Global Energy Monitor

Southeast Asia's Energy Crossroads

2024

THE COST OF GAS EXPANSION VERSUS THE PROMISE OF RENEWABLES

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Global Energy Monitor (GEM) develops and analyzes data on energy infrastructure, resources, and uses. We provide open access to information that is essential to building a sustainable energy future. Follow us at www.globalenergymonitor.org and on Twitter/X @GlobalEnergyMon.

ABOUT THE ASIA GAS TRACKER

The Asia Gas Tracker is an online database that identifies, maps, describes, and categorizes gas infrastructure across Asia, including gas pipelines, liquefied natural gas (LNG) terminals, gas-fired power plants, and gas fields. Developed by Global Energy Monitor, the tracker uses footnoted wiki pages to document each project and is updated annually.

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KEY POINTS

- Current gas expansion plans could lead to a doubling of Southeast Asia's gas-fired power capacity and an 80% increase in its liquefied natural gas (LNG) import capacity. If built, these projects could lock Southeast Asian countries into relying on an economically volatile and insecure fuel and would require a capital investment of over $220 billion.
- Vietnam, the Philippines, Indonesia, Malaysia, and Thailand are at the forefront of this push, with over 100 gigawatts (GW) of gas power capacity in development, 47 million tonnes per annum (mtpa) of LNG import capacity in development, and 16.7 mtpa of LNG export capacity in development.
- Renewable energy is a growing and viable alternative to gas power. Southeast Asia's planned solar and wind capacity could meet over half of the additional power needed by 2030. Current benchmark levelized costs of electricity (LCOEs) in Southeast Asia show that solar photovoltaic (PV) and onshore wind are cost competitive with new gas power plants.
- The region's in-development large utility-scale solar and wind capacity, if successfully built, could generate 450 terawatt-hours/year (TWh/year) of electricity according to GEM's Global Solar Power Tracker and Global Wind Power Tracker, covering nearly two-thirds of the increase in projected energy demand by 2030.

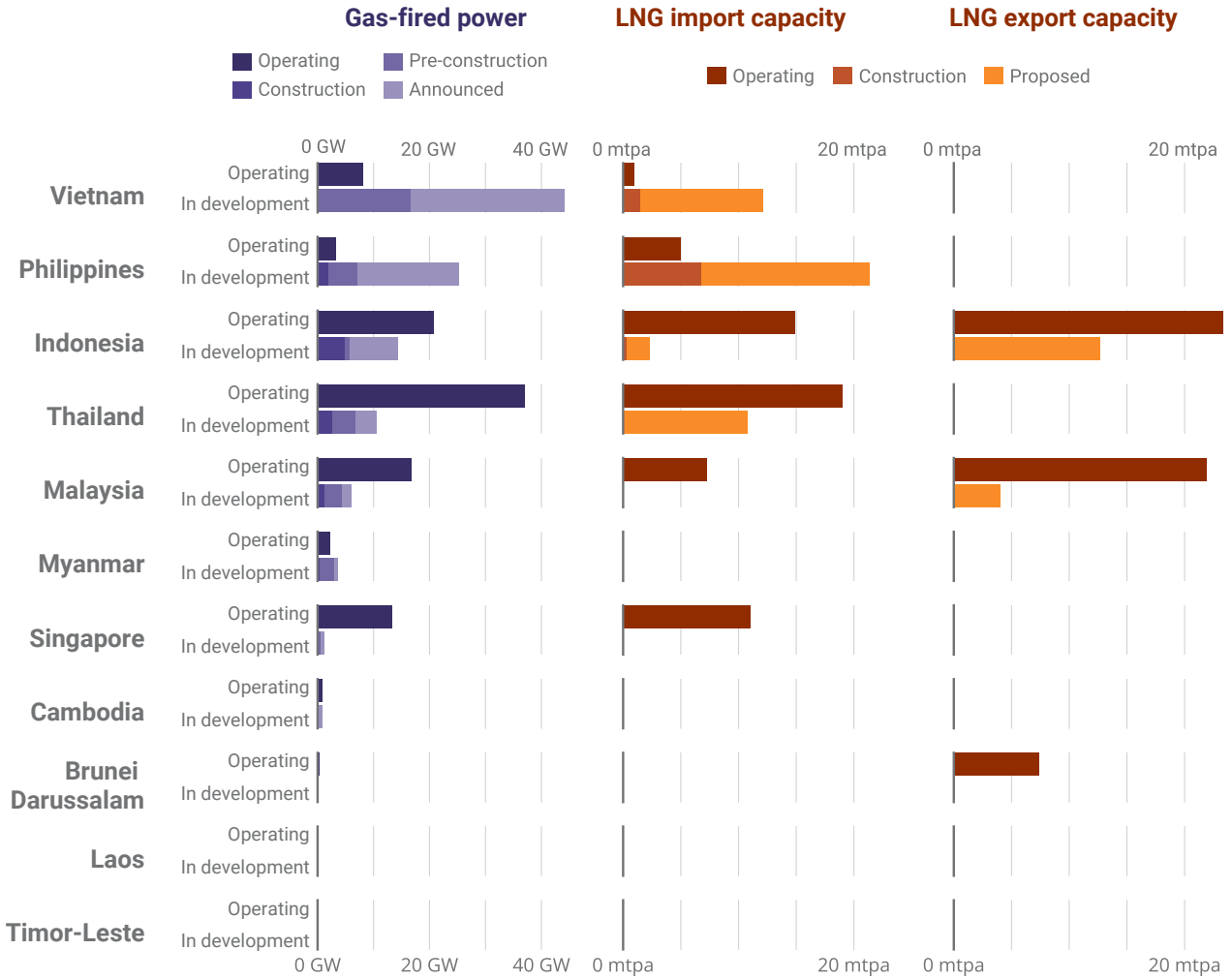
INTRODUCTION

Southeast Asia is notable within Asia's broader gas infrastructure buildout for its outsized influence on global energy. GEM data show that Vietnam, the Philippines, Indonesia, Malaysia, and Thailand are at the forefront of this push, with over 100 GW of gas power capacity in development, 47 mtpa of LNG import capacity in development, and 16.7 mtpa of LNG export capacity in development.

Due to rapid urbanization, a growing population, and an increasing standard of living, Southeast Asia's collective GDP has nearly tripled since 2000, surpassing global GDP growth rates. Consequently, the sub-region's energy demand has grown exponentially and is expected to have the second-highest energy demand growth in the world after India until 2050.

Vietnam, the Philippines, Thailand, Indonesia, and Malaysia lead Southeast Asia's gas expansion

Gas-fired power capacity in gigawatts (GW), and LNG import and export capacity in million tonnes per annum (mtpa), shown by country and status



Note: For gas plants, "in development" refers to announced, pre-construction, and construction; for LNG terminals, it refers to proposed and construction.
Source: Asia Gas Tracker

Most of Southeast Asia's energy demand is met with fossil fuels; hence, it has the largest absolute growth of carbon dioxide emissions of any region globally. About 40% of the region's electricity is currently generated using coal. However, Southeast Asian nations are driving a massive gas infrastructure buildout fueled by an erroneous view that gas is a "transitional fuel" that can help achieve net zero emissions targets and bridge the gap to a future powered by renewable energy.

Commissioning all of the region's gas power and LNG capacity in development would double the region's current operational gas-fired generation capacity, which stands at 102 GW. Additionally, LNG import capacity could increase by 80% and export capacity by over 30%. If built, these projects could lock Southeast Asian countries into relying on an economically volatile and insecure fuel and draw investment away from the energy transition. In-development gas power capacity would require a capital investment of over $180 billion, while in-development LNG import and export infrastructure would require another $40 billion. Moreover, it could also have broader economic and geopolitical ramifications, as increasing gas demand in Southeast Asia would drive extraction, processing, and infrastructure development activities in gas-exporting countries like the U.S., Qatar, and Australia.

However, GEM data and other research show that Southeast Asia could meet its growing energy needs through renewable sources, which are increasingly cost-competitive. While burning gas emits less carbon dioxide than burning diesel or coal, the lifecycle emissions (and therefore the climate impacts) of gas-fired power plants could actually be greater than those of diesel or coal plants due to fugitive methane emissions throughout the value chain. Furthermore, domestic renewable power paired with storage could offer countries independence from the price swings of the global gas market.

ZOOMING IN ON SOUTHEAST ASIA'S GAS EXPANSION

Vietnam

Vietnam has 44 GW of gas power capacity in development, all in the proposed and pre-construction stages. In addition, it has 12.1 mtpa of LNG import capacity in development, of which 1.5 mtpa is already in construction. It also has eight in-development and five discovered gas extraction areas.

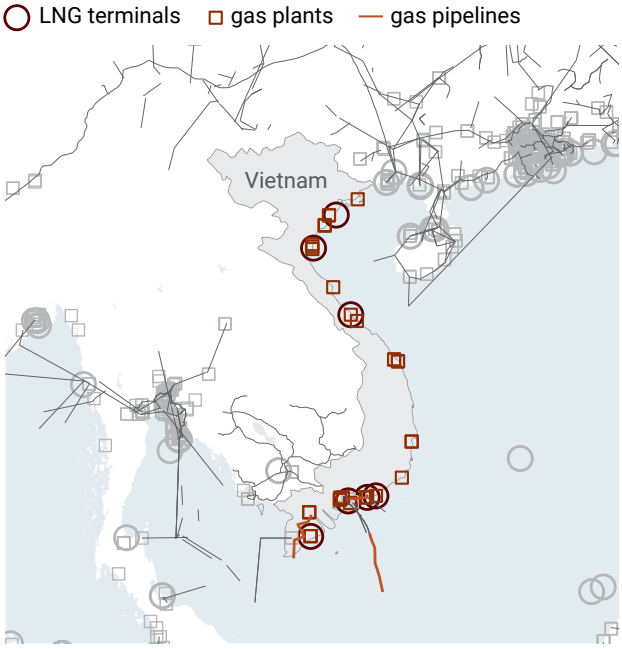
Vietnam's push for LNG began amid dwindling domestic gas resources and strong opposition to coal power. The country's Eighth Power Development Plan (PDP8), approved in May 2023, sets an ambitious target of moving away from coal and increasing the use of renewables, hydrogen, ammonia, and battery storage, positioning LNG as a transitional energy source. Vietnam views LNG as a bridge between phasing out coal and adopting clean energy solutions. Therefore, as it sets a 2030 target for coal-fired capacity to peak at 30 GW and for coal's share in power generation to be reduced to 20%, the plan is for gas-fired capacity to reach 38 GW in the same period, with a share of 25% compared to 9.3% in 2022. LNG will account for around 15% of the country's energy needs, while 10% will be met with domestic gas.

To meet this target, Vietnam plans to build thirteen LNG-fired power plants by 2030. It has already inaugurated its first LNG import terminal with a capacity of 1 mtpa and welcomed its first LNG shipment in 2023. However, Vietnam's ambitious plans to integrate LNG into its energy mix are fraught with difficulties, mainly due to disputes over electricity pricing and purchasing agreements. In the past, thermal power projects in Vietnam have often taken seven to ten years to reach financial close. Consequently, LNG is unlikely to alleviate Vietnam's power shortages, at least in the near term.

Vietnam's Just Energy Transition Partnership (JETP) is a significant international collaboration aimed at supporting the country's transition towards a greener and more sustainable energy system. Announced in December 2022, this partnership seeks to mobilize $15.5 billion of public and private finance to assist the country's shift away from fossil fuels towards clean energy, in alignment with PDP8.

Vietnam embraces gas as a transition away from coal

LNG terminals and gas power expansion throughout Vietnam



Note: in-development projects in Vietnam are shown in shades of brown; all other infrastructure is gray. "In development" includes proposed and construction for pipelines and LNG terminals, and announced, pre-construction, and construction for gas plants.
Source: Asia Gas Tracker

The Philippines

The Philippines has over 25 GW of gas power capacity in development, of which 2 GW has entered the construction phase. It also has 21 mtpa of LNG import capacity in development, with approximately 7 mtpa already in construction.

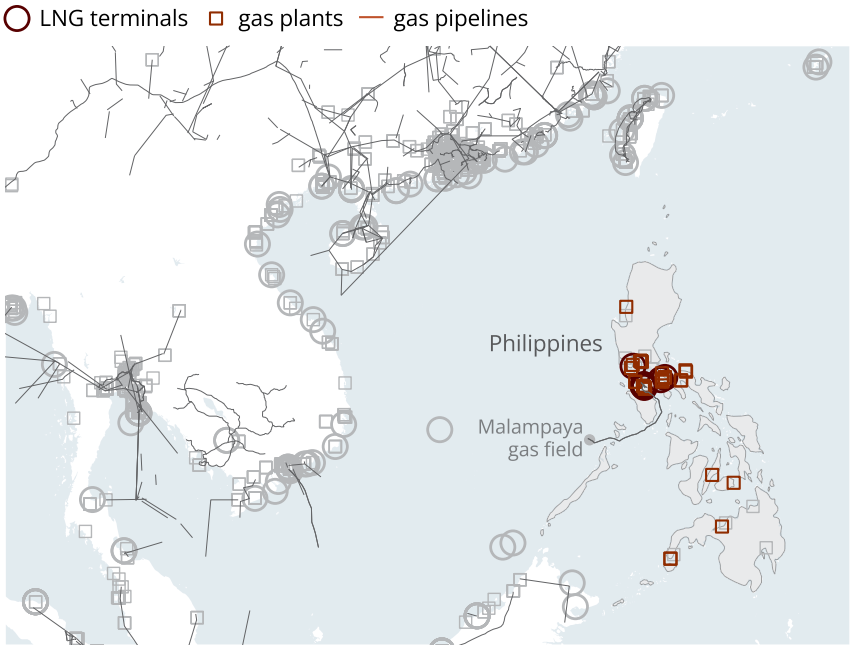
The country's domestic gas production comes entirely from the Malampaya field, which produces 3–4 billion cubic meters (bcm) of gas annually and supplies gas to three power plants with a combined capacity of 3 GW. However, production levels from the field are expected to decrease starting in 2024, and the field may run dry by 2027. Apart from Malampaya, the country has no operational or in-development gas fields.

Like Vietnam, the Philippines also considers LNG a crucial ingredient for its energy transition. To ensure a stable supply to its existing gas power plants and meet rising power demand, the Philippines commissioned its first two LNG import terminals in 2023. The Department of Energy (DoE) has issued the Notice to Proceed to another five. All of these measures are intended to fulfill the goals outlined in the Philippine Energy Plan (PEP) 2020–2040, which aims to facilitate LNG imports in the wake of the declining Malampaya field supply and increase the share of gas in the power generation mix to 26% by 2040.

However, analysts have also noted that even though gas demand in the Philippines is initially expected to reach 3 mtpa, it might decrease to 2.3–2.7 mtpa by 2030 due to further progress in the country's renewable energy initiatives. In fact, a recent report found that it is completely feasible for the Philippines to fully decarbonize its power sector by 2050. The

The Philippines increases gas reliance as domestic production declines in Malampaya field

LNG terminals and gas power expansion throughout the Philippines



Note: In-development projects in Philippines are shown in shades of brown; all other infrastructure is gray. "In development" includes proposed and construction for pipelines and LNG terminals, and announced, pre-construction, and construction for gas plants.
Source: Asia Gas Tracker

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government's Green Energy Auction Program (GEAP), launched in 2022, is an important initiative to increase the country's renewable energy capacity. The program involves a competitive bidding process through which different energy producers can submit their bids to develop renewable energy projects under predefined terms set by the DOE. The first and second rounds of auctions successfully contracted over 5,500 megawatts (MW) of renewable energy capacity in total.

Thailand

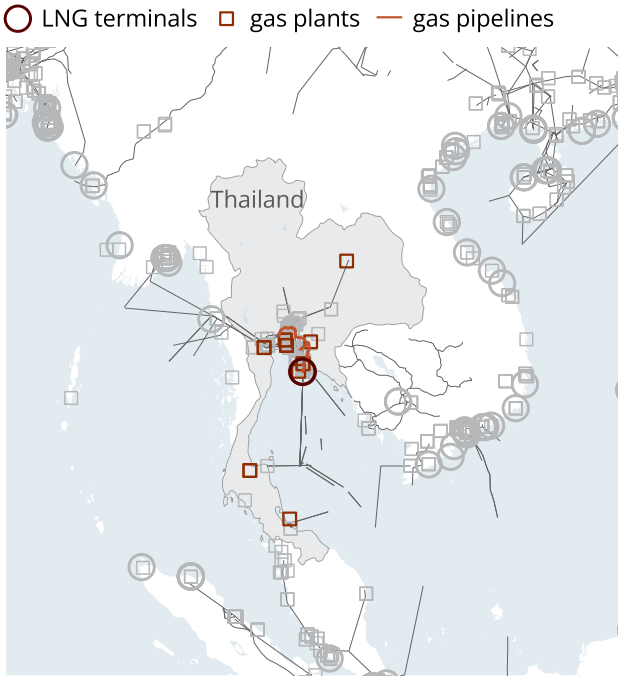
Thailand has around 10.5 GW of gas power capacity in development, with over 2.5 GW already in construction. It also has around 11 mtpa of proposed LNG import capacity.

Thailand has significantly pivoted its energy strategy in response to dwindling domestic gas reserves and evolving energy demands. Historically, the nation heavily depended on offshore reserves in the Gulf of Thailand and gas imports from Myanmar's Yadana and Yetagun fields. However, recognizing the depletion of these reserves, the government approved an amended National Power Development Plan (PDP) in April 2019.

The revised PDP places heightened emphasis on gas. It projects a substantial increase in gas' contribution to the energy mix, aiming for 53% by 2037, reflecting a 13% increase from prior projections. Anticipating

Thailand increases gas share in energy mix as national plan locks in gas dependency

LNG terminals and gas power expansion throughout Thailand



Note: In-development projects in Thailand are shown in shades of brown; all other infrastructure is gray. "In development" includes proposed and construction for pipelines and LNG terminals, and announced, pre-construction, and construction for gas plants.
Source: Asia Gas Tracker

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a surge in total gas demand, estimated at 60 bcm by 2030, Thailand aims to increase its reliance on LNG imports. The country plans to increase the share of LNG in the total gas supply to 40% by 2025 and close to 80–90% by 2037. However, recent reports suggest that the country will see a slowdown in LNG import growth in 2024. This trend is likely due to state policies aimed at reducing electricity costs, increasing reliance on alternative fuels for power generation, and boosting domestic gas production.

Indonesia

Indonesia has over 14 GW of gas power capacity in development, of which almost 5 GW is in the construction phase. The country is the sixth biggest LNG exporter in the world, with an operating LNG export capacity of over 23 mtpa and another 12 mtpa in development. Indonesia also has the largest LNG import capacity in Southeast Asia, with around 15 mtpa in operation and another 2.3 mtpa in development.

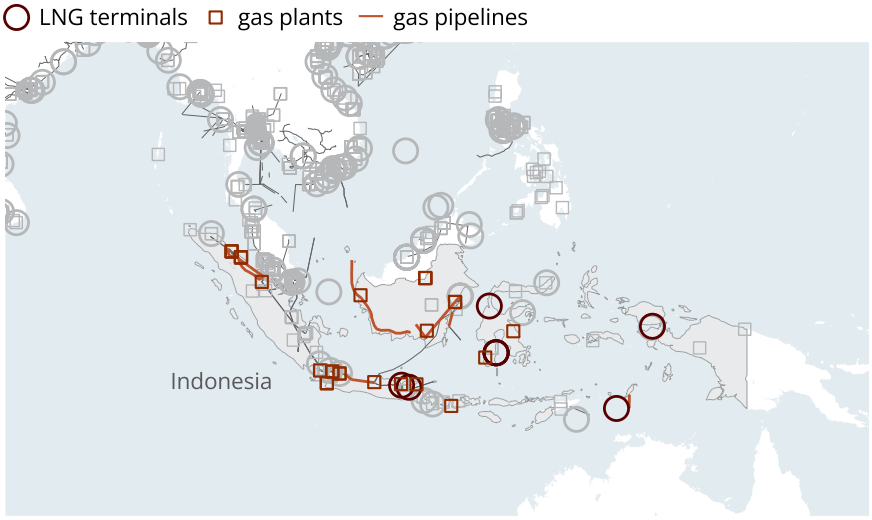
Indonesia holds the third-largest gas reserves in the Asia Pacific region. It has been successfully meeting its own gas needs while also exporting substantial quantities as LNG and via pipelines. However, there has been a consistent decline in domestic gas production since its peak of 87 bcm in 2010. As of 2012, the country's domestic gas use has consistently surpassed its exports. Consequently, the Indonesian government has pledged to enhance the use of gas domestically and to gradually curtail exports to maintain energy security and independence, thereby bolstering economic growth.

The 2022 APEC Energy Demand and Supply Outlook forecasts that Indonesia will shift to being a net gas importer by 2040. By 2050, imports could account for more than 30% of the nation's gas demand.

Recently, the country received a $20 billion commitment through Indonesia's JETP announced at the G20

Indonesia entrenches itself in gas further, as sixth-largest LNG importer globally and largest exporter in Southeast Asia

LNG terminals and gas power expansion throughout Indonesia



Note: In-development projects in Indonesia are shown in shades of brown; all other infrastructure is gray. "In development" includes proposed and construction for pipelines and LNG terminals, and announced, pre-construction, and construction for gas plants.
Source: Asia Gas Tracker

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summit in November 2022. This funding is designed to accelerate Indonesia's shift to renewable energy as part of its National Energy Plan (RUEN), aligning with its climate commitments under the Paris Agreement. Under the plan, coal will remain an important part of the energy mix for power generation until 2050. Meanwhile, the role of gas is also expected to grow, increasing its share of the primary energy mix to 24% by 2050, and all gas production is to be allocated strictly for domestic use.

Malaysia

Malaysia is the fifth-largest LNG exporter in the world. It has approximately 31.5 mtpa of operating LNG export capacity, with another 4 mtpa in development. It also has over 6 GW of gas power capacity in development.

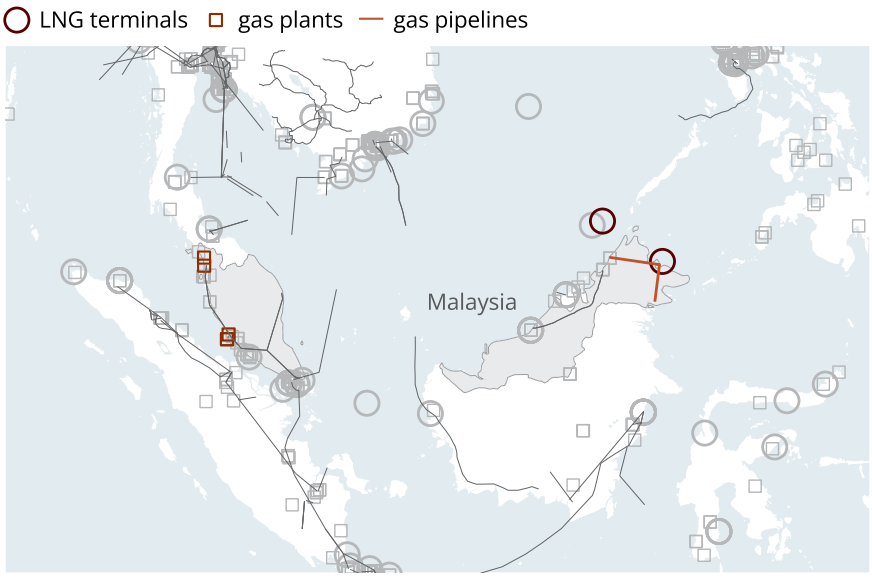
Ranked as the ninth-largest gas producer globally, Malaysia saw its production decline by 9% in 2022 compared to the previous year. Around 40% of its gas production is exported, primarily as LNG, while the rest is consumed within the country. Petronas, the national energy company, anticipates that domestic oil and gas production will peak by 2024.

Malaysia's National Energy Policy 2022–2040, published in September 2022, charts the country's shift towards a low-carbon future. By 2040, the strategy aims for gas to comprise 39% of the energy mix, while coal and oil will account for 17% and 27%, respectively. Renewable sources like hydropower, solar, and biomass are expected to fill the remaining 17%.

The 2022 APEC Energy Outlook predicts a quintupling of gas consumption in Malaysia by 2050 due to coal-to-gas switching and growing power demands. It also foresees gas-fired power's contribution rising from one-third to 71%, with gas infrastructure capacity exceeding 36 gigawatts.

Malaysia, the fifth-largest LNG exporter globally, develops additional gas power and export capacity

LNG terminals and gas power expansion throughout Malaysia



Note: In-development projects in Malaysia are shown in shades of brown; all other infrastructure is gray. "In development" includes proposed and construction for pipelines and LNG terminals, and announced, pre-construction, and construction for gas plants.
Source: Asia Gas Tracker

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THE ROLE OF INTERNATIONAL FINANCE IN SOUTHEAST ASIA'S GAS EXPANSION

International finance is an important driver of Southeast Asia's gas development plans. Different funding mechanisms are making it difficult for Southeast Asia to transition away from fossil fuels.

For instance, JETPs are intended to provide financial assistance to help coal-dependent emerging economies transition to cleaner fuels. Indonesia and Vietnam have both launched JETP initiatives in conjunction with international financing partners (including the U.S., Japan, the European Union, and others). However, Indonesia's proposal for the use of its JETP funding includes converting its diesel-fired power plants to gas, despite its lifecycle emissions issues. Similarly, Vietnam's plan includes the development of LNG-fired power plants to displace coal-powered units.

The JETP process is intended to support a "just transition" in part by allowing countries to define their own pathways in their move toward a cleaner energy system; however, without strong guardrails, the process may provide perverse incentives to lock in gas.

Additionally, the big push for new gas development across Southeast Asia wouldn't be possible without significant pro-fossil financing. JETP financing alone wouldn't be sufficient to support the large planned buildout. According to a report by CEED, four Japanese banks, Japan Bank for International Cooperation (JBIC), Sumitomo Mitsui, Mizuho Financial Group, and Mitsubishi UFJ, are among the ten biggest financiers of gas in Southeast Asia, with a combined funding of USD 9.7 billion over the last decade. Part of the impetus for this support seems to be an attempt to shore up Japan's own energy security and to help utilities offload excess LNG cargoes when they are overcontracted.

Recently, Japan's demand for LNG has fallen. Many Japanese companies, including JERA, Tokyo Gas, Osaka Gas, and Kansai Electric, are now looking for markets in which to sell their excess supplies. Supporting the growth of LNG use in Southeast Asia, as JERA is doing in the Philippines, would provide a growing market to Japanese LNG buyers who find themselves with surplus supply.

A similar trend has been noted in South Korea, where dwindling domestic gas demand is being managed by offloading excess gas supply in the emerging markets in South and Southeast Asia. Overall, between 2013 to 2022, South Korea has committed billions in USD in public financing to support the development of the gas sector in the region, posing a direct challenge to Southeast Asia's energy transition.

CARBON CAPTURE PLANS RISK DELAYING THE ENERGY TRANSITION

Japan's gas advocacy in Southeast Asia extends to carbon capture and storage (CCS), a concept that is gaining traction in the region. In March 2024, Malaysia's Petronas signed a memorandum of understanding with a Japanese consortium to explore storing CO2 emissions from Japan with CCS in Malaysia.

Malaysia, Indonesia, and Thailand are all considering establishing individual CCS projects or hubs. The largest such project in development in Southeast Asia, and the largest offshore CCS project in the world, is at the Kasawari Oil and Gas Field. CCS has been considered for LNG projects as well, such as the Abadi LNG Terminal in Indonesia.

Oil and gas developers are promoting CCS with an eye toward reducing project emissions and making projects appear more environmentally friendly. The resolution from the 2023 United Nations Climate Change Conference (COP 28) lends legitimacy to these plans by listing CCS alongside renewables and nuclear power as technologies critical to the energy transition, while reiterating the importance of "transition fuels" such as gas.

While CCS may have limited applications in hard-to-decarbonize sectors, International Energy Agency (IEA) chief Fatih Birol has said that industry needs to "[let] go of the illusion that implausibly large amounts of carbon capture are the solution." In its Net Zero by 2050 scenario, the IEA has been clear that new oil and gas development, including new LNG terminals, is not necessary and will detract from progress toward international climate goals. CCS projects planned for the upstream oil and gas and power sectors, as envisioned in Southeast Asia, risk locking countries into greater fossil fuel consumption and delaying their energy transitions.

CCS is largely unproven and has a mixed track record where it has been applied. Renewable energy, however, is an increasingly viable source of low-carbon power for regions like Southeast Asia.

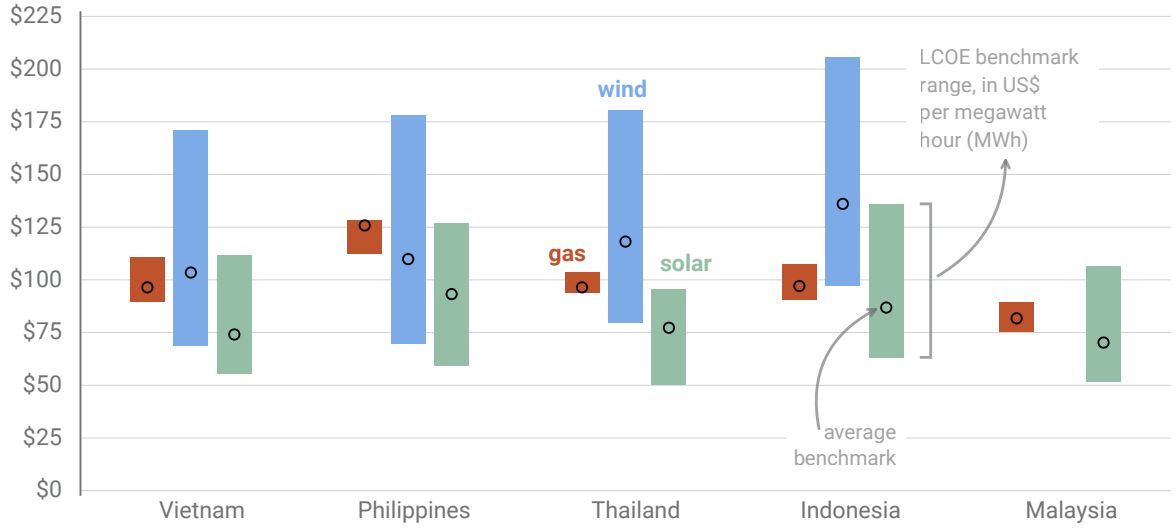
A STRATEGIC PIVOT TOWARD RENEWABLES

Southeast Asia has remarkable untapped potential for solar and wind energy. According to the National Renewable Energy Laboratory's (NREL) theoretical estimates, the region has over 30,523 GW of solar PV and 1,383 GW of wind power generation potential. If utilized, this could generate over 45,000 TWh of solar power and over 3,000 TWh of onshore wind power. Cumulatively, this is 131 times as much electricity as the region's currently in-development gas power capacity can produce.[1]

Currently, the region's cumulative electricity demand stands at 1,206 TWh/year. It is expected to reach 1,923 TWh/year by 2030, which implies that the region will need 716 TWh/year of additional electricity by 2030. Data from GEM's Global Solar Power Tracker and

Solar and wind are getting cheaper to build, but gas remains competitive

Levelized cost of electricity (LCOE), in US$ per megawatt hour (MWh), for gas-fired, wind, and solar power



Graphic reproduced from September 2023 Renewable Energy Report; bars show range, and circles show average benchmarks.
Source: Renewable Energy Institute

1. Asia Gas Tracker 2024 Report Methodology: https://www.gem.wiki/Asia_Gas_Tracker_2024_Report_Methodology

Global Wind Power Tracker show that the region's prospective large utility-scale solar and wind capacity,[2] if successfully built, can generate 450 TWh/year of electricity, which equates to almost two-thirds of this additional demand. The region's impressive offshore wind potential, estimated by IRENA at over 1,100 GW, can further fill in some of this gap in demand growth. Similarly, with the implementation of favorable policies for rooftop and smaller-scale solar, the region could easily generate an additional 100 TWh/year.[3]

The remaining demand could be met by the proposed gas expansion; however, there would be significant costs to doing so. The LCOE for solar PV and onshore wind in Southeast Asian countries is becoming increasingly competitive compared to gas. Current benchmark LCOEs range between $70 and $95/MWh for solar PV and $105–135/MWh for onshore wind, compared to $80–125/MWh for combined-cycle gas turbines (CCGT). Similarly, the LCOE for offshore wind in Vietnam and the Philippines, the two Southeast Asian countries with the highest planned offshore wind capacity, was recently estimated at $121–218/MWh and $154–157/MW, respectively. While the LCOE numbers are comparatively high at this time, the ambitious offshore wind plans, if successfully implemented, will likely quickly bring these costs down. This cost advantage is likely to become even more pronounced, considering the decreasing cost trend of renewables and the volatility of gas prices. Wood Mackenzie has stated that by 2030, renewables will be one-third cheaper than fossil fuels in the Asia Pacific region. With these competitive costs, harnessing Southeast Asia's abundant, locally available renewable resources is the sound decision, rather than investing in insecure, dirty fossil fuels from abroad.

The main challenge, however, is that these resources are unevenly distributed across the Southeast Asian region. NREL ranks Myanmar, Vietnam, and Thailand as the top three countries in the region in terms of wind power potential, while Thailand, Myanmar, and Cambodia have the largest potential for solar power deployment. Therefore, expanding cross-border electricity trade is critical to accelerating renewable energy growth and adoption in the region.

Another barrier to incorporating utility-scale solar and wind power into national electrical grids is the lack of sufficient investment in grid infrastructure. For example, Vietnam's recent solar initiatives have faced a plethora of challenges concerning grid integration, potentially serving as a harbinger to investors of the difficulties they may encounter in Southeast Asian countries that are initiating markets for solar and wind energy.

Southeast Asian nations have been discussing the possibility of a regional power grid, the ASEAN Power Grid. The initial agreement, signed in 1997, cited the goals of economic efficiency and energy security; these have since been expanded to include environmental benefits due to climate change concerns. As of May 2022, the region boasted nearly 8 GW of cross-border interconnection capacity, with Laos being the largest net exporter and Thailand the largest importer of electricity. Recent developments include a significant Power Purchase Agreement (PPA) between Laos and Singapore for the trade of 100 MW of hydropower, marking progress towards regional multilateral power trade. Additionally, Malaysia lifted a ban on renewable power exports in May 2023, potentially benefiting Singapore, which aims to source 30% of its electricity from decarbonized imports by 2035. Singapore's Energy Market Authority also recently granted conditional approval to five projects that will import a total of 2GW of low-carbon electricity from Indonesia to Singapore within five years.

2. GEM catalogs all solar installations 20 MW and greater and all wind installations greater than 10 MW. Both "Large utility-scale" and "utility-scale" are used in the text to refer to such projects.

3. Globally, large utility-scale solar tracked in GEM's solar tracker is about 45% of total global solar installations. Since GEM's solar tracker shows 101 TWh/year of solar generation potential, it is reasonable to expect an additional 100 TWh/year from smaller scale installations, especially with favorable policies.

CONCLUSION

According to GEM's data, in-development gas power capacity alone would require a capital investment of over $180 billion. In-development LNG import and export infrastructure requires another $40 billion. These projects, if built, can lock the region into long-term LNG and gas supply contracts and delay the transition to renewable energy sources. Moreover, it could also have broader economic and geopolitical ramifications, as increasing gas demand in Southeast Asia would drive gas development activities in gas-exporting countries like the U.S., Qatar, and Australia. Unfortunately, international finance is currently incentivizing the development of gas infrastructure, which is not in Southeast Asia's best interests. If redirected, this funding could instead support the development of renewables and the stability of the regional power grid, which, as shown, would create more long-term economic, environmental, and energy security benefits for the region.

Most of the in-development gas infrastructure capacity in Southeast Asian countries has not yet entered the construction phase; there is still time to change course and divert investments toward renewable resources and regional grid integration. The feasibility of this strategic pivot is clearly supported by the existing renewable energy potential, renewables' cost competitiveness, and the urgent need to address climate change.

METHODOLOGY

See here for methodology used within this report.