in the Philippines, including the contingency measure allowing for the use of Euro 2 fuels for industrial and transport sectors, the four-day work week for public offices and enhanced energy audits to cut electricity use. Demand-side measures can also support long-term reduction of import dependence, with some of the highest savings and most cost-effective demand reductions coming from policy measures that have been in place for longer periods.

Fuel imports in 2023 and avoided imports resulting from energy efficiency improvements, 2000-2023



Notes: PJ = petajoule. Fuel imports are net from exports, marine bunkers and aviation bunkers. Savings in the Philippines include those relating to efficiency progress in industry and buildings. Savings in Singapore include those relating to efficiency progress in industry, buildings and transport. Savings in Thailand include those relating to efficiency progress in industry and buildings.

Singapore: Standby LNG facility helps reduce risk of import dependence

Imported natural gas accounts for around 94% of Singapore's electricity generation. In response to the global energy crisis in 2021-2022, Singapore established the Standby LNG Facility and implemented new rules for fuel reserves in order to avoid supply disruptions, ensure continuity of power services and reduce volatility in power prices. Power generation companies can draw from this LNG facility when natural gas supplies are, or have the potential to be, disrupted. All power generation companies are also mandated to contract sufficient backup fuel for retail demand. In 2024, Gasco was created to centralise upstream gas procurement so as to aggregate demand.

Since 2003, the DOE in the Philippines has mandated that oil companies and bulk suppliers are to maintain a mandated 15 days' supply of oil supply and a 7-day supply of liquefied petroleum gas, while oil refiners need to maintain a 30-day supply of crude oil and petroleum products, and none for natural gas or LNG. In response to the disruption caused by the Middle East conflict in 2026, the Philippines' fuel reserve was increased to approximately 50 to 60 days of supply, yet it remains constrained by limited storage capacity.

In the Philippines, supply chain resilience is an important part of climate resilience, particularly as LNG imports are expected to grow and be physically concentrated in specific hubs (e.g. in Batangas). Singapore's model shows how contingency arrangements, such as the standby LNG supply and backup fuel requirements, can be codified so as to prevent disruptions.

To reduce import dependence in the power sector, the Philippines has been expanding gas exploration projects and working to develop the domestic supply of renewable energy. In addition, to mitigate import dependence throughout the supply chain, the Philippines has focused on critical minerals, which are an increasingly important pillar of energy security, given the highly concentrated supply chains for solar, batteries and the other technologies required for the future of the Philippines' power sector. The Philippines accounted for approximately 10% of global mined output in 2024, second only to Indonesia. It is primarily exported for stainless steel and lithium-ion batteries. However, unlike in Indonesia, the Philippines has very little nickel refining capacity. In early 2025, after industry pushback, the Philippines scrapped a planned ban on nickel ore exports that would have begun in 2030.

Beyond upstream critical minerals development, the Philippines has enacted policy measures aimed at developing downstream clean energy manufacturing, although these efforts remain at an early stage. Manufacturers of renewable energy components, including solar modules and energy storage systems, can access fiscal and non-fiscal incentives through the Philippine Economic Zone Authority and the Board of Investments, since these activities are listed as priorities under the Strategic Investment Priority Plan.

Access and affordability are shaped by market dynamics and geographic constraints

The Philippines has the second highest electricity prices in Southeast Asia, with household electricity expenditures at around 11% of monthly income in 2023. These prices are due to various factors, which include the cost-recovery regulation that passes through generation, the transmission and distribution costs of services to end users with minimal subsidies and the heavy reliance on imported fossil fuels for power generation. The generation charge accounts for the highest share of the electricity rate, at around 64%. Transmission charges directed to the transmission system operator account for around 8%. However, transmission charges include costs from the Reserve Market and Ancillary Services, which are ultimately charged to end users. Distribution charges account for 12%, and system loss charges represent 5%.

The Philippines, under energy sector reforms, had removed most market-distorting energy subsidies, retaining only a few subsidies targeting low-income households. These subsidies include the Lifeline Rate Program, a socialised pricing mechanism for qualified consumers determined by the Energy Regulatory Commission (ERC). There is also the Universal Charge for Missionary Electrification, which is collected from all on-grid consumers to subsidise electricity services in off-grid and remote areas.

During periods of crisis, the government may nevertheless intervene to safeguard energy access and affordability. In March 2026, a state of national energy emergency was declared amid fuel supply disruption and price surges driven by the Middle East conflict. The ERC suspended the Philippines Wholesale Electricity Spot Market (WESM). The DOE, jointly with electric power industry participants, was in charge of formulating detailed rules for the WESM and of governing its operations. The government also introduced new fuel subsidies for targeted groups, including transport workers, farmers and fishers.

Other factors contributing to high retail prices are limited competition at the retail and generation level, domestic taxation and inefficiencies. The Electricity Power Industry Reform Act (EPIRA) mandates that generation be procured in a least-cost manner, and yet there is a lack of binding measures and incentives for distribution utilities to do so. The adoption of the cost-plus approach in regulating individual power supply agreements allows costs to be passed to consumers. Long-term bilateral supply agreements have locked in higher prices, negating competitive market pricing, even when spot prices in the WESM decline. Since the establishment of WESM in 2006 until 2016, the WESM spot price was on average 16% lower than the generation charges of Meralco, the biggest distribution utility in Luzon. Therefore, lower electricity prices in the competitive market are not necessarily passed on to consumers.

The Philippines government is working towards more affordable electricity prices by shifting away from costly and volatile fossil fuels, moving towards renewable energy, enhancing energy efficiency and modernising infrastructure. Well-designed energy efficiency policies can help deliver affordability by reducing running costs and generation investment requirements to meet growing demand.

With 64% clean cooking access and a 1.9% annualised increase in access to clean cooking between 2018-2023, progress in the Philippines has stalled in recent years, with fuel price surges exacerbating existing affordability challenges. Many households continue to rely on traditional cooking methods, using wood or charcoal, which are a leading cause of household air pollution. This persistence is due to both supply and demand barriers: on the supply side, clean cooking technologies often lack availability and affordability, particularly in remote areas, while stable supplies of clean fuels remain inconsistent; demand-side barriers include the upfront cost of devices, cultural factors and the common practice of fuel stacking. Targeted interventions that address both market access in underserved areas and consumer awareness can help the Philippines accelerate the adoption of clean cooking.

Unserved and underserved communities require special considerations for electricity connection

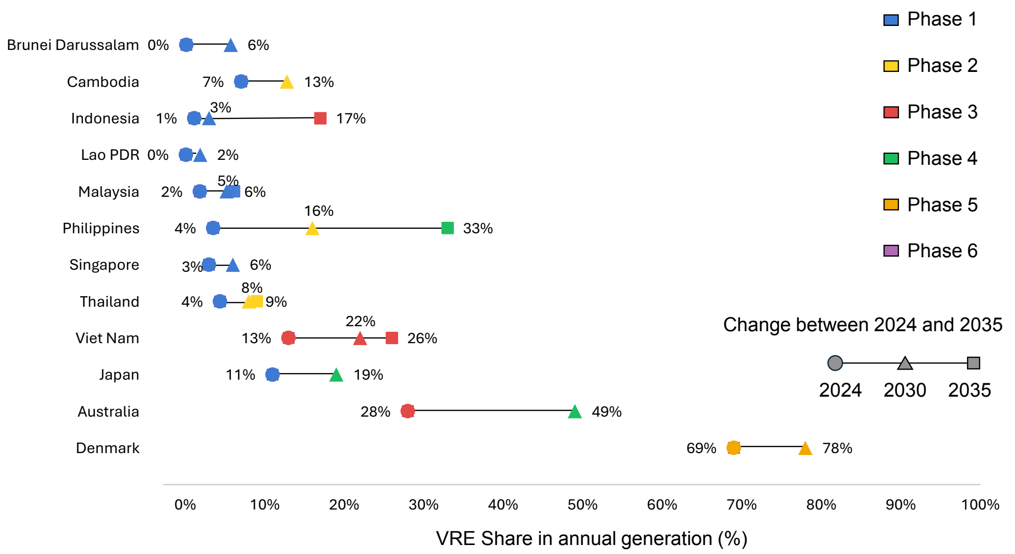
Electricity access for unserved and underserved communities are key priorities in the Philippines. Underserved area refers to a served area with less than 24 hours/day electricity resulting from system non-compliance, delayed investments or other causes, creating a failed Energy Regulatory Commission (ERC) performance rating. Unserved area refers to an area with no electricity access, distribution lines, home power systems, microgrid connection or grid extension implemented by the distribution utility. As of December 2024, the DOE estimates that 3.08 million households require an electricity connection. Of these, about 2 million households are located within the coverage of electric co-operatives and distribution utilities. The 2024-2033 National Total Electrification Roadmap: Empowering the Filipino People Through Total Electrification indicates an expected target of 100% electrification by 2028 through regular connections, line extensions, standalone systems and microgrids.

The DOE Missionary Electrification Development Plan 2024-2028 sets the policy direction for off-grid generation, transmission and distribution, focusing on reducing diesel dependence by expanding renewable energy, hybrid systems and battery storage to lower costs and emissions while improving reliability. At the local level, distribution utilities implement Local Total Electrification Roadmaps, identifying barangays and sitios where line extensions might not be feasible and microgrids or other off-grid technologies are the preferred solution.

Effective VRE integration will be increasingly important as VRE shares grow

With progressive targets and supportive market frameworks, the Philippines could achieve a 16% VRE penetration by 2030, up from 4% in 2024. Using the IEA phases of VRE integration framework, this scale of VRE penetration would put the Philippine power system towards phase 4 by 2035, from phase 1 in 2024. The framework outlines six phases of increasing solar PV and wind impacts on the power system, along with corresponding measures to enable the secure and cost-effective uptake of VRE. Phases 1 to 3 experience minor to moderate system impacts, although most challenges could be addressed through modifications to existing assets or operational improvements. The increasing influence of VRE in shaping system operations is more marked in the advanced phases (i.e. phases 4 to 6). In phase 4, VRE would meet almost all demand in some periods and have a growing influence on system operations. Changes include steep net load ramps, high instantaneous VRE penetration, reduced system inertia and lower short-circuit current levels, which would need to be addressed to ensure system stability.

Phase assessment of VRE integration in AZEC partner countries, with a comparison to the higher-phase system in Denmark, 2024-2035



Notes: AZEC = Asia Zero Emission Community; Lao PDR = Lao People's Democratic Republic; VRE = variable renewable energy. The phase assessments for 2030 are based on VRE forecasts (main case) in Electricity 2026. The phase assessments for 2035 are based on each country's national power development plans and publicly available data at the time of writing. These assessments are not based solely on VRE share in annual generation (see Annex B in Integrating Solar and Wind in Southeast Asia). For Indonesia, the future VRE shares are calculated on the basis of the on-grid Java-Bali-Sumatra system (captive plants are not included) and on the basis of new data in Rencana Usaha Penyediaan Tenaga Listrik 2025-2034 (Electricity Supply Business Plan 2025-2034).

The Philippines electricity system has a high readiness to integrate VRE, with advanced forecasting and mechanisms to procure system services. However, the country's level of preparedness varies across its main grids – Luzon, Visayas and Mindanao – making co-ordinated grid management and stronger national-level integrated planning more important. Enhancing transmission capacity and interconnections to the main areas where VRE generation is expected to be established would support system integration and efficient use of VRE.

The Philippines can improve VRE integration measures, for example by enhancing power plant flexibility and demand-side programmes. Integrating demand flexibility can help reduce peaks and curtailment, reduce system losses and enhance renewable utilisation. In addition, it is crucial for the Philippines to begin planning to manage the challenges associated with a high share of VRE, which are expected in phase 4 and beyond. Such challenges can generally be managed through the introduction of advanced technologies, sophisticated market design, and new business models that support investment in flexibility and resilience. Dispatchable power plants are a key flexibility resource in the Philippines, enabling a transition from baseload generation that provides short-term and seasonal flexibility. Addressing long-term supply agreements (especially for coal-fired power plants) could help to make the flexible deployment of these thermal power plants more economically viable.

According to the IEA Renewable Energy Progress Tracker, renewable energy growth could be nearly 90% higher than business as usual if the country addresses grid connection and land acquisition delays, transmission infrastructure, grid integration, the cost of capital and lengthy permitting procedures.

Power system development could be strengthened by addressing investment gaps

Achieving the aims of the Philippine Energy Plan (PEP) and the Power Development Plan (PDP) requires substantial investment. On the basis of the levelised cost of electricity, utility-scale solar in the Philippines is one of the cheapest sources of new bulk electricity generation. Despite cost competitiveness, the median cost of capital in the Philippines is 8% for a new utility-scale solar PV plant. While this percentage is only slightly lower than other Southeast Asian countries (9.4% for Indonesia, 9.0% for Viet Nam), it is higher than the advanced economies benchmark of 5-6.5%. Reducing financing costs could support investment in capital-intensive clean energy assets such as solar PV and wind.

In the Philippines, key investment risks include those relating to the regulatory, political and transmission infrastructure. Power generation investments have traditionally been concentrated among a few large domestic corporations. While there are barriers to attracting new foreign capital, progress has been made in recent years to eliminate these barriers. The cap of 40% foreign ownership in renewable energy projects was repealed in 2022, though the ownership limit in transmission and distribution utilities remains. Foreign investors are not permitted to own private lands, but in September 2025 land lease durations were increased to 99 years, extended from a maximum of 50 years (extendable once for 25 years). Since then, the DOE reports that a total potential capacity of 20 GW has been awarded to fully foreign-owned entities. Addressing broader structural challenges, including complex land acquisition processes, permitting delays and grid connection bottlenecks could help to effectively convert this pipeline of projects into operational capacity.

The Philippines is investing in strengthening the transmission backbone and extending the transmission of high potential renewable energy areas to demand centres. The National Grid Corporation of the Philippines (NGCP) had more than PHP 600 billion (around USD 10 billion) in capital expenditure projects in the pipeline in 2024, and envisages about PHP 905 billion (around USD 15 billion) of high-voltage grid investments in the 2024-2034 period. The Philippines has faced delays in transmission projects as the NGCP only completed 75 out of 258 planned projects, employing only 10% of its allocated capital expenditure.

Regional and inter-regional interconnections also require substantial investment. Addressing subsea cable costs is particularly relevant for the Philippines to facilitate cross-border power trade and integration into regional power trade networks. According to the PEP, PHP 8 trillion (around USD 132 billion) in investment would be required to achieve a policy-consistent pathway aligned with the target of a 50% renewable energy share by 2040. To reach the more progressive scenario with a higher share of renewables, the investment required for generation projects would be more than PHP 15 trillion (around USD 248 billion).

The Philippines also faces currency risks because income from tariffs or power purchase agreements is typically PHP denominated, but key financial obligations are often USD denominated. To address such a currency risk, the ERC feed-in tariff rules allow for annual tariff adjustments to reflect changes in local inflation and foreign exchange rates.

Analyses of priority areas for the Philippine power sector

Nuclear power could diversify baseload supply, strengthening long-term energy security

With the rising electricity demand, high levels of dependence on fuel imports and clear decarbonisation objectives, nuclear power has re-emerged globally as an option to strengthen energy security and diversify low-emissions baseload generation. More than 40 countries are currently operating or exploring the potential for operating nuclear programmes, supported by technological advances, new reactor designs and renewed policy interest.

Nuclear energy can contribute to system stability by providing firm capacity and, in some configurations, by supporting emerging applications through co-generation, for example by using the heat generated by the nuclear power plant to produce industrial heat or hydrogen. At the same time, nuclear development requires long-term government and policy commitment, institutional capacity, robust regulatory oversight, an extensive supply chain, skilled personnel and strong financial frameworks.

Concentrated markets for reactor technology and uranium enrichment also highlight the importance of diversified supply chains and international co-operation to manage potential risks.

The Philippines has established important foundational elements that support the consideration of nuclear energy within its long-term energy mix. In 1984, a 621 megawatt electrical Westinghouse reactor was completed at Bataan, but was never commissioned. The facility has since been maintained, preserving the potential for future assessment. The Philippines also acceded to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in 1998, signalling early engagement with international nuclear governance frameworks.

The Philippines is providing some readiness signals by preparing early requirements for nuclear energy

In recent years, policy signals have clarified the government's position to reconsider nuclear energy as part of the energy mix. Executive Order No. 164 established a national framework for nuclear energy development, aligned with the International Atomic Energy Agency (IAEA) standards and milestones. The Nuclear Energy Roadmap (2024) outlines a path forward using the IAEA Milestones Approach.

In 2025, Department Circular No. 2025-10-0019 provided the policy foundations for a first commercially developed and operated nuclear power plant, designating it as a pioneer facility with priority dispatch so as to support investment certainty. The government has articulated an indicative objective of 1.2 GW of nuclear capacity by 2032 with long-term scenarios in the PEP projecting up to 4.8 GW by 2050. The Philippines has adopted a technology neutral approach wherein technology options are assessed on the basis of their safety, economic viability and suitability to national energy needs. Under this approach, the Philippines could consider rehabilitating Bataan, deploying small modular reactors (SMRs) or building new nuclear power plants. These developments underline the institutional readiness of the Philippines to explore nuclear power as a long-term option, while key implementation steps remain ahead.

However, more robust frameworks, high investment, supply chains and a strong workforce are required

A credible regulatory framework is a prerequisite for nuclear development. Robust nuclear regulation requires sustained, long-term investment in human capital across various fields, including safety assessment, emergency preparedness, licensing, inspection, waste management and decommissioning oversight.

In 2025, the Philippine National Nuclear Energy Safety Act established the Philippine Atomic Energy Regulatory Authority (PhilATOM) as an independent regulator responsible for licensing, oversight, safeguards and emergency response co-ordination. The creation of an independent regulator is aligned with international best practice, and supports transparency and impartial supervision.

The regulator is expected to issue licences, oversee safety compliance, serve as the national point of contact during nuclear emergencies and ensure impartial oversight, independent from the Department of Energy. Ongoing work includes finalising the Implementing Rules and Regulations, appointing leadership and staff, and building technical capacity while ensuring independent budgets.

International assessments, including the second review mission of the IAEA in 2024, recognised progress in infrastructure preparation and legal drafting while identifying areas for further work, including in relation to grid integration planning, industrial participation frameworks, the completion of legislation and the finalisation of the nuclear strategy.

Building regulatory capacity will require sustained investment in technical expertise, institutional independence supported by stable budgets, workforce training and continued alignment with international conventions.

Institutional readiness also extends beyond regulation. Transparent environmental impact assessments, emergency preparedness, stakeholder engagement and clear public communication are essential to strengthen public confidence. Supply chain and geopolitical risks exist as a result of the heavy concentration of reactor technologies, uranium production and enrichment in a small number of countries. At the same time, safety, security, waste management and decommissioning remain essential long-term responsibilities that require robust regulation, stable funding and public trust.

Japan: Recommissioning nuclear reactors

Japan's experience with restarting nuclear reactors is unique in scale and complexity. Nuclear power, which provided 25% of Japan's electricity in 2010, fell to zero after the 2011 Fukushima Daiichi accident. Japan has been recommissioning its nuclear reactors in a gradual manner, with the aim of maximising safety, ensuring energy security and meeting its environmental requirements. Of the 54 commercial reactors shut down in 2011, 15 nuclear reactors have resumed operations, with the reactor in Kashiwazaki-Kariwa restarted in 2026. To support the long-term use of its nuclear fleet, Japan revised its Electricity Business Act in 2023 to allow operations beyond 60 years when shutdowns were caused by unforeseeable safety issues. In addition, a new Long-Term Decarbonisation Power Source Auction now typically guarantees predictable revenue for 20 years, supporting reinvestment and improving investor confidence.

Japan's experience is relevant for the Philippines as the country considers its nuclear power options, including recommissioning the Westinghouse unit at Bataan. However, it is important to acknowledge that Japan's long history with nuclear energy gives it an advantage in managing many aspects that may be challenging for other countries. The cost of recommissioning could reach several billion USD per unit, making financial planning a critical first step. Recommissioning is also technically demanding, requiring detailed safety and environmental assessments before approval can be granted. Securing qualified personnel remains an essential component, which could be challenging for a country without a large existing nuclear workforce. Local community engagement is also necessary to maintain transparency and ensure public acceptance, particularly during the early stages of programme development. Japan's strong safety standards, advanced regulatory system and proven track record in recommissioning reactors could make it a valuable international partner to support the Philippines should the option to recommission the Bataan reactor be pursued.

Nuclear projects are capital-intensive and involve long development timelines, as well as long payback periods. Many advanced economies have experienced cost overruns and long construction delays for nuclear new build, which can undermine investor confidence. Financing conditions therefore play a central role in project feasibility.

The Philippines has begun exploring international partnerships and financing pathways. Recent global policy shifts, including the World Bank lifting its longstanding restriction on nuclear financing in 2025 and the Asian Development Bank strengthening co-operation with the IAEA, have expanded potential access to technical assistance and concessional support for regulatory development and capacity building.

Securing large-scale, low-cost financing remains a central determinant of project viability. Nuclear projects typically require long-term risk allocation mechanisms, stable policy frameworks and strong contractual structures to reduce investor uncertainty.

Several international partners, including Canada, France, Japan, Korea, the United States and others have expressed an interest in co-operation on technology assessments, workforce development and strengthening institutions. Korean industry actors are conducting feasibility assessments for Bataan rehabilitation, while international SMR developers have explored the potential for siting studies. Such partnerships can contribute to knowledge transfers, supply chain development and industrial participation opportunities for Philippine firms.

Industrial involvement, including participation in construction, maintenance and ancillary services, can enhance domestic value creation while reinforcing capacity building across the nuclear life cycle.

Nuclear power has been discussed internationally as a potential enabler of low-carbon hydrogen production, either through a dedicated electricity supply or through thermal integration in advanced reactor systems.

In principle, nuclear energy could support stable hydrogen production where firm, low-emissions electricity is required. However, national hydrogen policy frameworks in the Philippines currently prioritise renewable pathways and natural hydrogen, with no explicit targets or incentives linked to nuclear-derived hydrogen.

From an economic perspective, nuclear-powered hydrogen faces structural cost challenges under the current market conditions. Even under optimistic cost assumptions, such as achieving capital costs comparable to the People's Republic of China (hereafter "China"), the levelised cost of electricity will be approximately 50-90 USD/MWh for new nuclear build and 20-30 USD/MWh for lifetime extensions of nuclear power plants, which could be less cost-competitive in the near to medium term relative to pathways involving renewable energy. Given these parameters, nuclear-powered hydrogen represents a longer-term option rather than a near-term priority, unless technological advances or financing innovation significantly reduces costs.

Recommendations

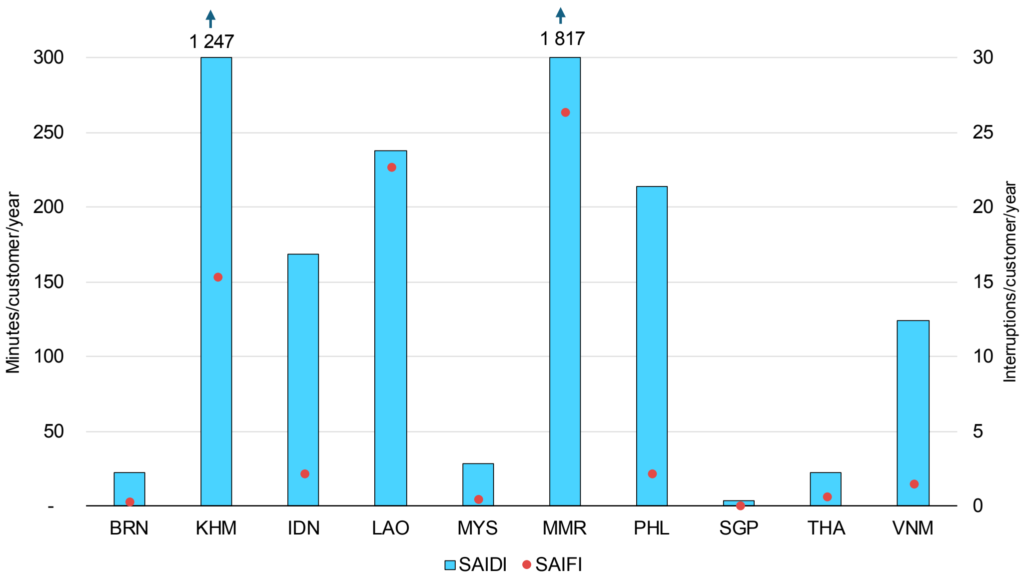
- **Strengthen regulatory capacity** by ensuring that PhilATOM is fully operational, with adequate technical expertise, enforcement authorities, sufficient staffing and stable budgetary support, as well as the ability to complete the implementing rules and regulations, consistent with international best practices.
- **Advance alignment with international best practices by implementing IAEA recommendations**, including continued work on grid integration and industrial participation, as well as finalisation of the national legislation and strategy.
- **Expand international partnerships** with countries that have experience in nuclear energy to support technology evaluation, workforce training and regulatory development through knowledge exchange, study tours and capacity building.
- **Enhance transparency and stakeholder engagement** through structured public consultations, environmental assessments and clear communication on safety, costs and system implications.
- If recommissioning the Bataan reactor, **establish a phased and technically rigorous approach** that prioritises safety validation, financial structuring, grid compatibility and community engagement to strengthen project credibility.
- **Develop long-term financing strategies,** similar to the Japan Climate Transition Bond Framework, to secure access to low-cost capital, recognising the lengthy investment horizon and risk profile of nuclear infrastructure.
- For potential future applications of nuclear energy in hydrogen production, **consider explicitly assessing nuclear energy's role within national hydrogen strategy updates** and evaluating cost competitiveness compared with pathways involving renewable energy.

Grid modernisation and system flexibility will strengthen system security in the Philippines

Electricity grids are the backbone of power systems, and critical enablers of energy security and energy transition. In the Philippines, the electricity grid is working to keep pace with rising electricity demand. The country's archipelagic geography shapes its grid development strategies and requires inter-island connections, microgrids and off-grid solutions to ensure electricity access. This geography combined with rapid growth in demand underscores the need for continued grid investment and planning.

While transmission-level reliability and outage rates have improved markedly in recent years, the reliability of electricity supply in the Philippines is still below the regional average. The System Average Interruption Duration Index was around 3.6 hours per year in 2020, reflecting persistent supply interruptions for end users. The lack of redundancy in many transmission and distribution lines means that even a minor fault can result in broader power interruptions. Limited interconnections between some of the islands add complexity to grid stability, making localised disruptions more difficult to address. These reliability considerations affect households and industry. In the Philippines, 46% of firms own or share diesel generators to meet their energy needs, with 43.9% experiencing electrical outages and 18% of respondents in a 2023 survey listing electricity as the top business environment constraint. Such constraints may also undermine investor confidence, particularly in more remote areas where reliability is lower.

System Average Interruption Duration Index and System Average Interruption Frequency Index in ASEAN countries, 2020



Notes: BRN = Brunei Darussalam; KHM = Cambodia; IDN = Indonesia; LAO = Lao People's Democratic Republic; MYS = Malaysia; MMR = Myanmar; PHL = the Philippines; SGP = Singapore, THA = Thailand; VNM = Viet Nam; SAIDI = System Average Interruption Duration Index, SAIFI = System Average Interruption Frequency Index;

Source: IEA analysis based on data from the World Bank archive (2020), Doing Business (Getting Electricity), accessed 29 April 2026.

Forced outages of generation plants add to energy security concerns. Between 2022 and 2024, forced outages accounted for more than 50% of the total outage capacity, leading to sudden power interruptions, price spikes, and in severe cases, load shedding, brownouts or even blackouts. Coal-fired power plants (including newer units) accounted for approximately 51% of all forced outages from 2019 to 2023, followed by gas at around 20%. In May and June 2024, forced outages of coal-fired power plants contributed to periods of insufficient power supply, mostly in relation to the Luzon grid.

Recent large-scale disruptions have highlighted the importance of strengthening the grid, reducing force outage rates and improving generator reliability, and managing the impact of unexpected events. This is especially the case for Visayas, which has five sub-grids and is dependent on Luzon and Mindanao as a net importer. In January 2024, the Panay sub-grid – the sixth largest island – experienced an island-wide outage caused by multiple tripping events and unscheduled maintenance of major coal-fired power plants, which affected almost 70% (451 MW) of the in-island generation capacity. The disruption lasted four days with estimated economic losses of around USD 60 million.

Grid upgrades and modernisations are key to reducing the risks of such events and ensuring the security of supply while supporting the integration of variable renewable energy (VRE). Upgrades include reinforcing ageing grid infrastructure, increasing network redundancy, expanding sub-grid and inter-island capacity, enabling remote monitoring and control, and implementing advanced grid protection schemes. Modernising grids requires a co-ordinated approach to grid planning, aligning infrastructure development with evolving system needs to optimise investments and efficiency across the three main grids, while also scaling up microgrid options for energy access in remote areas.

Integrated grid planning is key to expanding island interconnections and supporting renewable growth

The Philippines continues to develop the Transmission Development Plan (TDP), led by the National Grid Corporation of the Philippines (NGCP). The TDP 2024-2050 sets out an ambitious plan to strengthen and modernise all three grids by expanding the transmission backbone in Luzon, upgrading major corridors and increasing inter-island interconnections to accommodate renewable energy and improve connectivity across all islands. A key element of the TDP is expanding island interconnection, building on the 2024 Mindanao-Visayas Interconnection Project. The TDP 2025-2050 continues to build on the previous plans, retaining the broader long-term framework while providing targeted updates to reflect evolving sector conditions and system needs.

The TDP also incorporates Competitive Renewable Energy Zones (CREZ), which identify high-quality and cost-effective renewable resource areas to guide grid investment and upgrades. Currently, 25 CREZs have been identified, with a total of around 35 GW solar PV and onshore wind capacity having demonstrated private developer interest. A comprehensive roadmap for transmission investments linking CREZ with grid investment would help reduce the risk of grid congestion, curtailment and connection delays. This planning is critical given the long lead times of transmission projects, particularly those involving extra high voltage (above 220 kV), which can take up to fifteen years to complete with scoping, permitting and construction processes, whereas new renewable projects take only one to five years to complete.

These grid planning challenges are made more complex by evolving demand patterns. The Philippines' ambition to expand digital infrastructure markets and position itself as a data centre hub will place additional requirements on grid infrastructure as electricity demand becomes more concentrated, continuous and sensitive to reliability.

Co-ordinated planning among policy makers, regulators, grid operators and grid owners can help align generation, transmission and distribution network development with evolving system needs. An integrated planning approach would account for cross-sectoral linkages between the power sector and other sectors (including industry, transport, natural gas) and ensure that grid expansion can accommodate the growth of renewable energy, increased electrification and new demand centres, while facilitating island interconnections and maintaining grid reliability. This approach could unlock opportunities provided by distributed energy resources, including battery energy storage, microgrid and other non-wire options offering demand-side flexibility that complements physical grid upgrades.

Australia: Storage and interconnections support VRE integration

Australia has demonstrated strong progress on VRE integration, reaching phase 3 (at the national level) of the IEA VRE integration framework and phase 5 in South Australia, and offering valuable lessons for the Philippines as the only ASEAN country expected to be classified in phase 4 by 2035. In South Australia, the VRE share of total generation grew from less than 50% to around 80% by 2025. With limited interconnection to the rest of the National Electricity Market, South Australia has relied heavily on battery energy storage systems (BESS) to provide grid flexibility. Since the first large-scale battery project in 2017, BESS capacity in South Australia expanded rapidly to 823 MW by 2025.

To support the growth of renewables and the evolving energy landscape in Australia, a new 900 km transmission project connecting South Australia to New

South Wales, with an added connection to Victoria, has been constructed to improve security and reliability while lowering energy prices.

For the Philippines, deploying large-scale storage and demand response could support the integration of planned VRE capacity additions, which would require significant upfront investment given that the existing battery storage capacity in the Philippines (as of December 2024) is 759 MW. Additional storage capacity can be mobilised through targeted auction mechanisms similar to the fourth round of the Green Energy Auction (GEA-4). Given the country's seasonal variability and hydrological potential, pumped-storage hydropower represents another flexibility option. Enhancing regional and intra-regional interconnection capacity would further support the efficient exchange of VRE.

Microgrids can accelerate electrification and strengthen energy resilience in the Philippines

Renewable microgrids are emerging as a key solution to achieving electrification, offering a sustainable, cost-effective and scalable option in remote locations, and reducing reliance on diesel and gasoline generation. The 2021 Microgrid Systems Act provides a framework to promote private sector participation in electrification, prioritising low-cost, renewable and indigenous energy sources. Service contracts are awarded to microgrid system providers (MGSP) through a competitive selection process, enabling them to deliver integrated generation and distribution in unserved and underserved areas on behalf of the NPC. Microgrid tariffs follow the Full Cost Recovery Rate principle, allowing MGSP to recover efficient costs. Where eligible, microgrid projects may receive subsidies from the Universal Charge for Missionary Electrification, which bridges the gap between the true cost of supply and affordable end-user tariffs. Three rounds of MGSP selection have been launched in the Philippines as of 2025, helping to accelerate electrification and promote the role of the private sector in improving electricity access.

Microgrids can function independently or connect to the main grid, providing electricity to communities where grid reinforcement is technically or economically challenging. Microgrids are increasingly being developed as hybrid systems, which integrate solar, wind and BESS to meet demand throughout the day. For example, the Solar Para Sa Bayan initiative, launched in 2018, brings 24/7 electricity to 12 towns and projects across several provinces that previously had limited supply from the main grid. As the costs of solar PV and battery storage continue to fall, hybrid microgrids are becoming increasingly cost-competitive and therefore a key pillar to improve electrification.

Beyond electricity access, given the archipelagic geography of the country, well-designed microgrids can also enhance system flexibility and resilience to extreme weather events. In the Philippines, most off-grid households currently rely on diesel generators, which, while costly and sometimes prone to outages, provide a vital source of energy. Renewable microgrids can provide a more sustainable and resilient option that is scalable for these areas.

Achieving the full potential of renewable microgrids requires clear policy and regulatory frameworks and institutional arrangements, including licensing, tariff setting and grid connection rules to overcome barriers and attract private investment. It is particularly important in remote areas where demand data are limited, and consumption patterns evolve as access improves. Suitable technical arrangements for operation and maintenance are also critical for microgrid deployment. Strengthening local technical capacity and institutional support can help address skills shortages, reduce downtime and ensure the long-term sustainability of microgrid systems.

Japan: "Islandable" microgrids ensure essential services remain connected

During the 2011 Great East Japan Earthquake and Tsunami, the city of Higashi-Matsushima experienced a grid collapse, with 65% of the city flooded and 1 130 lost lives. Some residents did not receive access to electricity for up to three months. To strengthen resilience and ensure security of supply, the city developed an islandable microgrid as part of the Higashi-Matsushima City Disaster Ready, Smart Eco-Town. This microgrid was completed in 2016 as Japan's first microgrid community.

The microgrid includes smart grid infrastructure, a distribution system, a 460 kWh solar PV system, a 500 kilovolt amperes (kVA) biodiesel emergency generator and a 480 kWh BESS. Operated as a private microgrid by the city, with support from the Ministry of Environment's Independent and Decentralized Low Carbon Energy Society Promotion Project, it can continue to supply power for at least three days if the main grid fails. The microgrid can also redirect power to the hospitals from residential buildings for several days, if necessary, using the battery to regulate the variability of the solar PV plant for prolonged outages.

Higashi-Matsushima's microgrid provides a relevant resilience model for the Philippines, showing how grid-connected communities can be designed to maintain essential services during outages through local generation, storage and active energy management. While the Philippines' Microgrid Systems Act is primarily intended for underserved and unserved areas, it also formalises concepts such as grid-tied systems operating in island-mode, which could allow for the deployment of such a model.

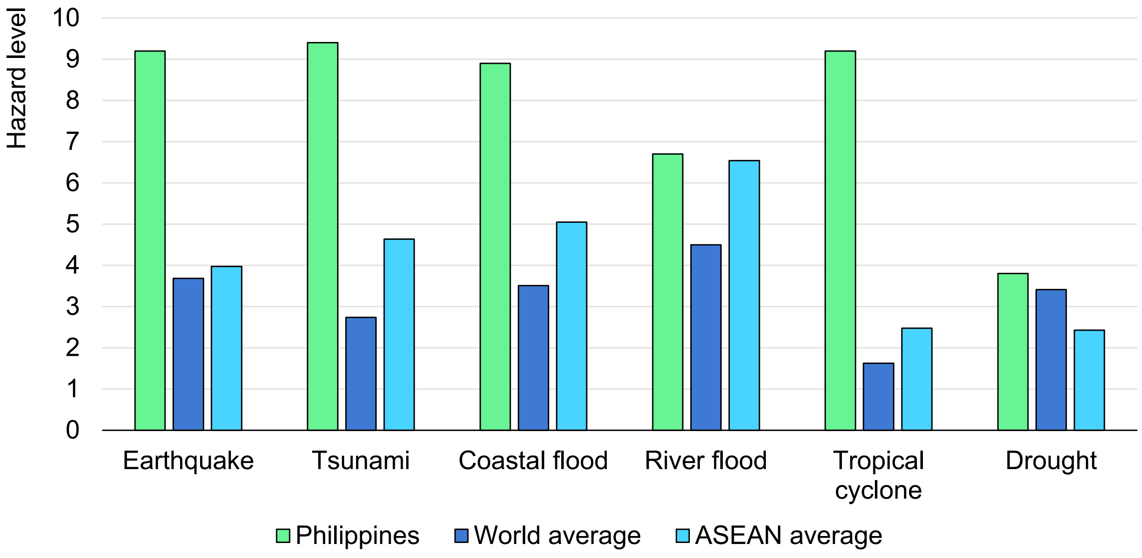
Recommendations

- **Strengthen electricity grids** with timely investments to ensure system reliability and security by replacing ageing equipment, expanding inter-island transfer capacity and enhancing remote monitoring and control systems to withstand extreme events and enable rapid restoration. One example from Japan is the use of advanced metering infrastructure and distribution automation.
- **Adopt a co-ordinated and integrated approach** to grid planning among policy makers, regulators, grid operators and owners to ensure infrastructure development keeps pace with evolving system needs and optimises investment value. An example is the Australian Energy Market Operator's bi-annual Integrated System Plan.
- **Scale up the deployment of renewable microgrids,** including microgrids across the region (see the example with Indonesia), to expand energy access in unserved and underserved areas, improve reliability and reduce dependence on costly off-grid diesel and gasoline generation**.**
- **Establish clear policy and regulatory frameworks**, including licensing, tariff setting and grid connection rules, to attract private investment. The Capacity Investment Scheme in Australia provides long-term revenue safety for investors in VRE generation and battery storage.

Climate resilience of the power system can enhance energy security and strengthen reliable electricity access

Globally, climate change-related risks and natural hazards are becoming an increasing source of interruption for power systems. The Philippines ranks among the countries most exposed to extreme weather events, particularly tropical cyclones (typhoons), which could threaten the physical resilience of power systems due to severe winds, heavy rainfall and storm surges. Weather- and hazard-related power outages in the Philippines resulted in around 107 million consumer-hours (or about seven hours per customer) of lost supply in 2021, around 10% higher than in 2015.

Natural hazard levels in the Philippines, 2025



Notes: The levels of climate hazard and exposure for earthquakes, tsunamis, coastal floods, river floods, tropical cyclones and droughts are assessed on the basis of indicators in the INFORM Risk Index. The minimum value is 0 and the maximum is 10 (see the INFORM Risk Index page for indicator methodology details). ASEAN average refers to the arithmetic average.

Source: IEA, based on data from INFORM (2025), INFORM Risk Index 2025, accessed 6 February 2026. INFORM is a collaboration between the Inter-Agency Standing Committee Reference Group on Risk, Early Warning and Preparedness and the European Commission. The European Commission Joint Research Centre is the scientific lead of INFORM.

Different natural hazards impact the Philippines' power system in distinct ways, varying in frequency, intensity and the regions they affect. Under the impact of the El Niño–Southern Oscillation, the Philippines has a risk of both flooding in the wet season and droughts in the dry season, both of which impact hydropower generation. Luzon and Mindanao, where most hydropower capacity is located, are more exposed to flooding, and water scarcity is more prominent in Visayas and Luzon. The 2023-2024 El Niño drought brought extreme heat and disrupted water resources and hydropower generation, leading to power outages affecting around 5 000 villages. Typhoons have also damaged transmission and distribution infrastructure and disrupted energy supply. In 2025, Typhoon Emong destroyed power lines, leading to power failure and affecting approximately 510 000 households in Luzon. During Super Typhoon Uwan in 2025, transmission lines, poles and transformers were damaged, affecting almost 4.8 million consumers. Flood events also happen every year, often after typhoons, and they also cause damage and disruption to power transmission and distribution.

Rural distribution utilities bear a disproportionate share of the damages from disasters compared with transmission and generation infrastructure operators. Electric co-operatives incurred about 76% of the total damages from Typhoon Yolanda in 2013, estimated at PHP 5.2 billion (over USD 80 million). With higher vulnerability to climate disasters and limited capital, resilience is especially important for rural and small island systems.

Coastal vulnerability from rising sea levels and storm surges can threaten energy hubs as well. For instance, a 10% increase in wave surge-height could put 3.4 million additional people in Metropolitan Manila at risk of flooding impacts, which could include damage to transmission and distribution networks or energy disruptions. Batangas City is an energy hub that hosts six major gas-fired power plants with 4.6 GW of installed capacity and the country's two only LNG terminals, along with coal-fired plants and geothermal infrastructure. Protecting such critical infrastructure is key to ensuring energy security.

Climate resilience is increasingly incorporated into power sector policy and design

The Philippines is incorporating climate resilience into the power sector through long-term planning, dedicated policies and institutional mechanisms that integrate disaster-risk reduction into energy development. The PDP 2023-2050 identifies energy resiliency as a key long-term goal, particularly through the development of climate-proof standards to strengthen the resiliency of the distribution utility infrastructure.

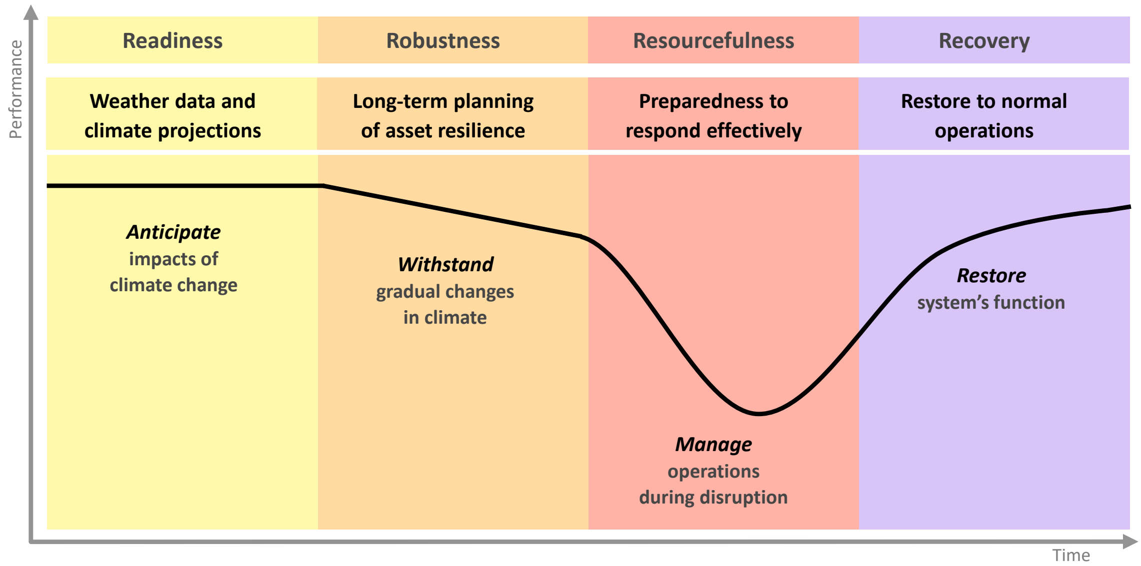
In 2018, the DOE launched an Energy Resiliency Policy for adaptation planning in the energy industry, which highlighted disaster risk reduction programmes in energy investments and project planning, and which established a Task Force on Energy Resiliency (TFER). The TFER develops resiliency compliance plans, and monitors and evaluates the adoption of energy resiliency programmes. In 2022, the Philippine government recognised the importance of not only disaster response and post-disaster rehabilitation but also prevention, mitigation and preparedness. A national hazard map has been developed to identify risks and utilities vulnerable to hazards. These measures signal a shift from ad-hoc disaster response to an institutionalised approach to resilience.

Climate and disaster risk finance and insurance can help provide financial protection and risk transfer in the case of disaster impacts. Under the 2022 supplemental circular, disaster risk financing, insurance and funding for the power sector was highlighted. The Philippine Catastrophe Insurance Fund, established in 2021, serves as a national mechanism for catastrophe risk pooling. The Electric Cooperatives Emergency and Resiliency Fund, established in 2018, with an annual appropriation of around PHP 200 million (approximately USD 3.3 million), was insufficient to cover all qualified co-operatives in restoring distribution systems from disasters in 2024. These funds currently focus only on post-disaster restoration, not pre-disaster mitigation, suggesting limited alignment with the expanded TFER mandate. The absence of pre-disaster financing is a concern, as international experience demonstrates that proactive mitigation is more cost-effective than reactive spending, which perpetuates cycles of damage and restoration.

Systematic and co-ordinated actions can strengthen power system resilience

A climate-resilient energy system can help the Philippines reduce risks by anticipating changes in climate patterns through improved access to weather data and climate projections (readiness), adapting to and withstanding impacts from slow-onset changes in climate (robustness), continuing to operate under the immediate shocks from extreme weather events (resourcefulness) and rapidly restoring function after weather-related disruptions (recovery). Proactive measures with co-ordination across government authorities, energy suppliers, and consumers, can strengthen the system's readiness, robustness, and resourcefulness.

Conceptual framework of climate resilience for energy systems



Source: IEA (2024), Climate Resilience for Energy Security in Southeast Asia.

A major pillar of readiness is the availability of robust data and tools for the scientific assessment of climate risks and impacts. As the deployment of renewables in the Philippines accelerates, these assessments inform power sector infrastructure and emergency planning. The Philippines could enhance its hazard map and resilience scorecard by incorporating updated climate scenarios and spatial risk modelling to support evidence-based investment decisions and regulatory oversight. Digital technologies can support data quality, access, sharing and forecasting capabilities in the case of significant weather-associated risks. For example, predictive digital twins have been used in Japan and Singapore to assess transmission assets and predict outages on the basis of the past performance of assets and vulnerabilities in the face of extreme weather. Moreover, in Japan, advanced metering infrastructure and distribution automation have been installed to enable faster outage detection and automated restoration.

The PEP 2023-2050 highlights the need for investment-enabling environments to support power sector resilience. As the Philippines is a liberalised energy market, the government can encourage private sector financing for both adaptation and mitigation measures through climate-risk reporting requirements, incentive schemes and access to green, transition or adaptation finance instruments.

Physical system hardening can strengthen resilience by introducing technical and structural improvements, particularly in energy hubs such as Batangas. To secure power generation and import facilities along coastlines, preventative coastal barriers can be built using green infrastructure (e.g. plants, reefs, sand) or grey infrastructure (e.g. seawalls and dikes).

Relevant actors in the power sector can contribute to system resilience. For the Philippines, system operators and utilities can be encouraged to integrate climate-risk assessments in their construction plans and operations, and to conduct physical hardening of power plants, transmission and distribution networks. In addition, emergency response protocols can be strengthened in alignment with the DOE resilience roadmap.

Consumers can also play a role by adopting demand-side energy efficiency measures and distributed energy resources, such as rooftop solar or storage that reduces strain during extreme events. Consumers can make important contributions through community-based resilience programmes, such as microgrid readiness, local disaster response drills and data sharing initiatives on localised outages.

Viet Nam: Resilience by design in the Mekong Delta strengthens flexibility and adaptability

Viet Nam's Mekong Delta has significant renewable energy potential, but faces risks from sea-level rise, upstream development from hydroelectric dams and groundwater extraction. Resolution 120/NQ-CP (2017) and a shift towards integrated master planning has brought increasing recognition of distinct ecological conditions, rather than a one-size-fits-all model.

With World Bank support, the Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project introduced integrated decision-making tools that incorporate complex interactions between hydropower development, land use and climate projections. The project also includes a "no-regret" design approach where investments are designed to perform under a range of future conditions. For example, hybrid infrastructure, such as coastal dikes alongside mangrove restoration, can help address coastal erosion and salinity intrusion. These solutions can be adapted over time as risks evolve.

The Mekong Delta project highlights the value of shifting from a recovery-focused approach to proactively building system readiness and robustness before extreme events occur. For the Philippines, prioritising long-term resilience can reduce outage risks, strengthen grid stability and enhance energy security, with the support of international co-operation in terms of planning, technical assistance and climate-resilient financing.

Recommendations

- **Strengthen climate risk and impact assessment tools and data** with improved climate scenarios and spatial risk modelling, similar to the digital twins used in Japan and Singapore.
- **Promote private sector participation for climate resilience** through climate-risk reporting requirements, similar to the Commonwealth Climate Disclosure policy in Australia, and through incentive schemes and access to green, transition or adaptation finance instruments.
- **Enhance physical system robustness** by prioritising technical and structural hardening, especially in energy hubs, building coastal protective barriers for shoreline facilities, similar to the tsunami protection walls in Japan.
- **Embed climate resilience in utility planning** by encouraging system operators and utilities to incorporate climate-risk assessments into infrastructure design and operations, similar to TransGrid in Australia, to undertake targeted physical hardening, and to align emergency response protocols with the DOE resilience roadmap.
- **Empower consumers** by promoting community-based resilience, similar to community-based organisations in Japan, through distributed power resources, microgrid readiness, local disaster response drills and data sharing.

Areas for enhanced co-operation under AZEC

Nuclear study tours

In the Power Development Plan (PDP) 2023-2050 and the Philippines Energy Plan (PEP) 2023-2050, nuclear energy is being considered as an option to support the Philippines' long-term energy security and decarbonisation objectives. Decisions on whether and how to pursue its development require clear, timely and proactive policy commitment, which includes establishing the enabling conditions that allow the private sector to undertake technical and investment assessments. This, in turn, necessitates a comprehensive and co-ordinated support framework encompassing regulatory readiness, market design and financing structures. Building a skilled workforce is also critical for the development of a robust nuclear energy industry, requiring national and regional workforce assessments to identify future skills requirements, potential gaps and required investment.

Regulatory capacity building could serve as a central pillar of enhanced co-operation under the AZEC framework and could include structured regulatory co-operation, training, and peer exchange, particularly with experienced nuclear regulators. Japan's leadership in advanced nuclear co-generation, robust nuclear safety, security, and mature regulatory and emergency preparedness systems make it an ideal partner for technical learning and translating policy into practice. Curated study tours to nuclear facilities and engagements with Japanese regulators, operators and research institutions could provide hands-on exposure to nuclear use cases, licensing and oversight processes, as well as best practices in community engagement and risk communication.

The Philippines is not the only AZEC country considering nuclear energy. AZEC-led platforms could support multi-country technical workshops to provide the Philippines and other AZEC partners with robust capacity building.

Training and knowledge exchange on grid modernisation

Like many neighbouring countries undergoing rapid transformations, modernising grids in the Philippines is essential to support rising demand growth, an increasing share of renewables, expanding electrification and the deployment of new technologies. As a resource with multiple benefits, energy efficiency can also be considered in integrated planning frameworks. It also aligns with Philippine Energy

Transition Strategies under the PEP 2023-2050, which aim to roll out the Smart Green Grid Project, while also incorporating energy efficiency and conservation measures.

Developing and implementing the integrated planning frameworks, and incorporating scenario analyses that account for climate targets, economic growth and key uncertainties, depend heavily on the capacity and awareness of key stakeholders. Strengthening technical expertise among planning entities helps ensure that strategies can be implemented, and that they are cost-effective and responsive to local constraints such as land availability. Regional capacity building workshops can support knowledge transfer to key stakeholders, including policy makers, grid planners, system and market operators, as well as market participants. Workshops could address advanced planning methodologies, including integrated planning, or VRE integration, digital tools and decentralised energy systems.

AZEC working groups, development partners and financial institutions can contribute by supporting training and facilitating regional and international knowledge transfer. Such collaboration strengthens institutional capacity and ensures consistency in planning approaches, data and scenarios across grid planning exercises.

AZEC Task Force on Energy Resilience

Resilience is a key component in the PEP 2023-2050 and an increasingly important component for the energy transition pathway as climate and extreme weather risks intensify. To facilitate investments in energy resiliency, the Department of Energy is strengthening partnerships with other government agencies, development partners and international funding institutions. The scale and complexity of emerging climate risks increasingly warrant international collaboration, for example on cross-border supply chains, technical expertise, regional learning, stress-testing and rapid mutual assistance during large-scale disasters.

Globally, regional platforms have proven effective in complementing national disaster response efforts. In Europe, the EU Civil Protection Mechanism co-ordinates cross-border assistance and risk assessments to strengthen disaster preparedness. In Asia, the India-led Coalition for Disaster Resilient Infrastructure establishes global standards, such as the Global Infrastructure Risk Model and Resilience Index, which quantifies climate risks internalised in power and infrastructure.

An AZEC Energy Resilience Task Force could serve as a voluntary, regional, implementation-focused platform that complements existing national mechanisms. Building on regional co-operation already underway through the

Asia Pacific Economic Cooperation (APEC) forum's Energy Resilience Task Force, an AZEC-level initiative could provide a smaller, implementation-focused platform to pilot practical tools (e.g. resilience benchmarks, mutual support protocols, guidelines for financing mechanisms, technical co-ordination and capacity building workshops) among economies with shared risk profiles and technical experience.

In light of the current energy landscape, which has highlighted the vulnerabilities of, and heightened risks to, global energy supply, it could also be valuable to incorporate co-operation under AZEC to strengthen regional energy supply chains.

General annex

Annex A – Key power sector policies

Policy	Year	Details	Reference
Department Circular No. DC2026-02-0008	2026	Supplementary and Amendatory framework for the DC No. 2023-04-0008 mandates that all variable renewable power plants of at least 10 MW integrate storage capacity of 20% or more of the plant's installed capacity.	DOE
Department Circular No. DC2026-02-0005	2026	Requires power producers and utilities to align their investments and procurement with system needs to ensure grid reliability	DOE
Senate Bill No. 2793 (Philippine Natural Gas Industry Development Act)	2025	Establishes a framework for the downstream natural gas industry to reduce dependence on imported fuel, promote LNG as a reliable power source and support transition to renewables.	Senate of the Philippines
Senate Bill No. 2348 (Act Strengthening Further the Electric Power Industry)	2025	Amends the EPIRA in expanding energy sources, attracting investments, modernising the distribution sector, increasing energy supply and lowering electricity prices.	Senate of the Philippines
Executive Order No. 21	2023	Directs the establishment of policy and the administrative framework for efficient and optimal development of offshore wind resources, and includes streamlined approvals.	DOE
Department Circular No. DC2023-05-0014	2023	Amends rules for RPS: the minimum percentage of energy supply from eligible renewable energy resources set at 2.52%, with annual incremental increases targeting 35%. No single national percentage for off-grid RPS but based on minimum share for optimal supply mix.	DOE
Department Circular No. DC2022-11-0034	2022	Amends the implementing rules and regulations of the Renewable Energy Act to remove nationality restrictions on foreign ownership for many renewable energy projects.	DOE
WESM System Security and Reliability Guidelines	2022	Provides operational rules for market participants to maintain grid reliability across Luzon, Visayas and Mindanao, reducing risks of outages and ensuring stable supply.	WESM

RA No. 11646 (Microgrid Systems Act)	2022	Provides the legal framework for deploying microgrid systems in unserved and underserved areas, mandating the DOE to declare such areas and to select microgrid system providers through competitive selection.	DOE
Department Circular No. DC2021-11-0036	2021	Provides revised guidelines for the GEA Program.	DOE
Department Circular No. DC2020-07-0017	2020	Adopts the GEA Policy, which governs the conduct of Green Energy Auctions.	DOE
Ready for Renewables: Grid Planning and Competitive Renewable Energy Zones in the Philippines	2020	Introduces a planning framework that aims to identify high-quality, low-cost renewable resource areas and align transmission investment and grid planning with those zones. It also aims to de-risk projects, lower integration costs and encourage private investment.	DOE
Advisory on coal moratorium	2020	Proposes a halt to endorsements for main-grid greenfield coal plants, except in the case of expansions and projects with substantial accomplishments. Exemptions are noted for new applications, such as industrial parks, exceptional circumstances and off-grid areas.	DOE
ERC Reliability Performance Indices	2019	Sets outage allowances and reliability standards for power plants, ensuring that facilities undergo servicing and limiting forced outages to improve system reliability.	ERC
Department Circular No. DC2018-01-0001	2018	Proposes the adoption of Energy Resiliency in the Planning and Programming of the Energy Sector to Mitigate Potential Impacts of Disasters. Mainstreaming inclusion of resiliency planning in infrastructure and energy projects and investments, and establishing the Task Force on Energy Resiliency to oversee the implementation. Updated through DC2022-06-0028.	DOE
RA No. 11285 (Energy Efficiency and Conservation Act)	2019	Institutionalises energy efficiency and conservation by creating a national framework.	DOE
RA No. 11234 (Energy Virtual One Stop Shop Act [EVOSS])	2019	Establishes the EVOSS online platform to centralise and streamline permitting for power generation, transmission and distribution projects, imposing clear processing timelines.	DOE

Department Order No. DO2016-10-0013	2016	Creates the Nuclear Energy Program Implementing Organisation (NEPIO) in the Department of Energy to co-ordinate and propose a national policy on nuclear power.	DOE
Department Circular No. DC2016-04-0004	2016	Implements Retail Competition and Open Access (RCOA).	DOE
Department Circular No. DC2015-03-0001	2015	Mandates must-dispatch for VRE and priority dispatch for renewable energy plants. Renewable resources thus get scheduling and dispatch priority over conventional generation in WESM, when available.	DOE
Department Circular No. 2009-05-0008, Section 4	2009	Introduces Renewable Portfolio Standards to mandate electricity suppliers to source a minimum percentage of their energy supply from eligible renewable energy resources.	DOE
Department Circular No. 2009-05-0008, Section 7	2009	Implements net metering for renewable energy for end users, up to a capacity of 100 kW to sell surplus power back to the grid.	DOE
Department Circular No. 2009-05-0008, Section 6	2009	Introduces the Green Energy Option Program that allows end users to directly contract energy requirements from renewable energy facilities through their distribution utilities.	DOE
Department Circular No. 2009-05-0008, Section 5	2009	Proposes a feed-in tariff scheme with a fixed tariff mechanism for electricity produced from emerging renewable energy resources for a minimum of 12 years.	DOE
RA No. 9367 (Biofuels Act 2006)	2007	Mandates the blending of locally sourced bioethanol and biodiesel into transport fuels and establishes a national biofuels programme to reduce oil import dependence, cut greenhouse gas and toxic emissions.	DOE
RA No. 9136 (Electric Power Industry Reform Act)	2001	Provides a framework for the restructuring of the electric power industry, including the privatisation of NPC assets.	Asian Development Bank

Notes: DOE = Department of Energy (Philippines); EPIRA = Electricity Power Industry Reform Act; ERC = Energy Regulatory Commission; EVOSS = Energy Virtual One Stop Shop Act; GEA = Green Energy Auction; LNG = liquified natural gas; NEPIO = Nuclear Energy Program Implementing Organisation; NPC = National Power Corporation; RA = Republic Act; RCOA = Retail Competition and Open Access; RPS = renewable portfolio standards; WESM = Wholesale Electricity Spot Market; VRE = variable renewable energy.

Sources: APERC (Asia Pacific Energy Research Centre) (2025), APEC Energy Overview 2025; Morales, L.T. (2023), Philippines Country Report, in Kimura, S., H. Phoumin, and A.J. Purwanto (eds.), Energy Outlook and Energy-Saving Potential in East Asia 2023.

Annex B – Ancillary services available in the Philippines' power market

Ancillary service type	Classification	Requirement
Regulating reserve	Readily available and dispatchable generating capacity that is allocated exclusively to correcting deviations from the acceptable nominal frequency, caused by unpredicted variations in demand or generation output.	4% of total demand
Contingency reserve	Synchronised generation capacity from qualified generating units and qualified interruptible loads allocated to cover the loss or failure of a synchronised generating unit or a transmission element, or of power import from a circuit interconnection.	Maximum capacity among: 1) the largest synchronised generating units; 2) transmission elements; or 3) power import from a circuit interconnection
Dispatchable reserve	Generating capacity that is not scheduled for regular energy supply, the regulating reserve or contingency reserve; or interruptible loads not scheduled for contingency reserve and that are readily available for dispatch to replenish the contingency reserve service whenever a generating unit trips or the loss of a single transmission interconnection occurs.	Maximum capacity among: 1) second largest synchronised generating units; 2) transmission elements; 3) power import from a circuit interconnection
Reactive power support	Capability to supply reactive power to, or absorb reactive power from, the grid to maintain the bus voltage within ±5% of its nominal voltage.	System operator to determine the day ahead through load flow simulation
Black start services	Ability of a generating unit, without assistance from the grid or other external power supply, to recover from a shut-down condition to an operating condition so as to energise the grid and assist other generating units to start.	At least two generating units contracted per power restoration highway, with one always available at any given time

Source: National Grid Corporation of the Philippines (2024), 2025-2034 Ancillary Service Agreement Procurement Plan.

Abbreviations and acronyms

APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
AZEC	Asia Zero Emission Community
BESS	battery energy storage system
BIMP-PIP	Brunei Darussalam-Indonesia-Malaysia-Philippines Power Integration Project
CREZ	Competitive Renewable Energy Zones
DOE	Department of Energy of the Philippines
EPIRA	Electricity Power Industry Reform Act
ERC	Energy Regulatory Commission
ERIA	Economic Research Institute for ASEAN and East Asia
EV	electric vehicle
GEA	Green Energy Auction
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IEMOP	Independent Electricity Market Operator of the Philippines
LNG	Liquified natural gas
MGSP	Microgrid system provider
NGCP	National Grid Corporation of the Philippines
NDC	Nationally Determined Contribution
NPC	National Power Corporation
NPC-SPUG	National Power Corporation Small Power Utilities Group
PDP	Power Development Plan (2023-2050)
PEMC	Philippine Electricity Market Corporation
PEP	Philippine Energy Plan (2023-2050)
PhilATOM	Philippine Atomic Energy Regulatory Authority
PHP	Philippines peso
PSH	pumped-storage hydro
RPS	renewable portfolio standard
TDP	Transmission Development Plan
TFER	Task Force on Energy Resiliency
VRE	variable renewable energy
WESM	Wholesale Electricity Spot Market (Philippines)

Units of measure

Bcf	billion cubic feet
bcm	billion cubic metres
bcm/yr	billion cubic metres per year
g CO_2/kWh	gramme of carbon dioxide per kilowatt hour
GW	gigawatt
GWh	gigawatt hour
kV	kilovolt
kVA	kilovolt ampere
kWh	kilowatt hour
Mcf	million cubic feet
mtpa	million tonnes per annum
MW	megawatt
MWh	megawatt hour
PJ	petajoule
PHP/MWh	Philippines peso per megawatt hour
Tcf	trillion cubic feet
TWh	terawatt hour
USD/MWh	United States dollar per megawatt hour

See the IEA glossary for further explanation of many of the terms used in this report.

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