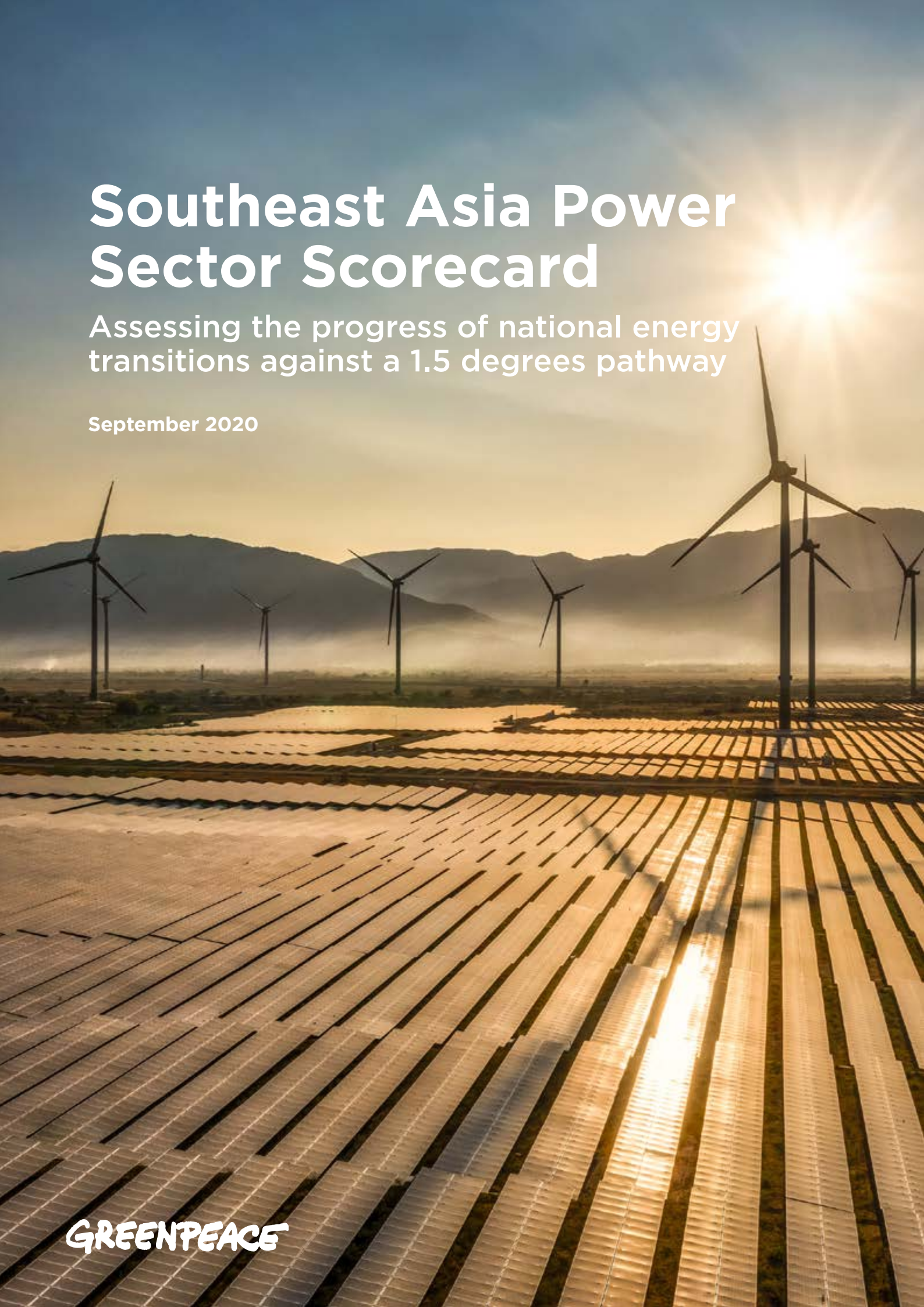


Southeast Asia Power Sector Scorecard

Assessing the progress of national energy transitions against a 1.5 degrees pathway

September 2020

GREENPEACE

Cover image: Aerial view of windmill and Solar panel, photovoltaic, alternative electricity source - concept of sustainable resources on a sunny day, Bac Phong, Thuan Bac, Ninh Thuan, Vietnam
© Hien Phung

This page: A shepherdess watches over her flock of sheep that graze near a coal power plant in Jepara, Central Java.
© Kemal Jufri/Greenpeace

Contents

View of Suralaya coal power plant in Cilegon city, Banten Province, Indonesia
©Ulet Ifansasti/Greenpeace

Introduction: Southeast Asia, a region at the crossroads

The inevitable end of coal power has been known by policymakers and project developers for decades, and was formalized by the ratification of the Paris Agreement in 2015. Yet while countries around the world have made huge strides towards renewable energy solutions, new fossil fuel power plants that have no place in 2020 or beyond are still being built.

How Southeast Asia meets growing energy demand is a crucial challenge in the fight against climate change. These countries have not historically been the worst offenders in global emissions at less than 3%.[1] But they have long relied on fossil fuels, especially coal and gas power, whose controlling economic interests have embedded themselves deep into political structures. Moreover, they will witness one of the biggest historical jumps in greenhouse gas emissions in the next ten years.[2] Now is the time to change course.

Investment in renewable energy -- wind and solar in particular -- impacts job creation and other baseline economic indicators positively, as well as the transformation of energy systems. Government spending on renewable energy has been proven to create nearly three times more jobs than coal and gas.[3] And because some renewable energy technologies, like solar, are much faster to market than coal (as solar projects have less overhead, start construction earlier and finish and go online faster), renewable energy investment is an ideal and relatively immediate vehicle for economic development. Renewable energy is analyzed here as both a tool for fast recovery from economic crises such as Covid-19 and a means to build better performing, more resilient economies.

All of the countries of Southeast Asia are party to the Paris Agreement. And each has acknowledged both the imperative to keep global temperature rise below 2 degrees Celsius in this century and the importance of pursuing a 1.5 degrees Celsius target. Regionally, the challenge of keeping below 1.5 degrees cannot be more urgent and should not be underestimated.

The region is one of the world's most vulnerable to the impacts of climate change, according to the Global Climate Risk Index 2020, with four Southeast Asian countries in the top ten most vulnerable (Myanmar, the Philippines, Vietnam, and Thailand).[4] Impacts include coastal flooding and extreme weather events, among others, that risk the livelihoods of people across Southeast Asia. To this end, the region is also home to leading campaigns for climate justice and liability that work to hold governments and fossil fuel companies accountable for climate-related risks. This work has already provided further incentive to abandon fossil fuel generation, including the impending resolution to the climate change inquiry conducted by the Philippines Commission on Human Rights that will determine whether fossil fuel companies have legal and moral responsibility to act on the climate crisis.[5]

In 2018, the Intergovernmental Panel on Climate Change (IPCC) brought together nearly 100 scientists to map out a 1.5 degrees pathway and to substantiate the difference between 1.5 and 2 degrees warming.[6] They laid out targets for where the world would need to be by 2030, 2040, and 2050 in order to be on a 1.5 degrees pathway and found that coal power has no future in these targets. In order to meet the necessary threshold, coal will need to reduce sharply by 80 percent (from 2010 levels) by 2030, meaning any coal-fired power plant (CFPP) built today goes directly against that pathway.[7]

This report will analyze the progress of eight countries' energy plans against this backdrop. As the development and progress of each country in the region vary substantially, this report will also compare the progress of countries against each other. This report will also present a model of electricity generation with two scenarios - a Business as Usual (BAU) Case and a Best Renewable Energy (RE) Case. The BAU Case is each country's energy mix based on and extrapolated data from current Power Development Plans (PDPs). The Best RE Case prioritizes solar and wind and focuses on a least-cost pathway to meet the same projected generation needs.

Scope

Our scope is the major power sectors of Southeast Asia, state-owned utilities that operate *de facto* monopolies, conglomerates that build energy projects, COVID-19 response targets for the energy transition, and the bottlenecks in market design and development where vested interests in fossil fuels (particularly coal power) still have influence.

We focus on eight countries in the region: Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. Cambodia, Lao PDR, and Myanmar are included because the size and maturity of their institutions and recent progress allow for solar and wind development, which itself can be an engine for sustainable development goals (SDGs).[8] The key SDG addressed in this report is Goal 7: Affordable and Clean Energy, as its people-centered approach addresses the need for decision makers to prioritize clean energy development in order to bring social progress and prosperity.

We focus on utility-scale solar and wind to analyze the markets that are developing in the region, and also assess each country in a scorecard that benchmarks each country's energy transition, energy planning, and the role of solar and wind in Covid-19 recovery packages.

This report promotes utility-scale renewable energy solutions, prioritizing solar and wind above other RE resources.

Thick smoke emanates from the stacks of the 2,625 megawatt (MW) coal power plant in Mae Moh district, Lampang Province in northern Thailand.
© Vincenzo Floramo / Greenpeace

Key Regional Themes in Southeast Asia's Power Sector

Toxic Coal Power

Collectively, the eight countries analyzed here represent the largest block of CFPPs under planning or construction outside of mainland China.[9] This over-reliance on coal power, especially in Indonesia and Vietnam, creates obstacles to forward-thinking energy planning and policy. There is a present and projected overcapacity of CFPPs, such that existing plants are frequently switched offline. The global average utilization of CFPPs in 2019 was on track to hit a record low, with new-build CFPPs particularly vulnerable to low utilization and, in turn, low profitability.[10] At the same time, overseas industrial corporations and power plant operators continue to be paid handsomely with the help of sovereign guarantees, state-subsidized "take or pay" power purchase agreements (PPAs), and other pay-out mechanisms.

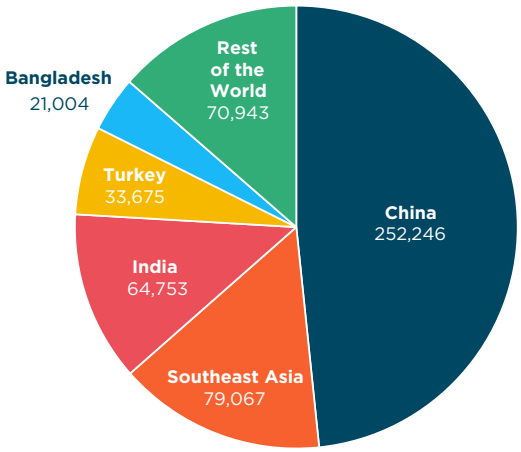


Figure 1: Largest Coal-Fired Power Plant Pipelines (MW)
Source: Global Energy Monitor, Global Coal Plant Tracker, July 2020

While there are vast differences in the economies of the countries in Southeast Asia -- some centrally planned, some market-oriented -- several of the countries have influential state-owned enterprises or utilities and other non-state actors affiliated with the government that provide electricity generation, networks, and planning. Decision making is not independent from government or other state interests. And many of these actors have serious financial troubles, compromised energy plans, and frequent diversions from "least-cost" pathways that do not provide for the best interests of ratepayers.

While we do not consider governance as a factor here, persistent financial problems of state-owned utilities (like EVN in Vietnam, PLN in Indonesia, and measures such as the increased liberalization of EGAT in Thailand) demonstrate the correlation between corruption, fossil fuel interests, and institutional barriers to least-cost solar and wind development.

Regional Renewable Energy Targets

In 2015, ASEAN set a region-wide target of 23% renewable energy share in the energy mix by 2025 (for all forms of renewable energy, including solar, wind, hydropower, geothermal, etc.).[11] This is a modest target, but nonetheless a challenge for those countries that are already too far behind to meet it. Moreover, it is a soft target, and there is no political consequence for national governments if it is not achieved.

Many of the PDPs of state-owned utilities in the region forecast around ten years ahead. In addition, the 2018 IPCC report focused on 1.5 degrees pathways, including targets for the share of RE in power generation by 2030, 2040, and 2050. Most immediately, the IPCC target for 2030 is 50% RE generation in a country's energy mix. So we focus on 2030 - the most pressing of the IPCC targets and the most useful in terms of both PDPs and the stimulus and recovery packages that continue to emerge in the region as a response to the Covid-19 crisis.
RE generation targets offer forward-looking analysis. But there is also a need to work backwards: given coal plant lifetimes, a coal plant financed now and constructed in the 2020s is already inconsistent with a 1.5 degrees pathway.[12] Likewise, any "transition to gas" is shortsighted – gas power also locks countries into high emissions for the life of the plant's operation. In this context, countries should quit coal power and "leapfrog" over gas power at the same time, rather than substituting one for the other. We will explore those countries that are at risk of making this negligent transition to gas in this report.

Rapid Energy Demand Growth in Southeast Asia

Southeast Asia's economies have developed rapidly over the past two decades with exponential growth in energy demand that public institutions and policy planning have struggled to keep up with.

Outstanding regional electrification needs and rapid growth in energy demand are both factors that, considering their scale, highlight the need to start solar and wind development now. RE is the quickest method of increasing energy access in lower income countries[13] and creates more jobs and cheaper electricity over a faster time period than coal power.[14]

The International Energy Agency (IEA) estimates that Southeast Asia's overall energy demand will grow by 60% between 2018 and 2040 while the region's economy will more than double in size. Fast-growing economies like Cambodia and Lao PDR stand out because of high-energy growth and high-energy demand. Cambodia's GDP growth has been over 7% for nearly ten years, while regional energy demand has grown at an average of 6% per year.[15]

Electricity planners in each country have the challenge of planning for growth, providing 100% electrification, providing least-cost energy options, and delivering a 100% clean and optimized power sector in the long run. This report reflects all of these concerns and presents scenarios that can deliver against them.

Mythbusting for Solar and Wind

RE investment in Southeast Asia has long been dismissed as risky, expensive, or "unbankable."[16] Recent market design and development in Vietnam has exposed many of these views as out of date or out of touch.[17] Vietnam's solar capacity went from 134 MW in 2018 to 5.5 GW by the end of 2019, or 44% of Southeast Asia's total solar capacity, by introducing a feed-in-tariff (FiT) program.[18]

Solar and wind have capital-intensive upfront costs but no ongoing fuel costs by definition. As such, they avoid the volatility of fuel prices and the need for fuel cost management, such as the caps on coal prices for CFPPs in Indonesia.[19] Examining the levelized cost of electricity (LCOE) where available for the five largest countries in the region, unsubsidized solar is now cheaper than unsubsidized coal and gas power in Thailand, the Philippines, and Vietnam, according to Bloomberg New Energy Finance (BNEF), and more expensive in Malaysia and Indonesia. Decreases in costs for solar and wind have been rapid and are projected to continue as technological advances improve efficiency.[20]

More than other regions, Southeast Asia's incredible potential for solar and wind is a critical comparative advantage.[21] This potential already translates into incredibly low costs of electricity, such as 3.877c/kWh in Cambodia's national park solar auction.[22] In our own forecasts, we prioritize solar and wind and discuss this in individual country profiles.

Current overcapacity of fossil fuels and new developments in solar and wind make baseload arguments irrelevant for 2030 targets. Baseload generation has historically been a measure used by the fossil fuel industry to protect its interests. But baseload generation globally is becoming redundant as energy systems become more flexible and distributed.[23] We do not focus on the 2040s even though new technologies and other energy forms will be entering the market. Ultimately, the climate emergency makes this debate rather academic.

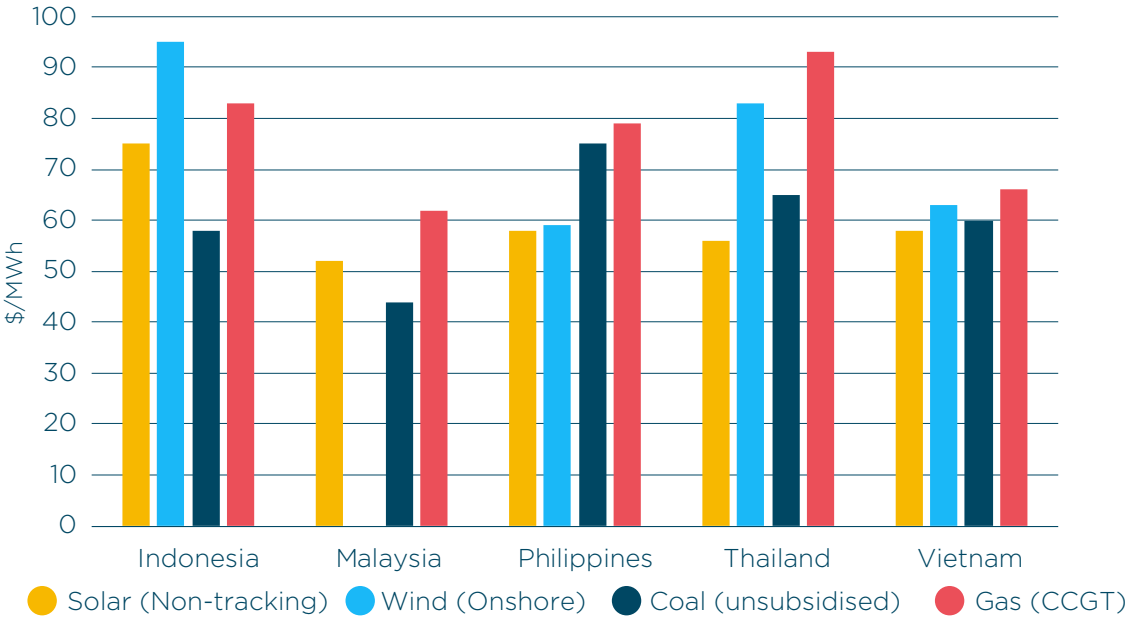


Figure 2: Levelized Cost of Electricity (LCOE) for different energy sources
Source: Bloomberg New Energy Finance (BNEF), H1 2020

Bottlenecks in Solar and Wind Development

Market design bottlenecks that stall development of lowest-cost energy sources are evidence of institutional barriers. There is now a multitude of approaches to market design from other countries around the world with high deployment of RE technologies, from transparent pricing schedules using universal FiTs to auctions for utility-scale solutions. There is little excuse for not having working PPAs for solar and wind in Southeast Asia.
For new solar and wind markets, market design requires consultation and discussion between planners, developers, and financiers. Vietnam's proliferation of utility-scale projects, for example, were in planning for 18 months before project development. Planners should capitalize on the lull brought by the economic downturn and respective decline in energy demand caused by Covid-19 and focus on fit-for-purpose frameworks to promote a green and just recovery now, with the market design of solar and wind at the center.

It is also important to note that the power grids in these countries were built in order to accommodate traditional energy generation sources, rather than solar and wind power. Grid developments and policies need to be created in market design plans, along with investment in storage technologies, in order to take full advantage of the benefits brought by the transition to solar and wind.[24]

As discussed, the actual planned capacity provided in PDPs and the IPCC target for 2030 is the focus here. In this context, it is worth noting that the vast untapped solar and wind potential of the region is neither a bottleneck for 2030 nor beyond. Moreover, next generation technologies like energy storage are forecasted to decrease in price and increase in scale towards the end of this decade. The lead times to large energy projects are counted in years (albeit quicker for solar and wind than coal power). To move as fast as possible in the 2020s to a green energy transition, market design and development is the key priority.

This report explores:

- Market design: To consider whether a country is active in developing solar and wind from an institutional perspective or whether barriers remain, we assess tariffs (whether or not a government sets a universal FiT or running auctions for utility-scale solutions), regulatory frameworks, PPAs, subsidies to coal projects, and project risks (such as land use and transparency).
- Market development: Whether utility-scale solar and wind projects are implemented and financed (by national or international banks) without regulatory, pricing, or institutional barriers and whether the market has "lift off."
- Grid development: Whether utility-scale RE projects have equal access to transmission and grid stability and risk management is in place (to avoid issues such as curtailment).

Hydropower Is Not Worth the Risks

Hydropower in the Greater Mekong Subregion (Thailand, Lao PDR, Cambodia, Vietnam, Myanmar) kick-started much of the region's ability to meet growing energy demand, but many of these projects in recent years have been large-scale hydropower dams. These projects have high capital costs and long planning and construction timelines, where delays incur further costs that pass on to ratepayers. Most importantly, these projects have severe adverse effects on the surrounding environment and local communities.[25]

Large hydropower projects have extremely high social and environmental costs, including forced relocation of communities, loss of cultural heritage, and disruption of the local ecosystems that many communities rely on for water or agricultural productivity.[26] One aspect of this local ecosystem disruption includes sediment flows that are needed for agriculture, ecosystem services, and healthy biodiversity. If all currently planned large hydropower projects along the Mekong River are completed, up to 97 percent of sediment flow to the river's mouth could be blocked by 2040.[27] Impacts like these, in addition to droughts and flooding, will be amplified in the future as climate change worsens.

Solar and wind are far less resource-intensive, less harmful to communities and ecosystems, quicker to bring online, and lower cost than large hydropower projects. Moreover, hydropower generation is not climate-proof. In 2019, the Mekong region saw historically low levels of rainfall, which caused energy security issues for countries like Myanmar and Lao PDR, where hydropower makes up the vast majority of generation.[28] Decreased power generation from hydropower led to a surge in proposed gas projects to prevent supply gaps and power outages, evidencing the knock-on risk that hydropower poses to regional energy systems.[29]

Wind turbines in Mongolia.
©Usukhbayar Gankhuyag/Unsplash

Energy Security and Regional Hegemony

For countries who are now net importers of coal, like Vietnam, solar and wind energy provide economic and energy security. One of the obvious benefits of Vietnam's solar expansion has been some immunity to the volatility of imported gas and coal prices in 2020. In countries like Thailand, a net importer of natural gas, the rapid expansion of gas projects without solar and wind development threatens the energy security of a country rich in renewable resources. Indonesia is a cautionary tale about depleting resources and energy security. It was once a net exporter of oil, but now suffers severe deficit from oil imports.[30]

Power sector imports and exports are an increasing theme in the region. For example, in the Greater Mekong Subregion, energy projects are being financed and constructed across regional borders. Thailand, Vietnam, and Cambodia will all be importers of energy generation from Lao PDR in the 2020s - from both coal and hydropower. Though regional coordination and connectivity offer regional energy security, it also exposes some economies to the adverse effects of regional hegemony.

This report examines regional dynamics, including the Thai finance and construction of coal and hydropower projects in Lao PDR,[31] Lao PDR's construction of its first CFPP since 2009 to export energy generation to Cambodia, and cross-border innovations like the prospective Thai finance of a Lao PDR wind farm to export energy from Lao PDR to Vietnam.[32]

The analysis we present includes imports and excludes exports to show a true picture of the source of electricity generation.

Covid-19 Crisis

The Covid-19 crisis has put energy supply and demand into a tailspin, which has had some serious consequences for the energy transition:

- The recession and economic downturn stalls the ability of national governments, overseas financiers, and industrial corporations to construct energy projects and advance the energy transition; and
- Reliance on imported coal and other fossil fuels poses a threat to energy security. In the Philippines, for example, Covid-19 has led to delays in fuel shipments, which is expected to result in increased electricity rates;[33] and
- As total energy demand is hit by Covid-19, the cost of each unit of coal power generated increases. For example, estimates of coal power capacity used in Indonesia, where energy demand fell around 10%, could be around 50% during Q2 2020.[34] There is even more existing surplus capacity to use before needing to build new power projects.

The ASEAN target of 23% RE in the power sector by 2025 was already weak and is now made redundant by these expected delays to energy project development. With drops in energy demand and overcapacity in incumbent fossil fuels (especially CFPPs), this 2025 target needs to be increased for 2030 to drive economic recovery and job creation, lower air pollution, and transition to a sustainable energy system. Below, we identify the best possible case for solar and wind development in this context and more up-to-date and meaningful RE targets.

Brown Coal Power Station
© Ana Gram

Country Profiles Explained

The country profiles provide a high-level overview of the key dynamics supporting or hindering each country's RE development.

Country name
Grade: (letter)

Key Takeaways

The 4 key observations to read a country profile "at a glance"
Source: GP Analysis

Country Snapshot

The headline analysis of:

- Energy Transition
- Energy Planning
- Covid-19 Response

Source: GP Analysis

Country Overview

A country overview including but not limited to geopolitics, political economy, oligarchs/elites, potential, etc.

Key Country Themes

Three fundamental features (good, bad, neutral) of all the above.

Energy Model Breakdown

The BAU Case and Best RE Case in more detail for more comprehensive details on capacity, generation, PDPs, etc. with charts of electricity generation to 2040.

Best RE Case

Solar Target from Best RE Case
Wind Target from Best RE Case

Business as Usual Case

Data on coal power plants is frequently difficult to verify, time bound, or inconsistent. We use Planned Coal Capacity (Announced, Pre-permit, Permitted, or In Construction)
Source: GP/IESYS modelling, Global Energy Monitor

Energy Model Targets

The curve of RE% of generation to 2050 in both the BAU (Probable) and Best RE (Possible) cases with an indicator for the IPCC 2030 target.

Key Recommendations

A selection of three from the following recommendations:

1. Fossil fuels

a. Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020 **OR**
b. Fossil fuels: Confirm exclusion of new coal power and create exclusion policy for gas power starting from 2020

2. Ambition: Where RE Target is a % of generation

a. Ambition: Increase 2030 RE Target to 50% **OR**
b. Ambition: Prioritize solar and wind over other RE, especially hydropower **OR**
c. Ambition: 2030 RE Target failure. Create 50% RE Target urgently

3. Solar/wind:

a. Solar/Wind: Improve Market Design, especially... [optional key feature] **OR**
b. Solar/Wind: Improve Market Development, especially...[optional key feature] **OR**
c. Solar/Wind: Improve Grid Development, especially...[optional key feature]

1.5° Achievable?:
Achievable rating, from the following:
Impossible without system change
Possible, if recommendations are adopted
Probable, if recommendations are adopted

Introduction to the Energy Model

The key tests in the scorecard are based on modelling work done by Intelligent Energy Systems (IES), based in Sydney, Australia.[35] IES has expertise in energy planning in the region, as well as in detailed energy modelling.

For two pathways, the Business as Usual (BAU) Case and a Best Renewable Energy (RE) Case this work provides a least-cost "solve" of the expansion and generation plan for each of the countries in the scorecard. Other assumptions clearly influence this. Least-cost means a solve of capacity and generation is performed to meet total system costs which includes capital costs, fixed operational and maintenance expenses, fuel costs, and variable operations and maintenance. Here, the model creates "penalties" for not meeting demand and/or an energy reserve margin to enforce this.

For the BAU Case, it takes the existing installed capacity and committed plants as a fixed schedule given by each country's current PDP and mirrors or extrapolates this (up to 2030). We assume anything that is currently being constructed or has PPA-equivalent contracts signed to be committed and therefore, to be completed. Thereafter, carbon intensity can decline and capacity build can shift to RE by virtue of lower-cost planning, even in the BAU Case.

The RE Case assumes a best possible pathway towards 100% renewables by 2050 or before. Renewables here prioritize solar and wind where appropriate but also includes other RE technologies. However, we cap the latter – the energy transition should not and does not, for example, need to invest in hydropower. Moreover, the least-cost "solve" automatically prioritizes solar over other RE sources before 2030 (and diversifies thereafter). The model we use factors in storage (with its costs reducing through the 2020s) to optimize the power sector for solar, wind, and existing hydropower.

The intention of the scorecard is to benchmark the eight countries profiled here as well as the region. We look at the BAU Case and a Best RE Case, especially over the next ten years. That is, the immediate need for transition - rather than examining longer term pathways or future technologies. As such, the key test in the scorecard is whether a country can deliver 50% RE generation by 2030 as required by IPCC milestones. In this context, it is worth noting that the Best RE Case does not automatically mean a country will be on a 1.5 degrees pathway. It is simply the best possible case for an energy transition in each country. For example, Indonesia has so much coal power in operation that it will be behind the curve required to deliver a 1.5 degrees pathway by 2030 even in the Best RE Case.

Elsewhere, the model includes reserve margins, imports and exports of energy, retirements based on project life, etc. For example, new entry schedules for capacity mean no country can build unrealistic amounts of capacity and the total capacity must fall within the total resource potential of the country as well. This work is intended to be realistic and achievable.

As discussed above, the analysis we present includes imports and excludes exports to show a true picture of the source of electricity generation, in particular the current and planned import/export between Cambodia, Thailand, Vietnam and Lao PDR.

Solar rooftop at Luang Suan Hospital in Thailand
© Arnaud Vittet/Greenpeace

Country Profiles

Salt fields near a wind farm in Guimaras, Philippines.
© Veejay Villafranca/Greenpeace

Vietnam

Grade: C-

Key Takeaways

Recent solar and wind market design and development since 2016 establishes Vietnam as a regional leader

Potential exclusions of coal power have been floated, but PDP8 needs to reject coal and gas power

The impact of Vietnam's solar success is offset by its current coal pipeline that is second in the region, only after Indonesia

RE curtailment and grid stability remain two of the most pressing issues

Country Snapshot

Energy Transition
The Vietnamese "solar miracle" has shown the region what is possible with both RE ambition and an industrial strategy for RE – Vietnam is home to around 7% of global solar panel manufacturing.[36] The country is also beating time and cost forecasts for the region by pushing offshore wind development as well. In part, this development of solar and wind was driven by becoming a net importer of coal, increasing the costs of coal power. And herein lies the challenge for Vietnam - to stop their coal power pipeline which keeps them from a 1.5° pathway. It is one of the two largest pipelines in the region.[37]

Energy Planning
This is a leading model for the region including the speed of utility-scale solar development, the use of regional finance, consultation with domestic and international actors and advisors, and expedition of a working framework for solar in less than two years, which was followed by a boom in installation. But debate still remains between sponsors and the state-owned utility, EVN, on investment risk and curtailment.

Covid-19 Response
No mention of solar/wind as an economic stimulus or "green and just recovery" for Covid-19.

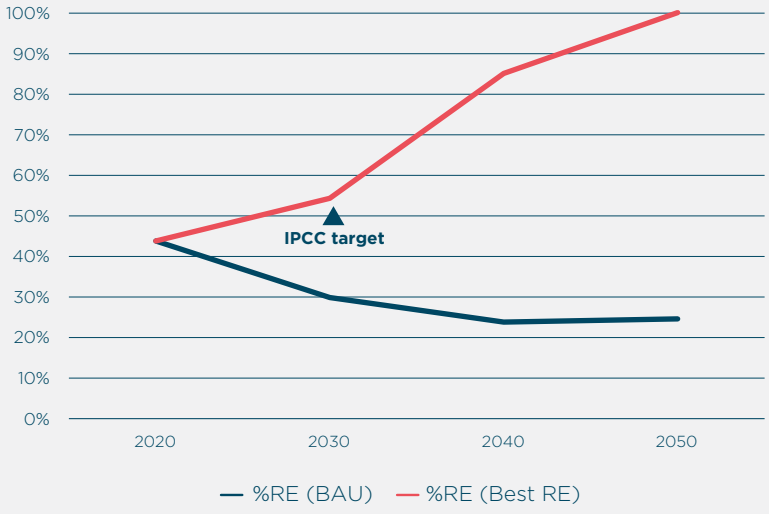
Best RE Case

	2030
%RE	**54%**
GW	**Solar Target** **50.0** / **Wind Target** **17.1**

Business as Usual Case

Actual Planned Coal Capacity 24.4 - 29.7 GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020

Ambition: Increase 2030 RE Target to 50%

Solar/Wind: Improve Grid Development, especially curtailment provisions

1.5° Achievable?: ***Probable*** if recommendations are adopted

Vietnam

Grade: C-

Country Overview

Vietnam is moving so fast that the new PDP8 is highly anticipated by sponsors, financiers, and NGOs alike. It is likely to codify a more aggressive target for RE by 2030, but is expected to be less than 50%. In addition, a direct PPA (DPPA) pilot program is expected to launch this year, which is the first of its kind in the region.[38] While all of this may not be enough to overcome the dominant share of a large existing coal fleet which will remain core to generation, the battle between state-owned power, fossil fuel, and mining companies seems to be changing in favor of new solar and wind projects. Successive Prime Ministers have commented on the need to minimize coal-fired power and tighten sovereign guarantees for overseas energy projects, and at the time of writing, coal power exclusions until 2030 have been floated in the media ahead of the release of PDP8.[39][40][41][42] What is not clear is how much of this will be replaced with gas power. Vietnam has to reject gas as well as coal, otherwise it will still be a global laggard despite regional leadership.

Key Country Themes

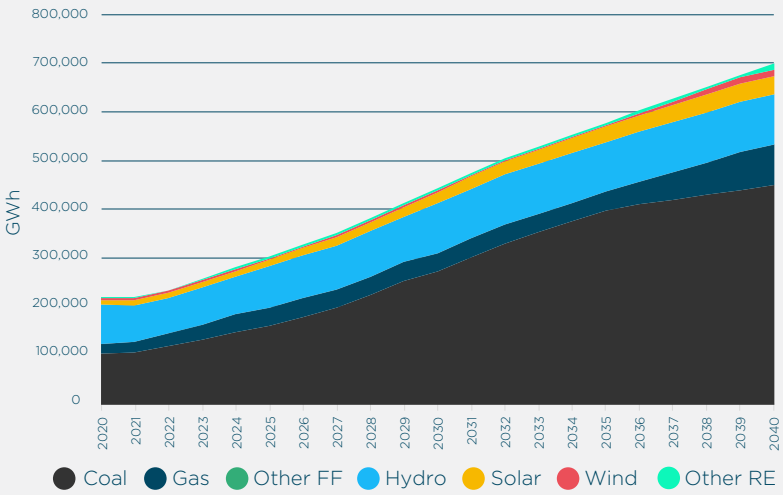
FiTs and Pricing
Vietnam went for a high FiT of 9.35c/kWh, which kick-started market development and was later reduced clumsily with limited consultation to 7.09c/kWh .[43] This current system ends in December and it is unclear what will follow.

Victims of Success
The recent boom has led to a huge rush to start solar projects now ahead of 2021, to hedge against potential policy changes, which may cause an overload of solar development in the south of Vietnam leading to poor grid stability. This has led to huge concerns about curtailment, particularly of new solar projects, which may disincentivize further progress.

Increase in Jobs from Solar
Several studies have demonstrated that solar creates more jobs in RE than coal across the respective value chains.[44][45] Industry is relocating and growing throughout Vietnam to support this, providing economic value and a strong industrial strategy for RE.

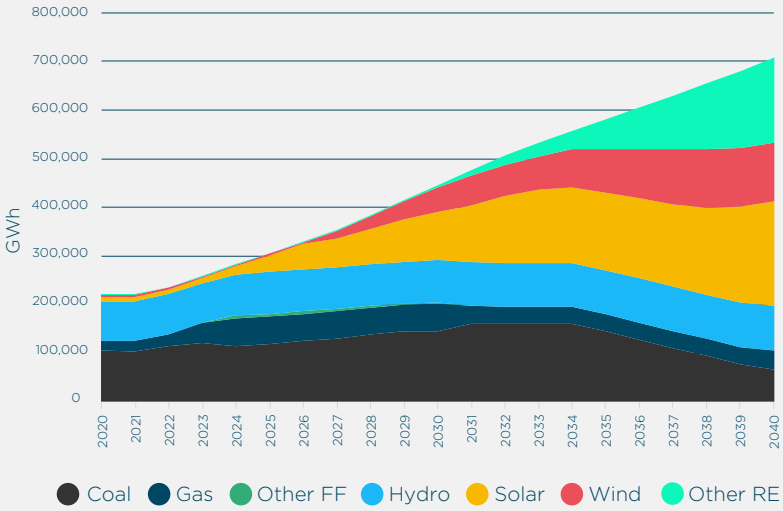
Business as Usual Case

- We expect Vietnam's PDP8 to improve on this case following recent announcements alluding to future coal cancellations and new solar targets for 2030
- However, at the time of writing, coal and gas power expansion is business as usual and modelled here
- Resources in hydropower form the bulk of Vietnam's RE portfolio



Best RE Case

- The Vietnam Energy Outlook models scenarios with no new coal power after 2025 that is not already planned or in construction and we model no increase in gas
- In reality, offshore wind remains more expensive than solar, but Vietnam seems determined to develop this market, possibly because it creates high-capital projects
- Despite the improvements anticipated in PDP8, getting onto a 1.5° pathway by 2030 still requires around 50 GW of solar and 17.1 GW of wind in this booming economy, which is more than is likely in PDP8
- We expect an energy storage boom in the 2030s



The Philippines

Grade: D+

Key Takeaways

Lack of grid connectivity throughout the country impedes utility-scale RE efforts

Reliance on large private conglomerates to unlock wind and solar

Reliance on coal for generation and imported fossil fuels has forced high tariffs

Green Energy Auction implementation should be fast-tracked for Covid-19 recovery

Country Snapshot

Energy Transition
The Philippines was an early leader in the region on RE after the introduction of an RE Law in 2008 but this policy has not been a significant catalyst for an ambitious energy transition. Solar and wind development has been abysmal for the amount of time since policy support began. Coal remains dominant in the country's power sector expansion.[46] Increasing reliance on importation of fossil fuels has exposed vulnerabilities of the Philippines' addiction to coal power generation, leaving the country locked into long-term import contracts for fossil fuels.[47] The added costs of load drops have increased power tariffs and require force majeure provisions to alleviate costs for consumers.[48]

Energy Planning
A FiT was introduced in 2008 and the country is expected to launch a Green Energy Action in 2020 to fill 2 GW of RE capacity. While these moves are positive, the rate of growth has been far too slow. Challenges related to grid connectivity remain, hindering deployment of utility-scale solar and wind.

Covid-19 Response
No mention of solar/wind in economic stimulus or "green and just recovery" for Covid-19.

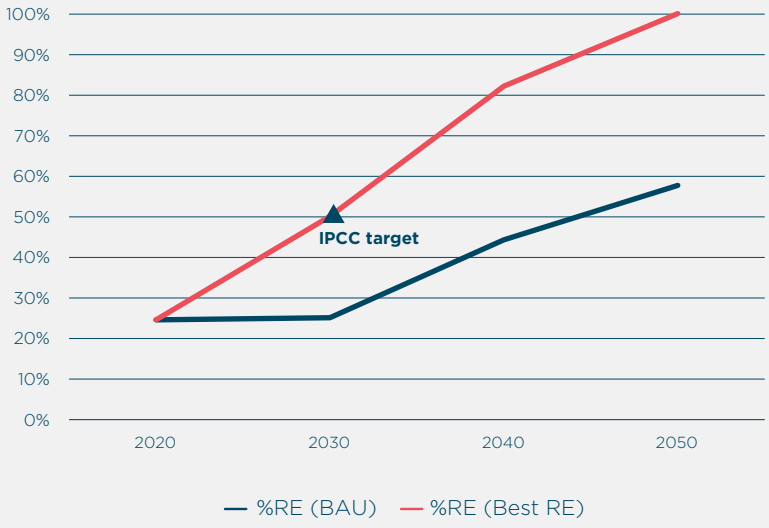
Best RE Case

	2030
%RE	**50%**
GW	**Solar Target** **24.2** / **Wind Target** **3.8**

Business as Usual Case

Actual Planned Coal Capacity
12.1 - 13.7 GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020

Ambition: Increase 2030 RE Target to 50%

Solar/Wind: Improve Grid Development, especially connectivity

1.5° Achievable?: ***Probable*** if recommendations are adopted

The Philippines

Grade: D+

Country Overview

The Philippines is highly dependent on imported fossil fuels, with a near tripling of its thermal coal imports in less than 10 years. Regulatory incentives for investment do not prioritize system-level resourcing, which has resulted in large investments in coal power, pushing coal to over 50% of the energy generation mix today. The Philippines has a deregulated wholesale electricity market where price signals drive new entrants. Large private conglomerates are heavily involved in the energy sector due to their ability to foot large capital costs. The top 5 of these account for over half of existing and proposed power projects in the country and are influential over the direction of energy planning.[49] Current RE generation is fueled by geothermal, biomass, and large hydropower, rather than increasingly low-cost solar and wind.

Key Country Themes

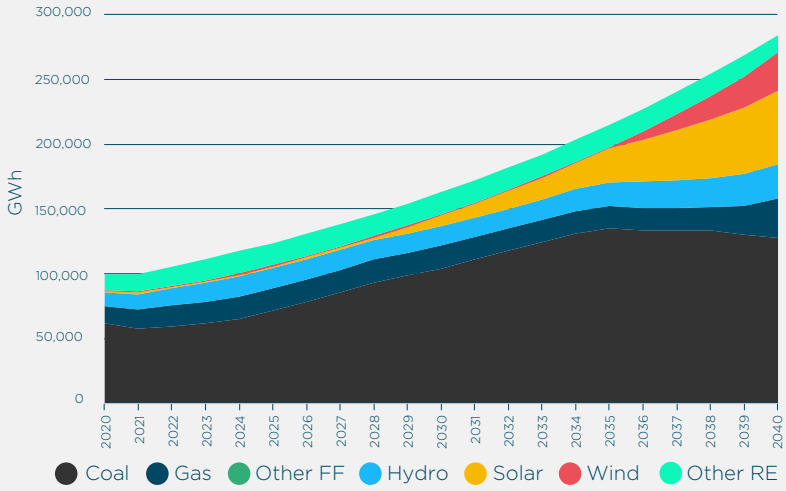
Poor Grid Development
The country's unstable and disjointed power grid prevents significant buy-in for utility-scale capacity. Development and modernization of the grid needs to be prioritized along with the development of energy storage module infrastructure on the grid.

Private Conglomerates Driving Industry
The direction of energy investments is dictated largely by private conglomerates rather than the needs determined by government. Lack of disclosure requirements on who owns which assets and what is driving continued investment prevents outside interests from getting involved.

Auctions, FiTs, and Pricing
Policy mechanisms such as FiTs, net-metering, and PPAs are in place to support solar and wind growth but have not translated into significant development, as private conglomerates' interests and focus on coal have kept the cost low.[50] However, the cheapest PPA recently came from a solar project, so those interests may soon change.[51]

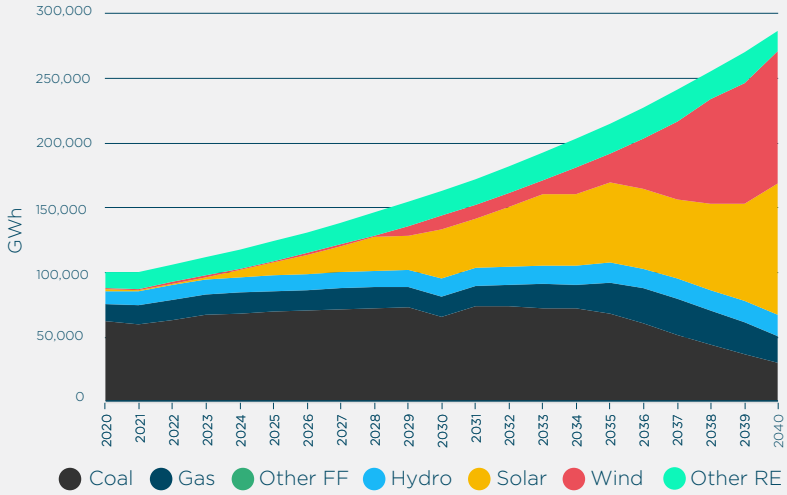
Business as Usual Case

- If continuing on current plans, the Philippines will have over 60% of coal in its energy generation mix at 2030, and around 5% of solar and wind
- Serious expansion of solar capacity is not likely to happen until the late 2020s
- This is a market-based expansion plan, but with high carbon intensity
- We expect coal and LNG projects to be used to meet demand outside of the National Renewable Energy Program (NREP)



Best RE Case

- 50% of RE is achievable by 2030, made up mostly of solar at 24.2 GW
- Coal power capacity would need to remain flat in the 2020s but decline in the 2030s as retirements take place
- At the same time, wind would grow, followed by energy storage
- Demand projection from Philippines Energy Plan (PEP) 2016-2040, based off high GDP growth, and assumes constant electricity to GDP elasticity



Malaysia

Grade: D+

Key Takeaways

Malaysia is dominated by gas power that is driven by gas reserves and corporate gas elites

Adequate policies supporting solar are in place, but limitations prevent realizing full potential

Advanced solar manufacturing capabilities exist, but are primarily used for export

Falling oil and gas prices and demand for energy exports from Covid-19 expose vulnerabilities

Country Snapshot

Energy Transition
Gas interests both politically and economically have prevented development of full solar and wind potential, as the country has extensive natural gas reserves that bring in high export revenue.[52] Still, working RE policies are in place and incentivize some development.

Energy Planning
Supportive policies for RE development exist, and while there are quotas on RE generation capacity that constrain RE growth, the amount and maturity of the policy mechanisms positions the country as a potential regional leader in the future.[53] These include net metering, FiTs, solar auctions, green investment tax breaks, and a green technology financing scheme. However, these have not resulted in significant RE growth and gas is still the priority.

Covid-19 Response
In power since March 2020, the new government has positioned solar and wind investment as an economic stimulus. In June 2020, the government announced the 4th and largest solar tender.[54] No formal plan has been released, however, and long-term outcomes are yet to be seen.

Best RE Case

%RE

2030

37%

GW

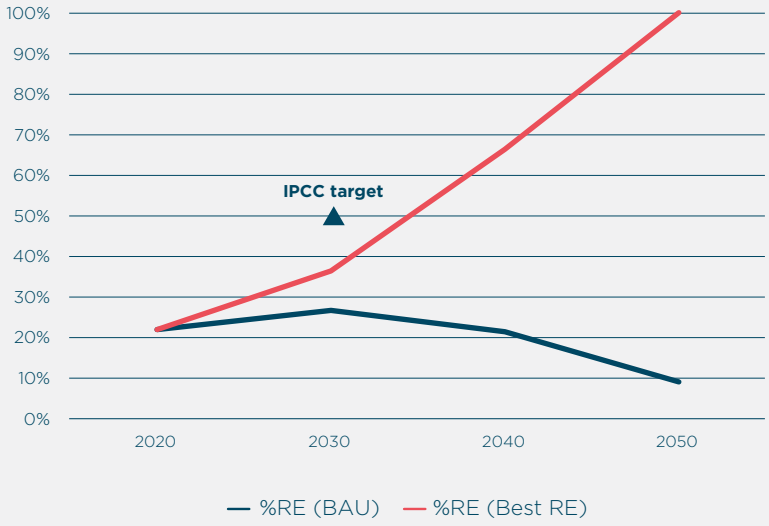
Solar Target

19.3

Wind Target

1.0

Energy Model Targets



Key Recommendations

Fossil fuels: Confirm exclusion of new coal power and create exclusion policy for gas power starting from 2020

Ambition: 2030 RE Target failure. Create 50% RE Target urgently

Solar/Wind: Improve Market Development, especially capacity constraints

1.5° Achievable?: ***Probable*** if recommendations are adopted

Malaysia

Grade: D+

Country Overview

Malaysia has perhaps the highest technical capability of becoming the region's RE champion, given its position as a global solar manufacturing hub and adequate grid development.[55] However, despite its high solar potential, government support lies in gas. Natural gas is used as a key tool for energy security, representing the largest source of energy capacity, supported by the fact that the country is one of the few in the world with proven natural gas reserves.[5657] These reserves position the country as an energy exporter, and in addition to gas, the government gets 15-20% of its revenue from petroleum, which exposes it to volatile oil and gas price fluctuations.[58] For example, during the Covid-19 crisis, there has been a huge decline in crude oil and gas exports, leading to a 31.5% trade deficit.[59] Additionally, coal represented more than half of the country's energy generation mix in 2019, and plants are still being built, with the most recent being two 1 GW coal plants commissioned in 2019.[60]

Key Country Themes

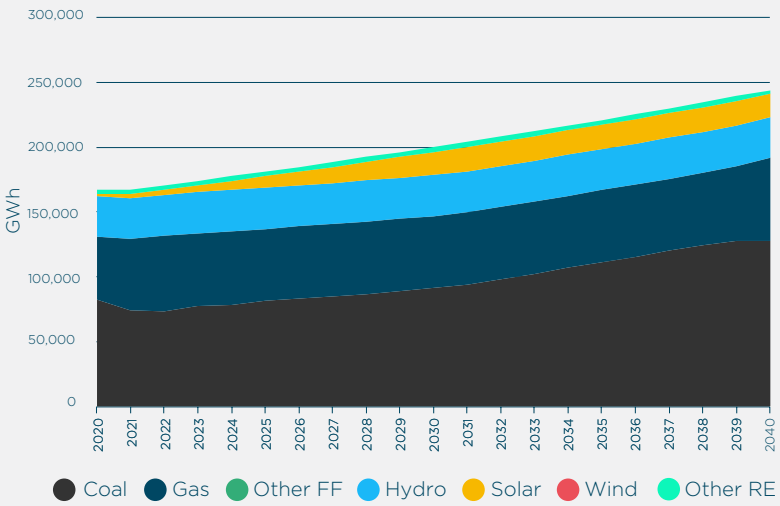
Corporate Gas Dominance
Petronas, a state-owned gas company and one of the world's largest LNG exporters,[61] is the country's only fortune 500 company and a large contributor to the nation's revenue.[62] This reliance, combined with high gas reserves, makes excluding new gas plants a political challenge.

Developed RE Policy, but Low Investment
In terms of a policy framework for RE, Malaysia's is fairly developed, but this has yet to translate into increased investment in the country or greater government support to increase RE generation.

Solar Manufacturing Expertise
Since 2017, Chinese solar panel manufacturers have set up plants in the country, reducing local costs and strengthening government support. It now distributes 5% of the world's solar modules worldwide.[63] Although most of the panels are exported, this has allowed for in-country expertise and investor confidence.

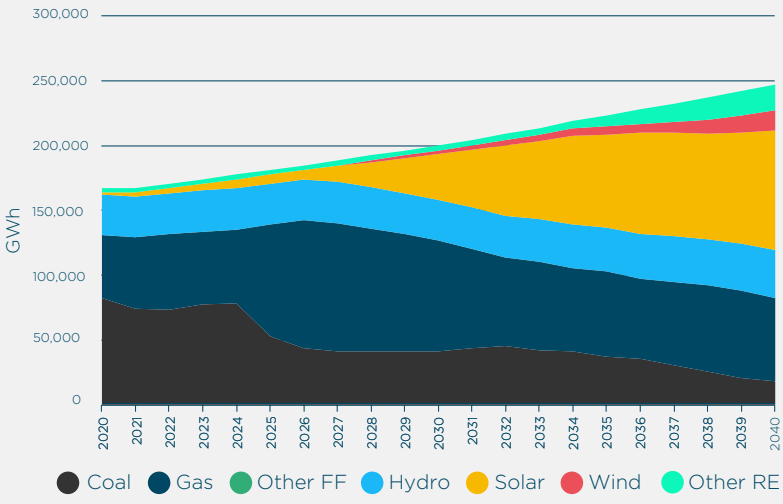
Business as Usual Case

- Malaysia has a target of 20% RE capacity by 2025. Even if this is achieved with overcapacity in fossil fuels and an assumed flatlining of demand as a result of the Covid-19 crisis, it will not be on a 1.5° pathway by 2030
- Solar is the key new energy driver even in the BAU Case when coal and gas flatline
- Despite its position, Malaysia's interconnections with surrounding countries do not present any significant energy transfers



Best RE Case

- The two cases share remarkably similar base realities and should be viewed in the context of Malaysia's solar panel manufacturing potential
- 37% of RE is achievable by 2030 by excluding new coal and gas power and developing solar and wind on a much smaller scale
- Only in the the 2030s would coal and gas capacity significantly reduce and Malaysia could catch up with a 1.5° pathway
- Actual total generation is used to further scale peak demands beyond the 2019 PDP in order to account for the Sarawak region



Thailand

Grade: D+

Key Takeaways

Gas is closely tied to government and elite interests and this is unlikely to change soon

Large-scale investment in solar and wind are disincentivized due to policy changes and grid favoritism for large-scale power plants

More than 12% imported generation and cross-border projects position it as a regional hub[64]

Private sector has been active in the market, but projects tend to be small-scale

Country Snapshot

Energy Transition
The National Energy Policy Council's (NEPC) resolution in 2015 fundamentally harmed the industry, as did the subsequent Energy Regulatory Commission (ERC) announcement in 2016 which barred any new ground-mounted solar and wind projects from being added to the grid.[65] This kind of erratic policy change disincentivizes project developers from taking risk without long-term sovereign guarantees and support.

Energy Planning
The Ministry of Energy has several programs to support RE, such as FiTs, auctions, and community power programs. However, the price or quota setting in each of these programs has little transparency. Somewhat ambitious non-hydro RE targets of 30% by 2036 are overshadowed by low near-term targets, with additional fossil fuel capacity still a major part of its PDP.

Covid-19 Response
No mention of solar/wind in economic stimulus or "green and just recovery" for Covid-19.

Best RE Case

%RE — 2030: **29%**

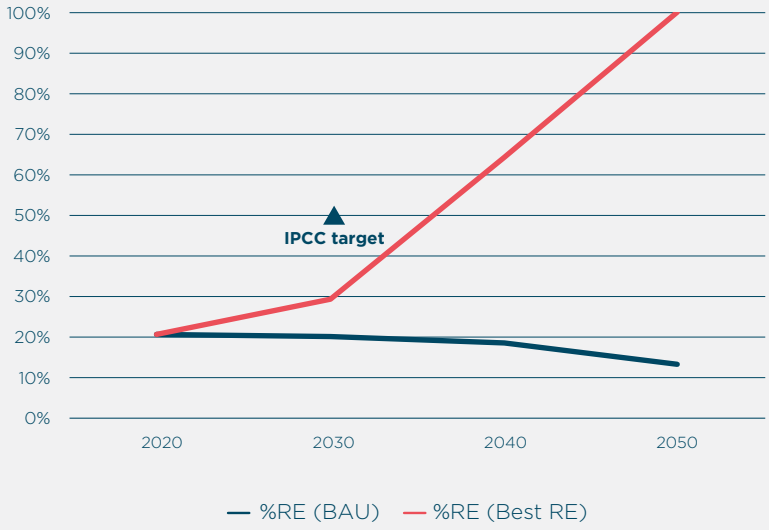
GW

Solar Target	Wind Target
12.6	**3.7**

Business as Usual Case

Actual Planned Coal Capacity
1.3 GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020

Ambition: 2030 RE Target failure. Create 50% RE Target urgently

Solar/Wind: Improve Market Development, especially evidence of long-term sovereign support and guarantees

1.5° Achievable?: ***Possible*** if recommendations are adopted

Thailand

Grade: D+

Country Overview

Thailand promotes itself as the regional hub for energy trading, allowing other countries to utilize its grid for cross-border trades. Thailand itself also imports over 12% of its generation capacity as of July 2020.[66] Gas is the key concern in Thailand's story, and PTT plc, the dominant player in the industry, is 51% owned by the Ministry of Finance. PTT plc controls the gas pipeline system and has a wide-ranging portfolio of fossil fuel interests. Despite its neighbors' love for large hydropower, Thailand has had significant push back from its affected communities for decades, leading to the abandonment of many new large hydropower projects domestically. It is therefore problematic that Thai companies and financiers exploit other countries, particularly in Lao PDR and Myanmar, to invest in large hydropower and fossil fuels for Thai consumption or commerce. The Electricity Generating Authority of Thailand (EGAT) is the system operator and focuses on coal and gas. EGAT has shown some support for RE, but continues to spread the myth that RE only works as a supplement to coal power, stuck in the myth of baseload.[67]

Key Country Themes

Gas is King

Despite providing some hope for solar and wind, the 2018 PDP changed its focus back to gas, with many large gas plants proposed. Gas is being touted to the public as a safe and healthy power source, which makes it difficult to create momentum for deprioritization.[68]

Obstacles to Solar Increase

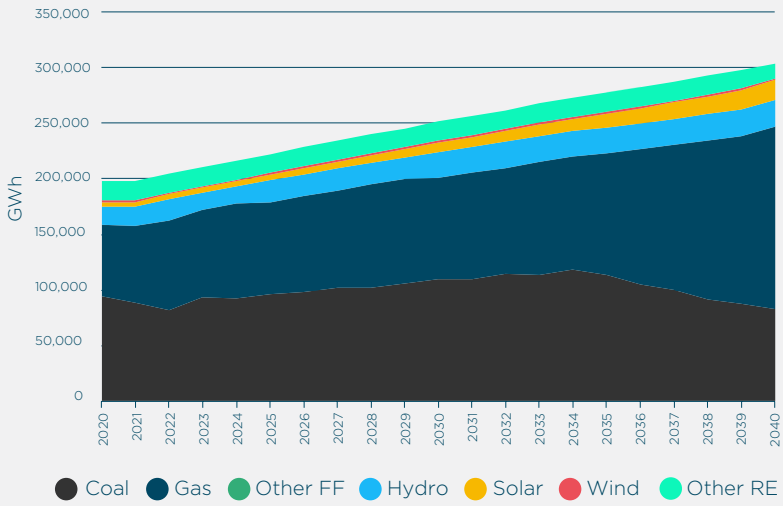
The aforementioned NEPC and ERC announcements regarding solar and wind development need to be reversed. A fair and transparent price mechanism for utility-scale solar and wind should be set without a quota or limitation on development.

Private Sector Buy-in to SPPs and VSPPs

Small power plants (SPP; up to 90 MW) and Very SPPs (VSPPs; up to 10 MW) are channels that open the solar and wind market to the private sector, which have helped to develop RE in the region.[69] The size of this opportunity is clearly limiting, as the grid prioritizes large-scale fossil fuels and hydropower.

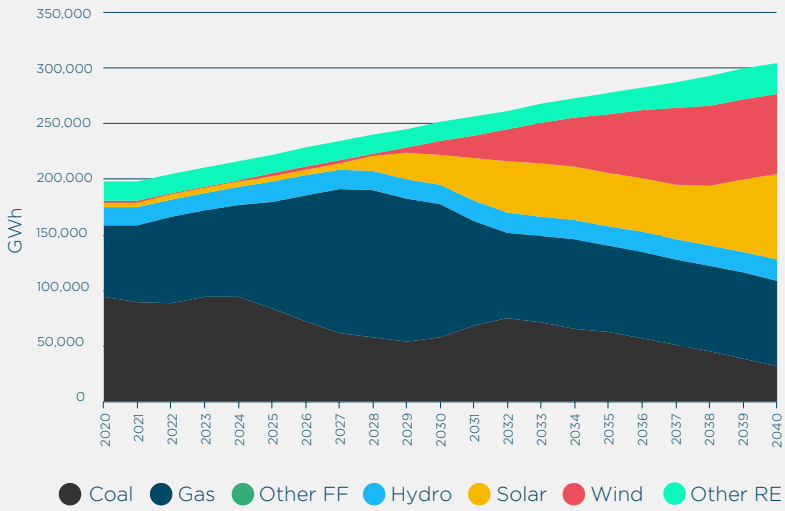
Business as Usual Case

- Most recent PDP (2018-2037) focuses on system security, with high domestic capacity installation (EGAT/IPP) increases in combined cycle (13 GW), coal (1.7 GW), and cogeneration plants (2 GW). There is also a target for new solar capacity of 10 GW by 2037 but most of this is planned too late to put Thailand on a 1.5° pathway by 2030
- Onshore solar and wind capacity factors are assumed to be 28% and 18%, respectively, while the average hydropower capacity factor is based on 2018 generation data



Best RE Case

- 29% of RE is achievable by 2030 but gas is still king at over 48% of generation
- A solar target of 12.6 GW and 3.7 GW for wind are eminently achievable in the context of Thailand's recent progress but not enough for a 1.5° pathway by 2030
- Peak demand and energy projections are based on actual 2017-2019 data and scaled to reflect the changing rate of peak demand and energy projections per the 2015 PDP
- Expects import of 7 GW of energy capacity from Lao PDR by 2030



Lao PDR

Grade: D-

Key Takeaways

It aimed to be the "Battery of Asia" and has been exploited by neighbors' energy needs

No planning and no vision. Lao PDR lacks proper market design for solar and wind

Vulnerability to neighboring countries and overseas finance of coal and hydropower

Still possible to build solar and wind and be regional global RE leader by 2030 with less hydropower

Country Snapshot

Energy Transition
The dream of becoming the "Battery of Asia" is becoming a nightmare.[70] The simultaneous growth of damaging megaprojects in hydropower and coal ignore cost, health, sustainable economic development, and domestic energy security and demand in favor of cross-border energy generation sales. There is no evidence of an energy transition to complement existing hydropower, simply an increasing exploitation by neighboring countries who can take advantage of the necessity to open up to overseas finance for high-expenditure projects.[71] And yet, there is a glimmer of hope, still capable of being a unique and global leader - delivering solar and wind in the next ten years would mean Lao PDR could, in theory, lead the world with 97% generation from RE in 2030 and balance its energy system without building more hydropower.[72]

Energy Planning
Of the countries profiled here, Lao PDR has the least transparency on projects and power development and does not produce detailed and timely plans of its own.

Covid-19 Response
No mention of solar/wind in economic stimulus or "green and just recovery" for Covid-19.

Best RE Case

%RE — 2030: **97%**

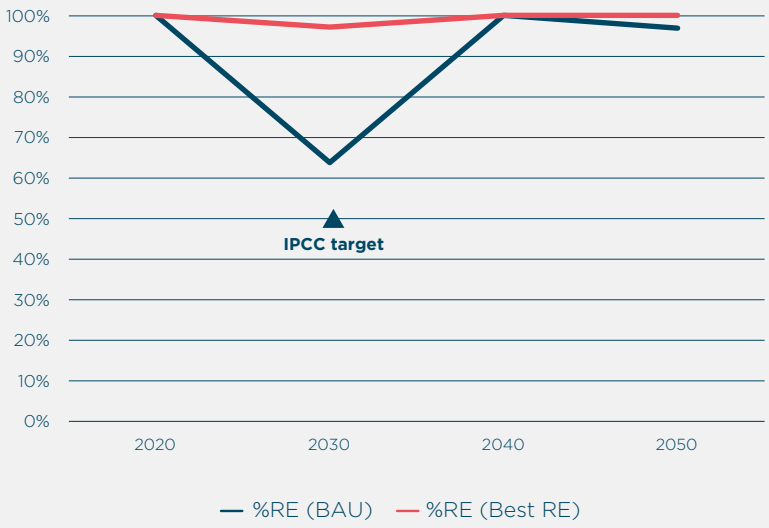
GW

Solar Target	Wind Target
18.7	**3.9**

Business as Usual Case

Actual Planned Coal Capacity 2.8 (including exports) GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal power starting from 2020

Ambition: Prioritise solar and wind over other RE, especially hydropower

Solar/Wind: Improve Market Design, especially fundamental frameworks

1.5° Achievable?: ***Possible*** if recommendations are adopted

Lao PDR

Grade: D-

Country Overview

Lao PDR is the only landlocked country in the region. Like Cambodia and Myanmar, it has much lower development indices than its larger and more powerful neighbors, but still needs to create economic and social development. While electrification rates are high at almost 98% and driven by a dominant mix of hydropower and a small amount of coal power, Lao PDR is yet to make any serious attempt to develop solar or wind resources. The preference for steel and cement-heavy megaprojects like hydropower and coal point to an economic vulnerability to both electricity buyers and overseas project sponsors and financiers. This includes prospective exports to China. IPPs make up 88% of installed capacity in Lao PDR, but government revenues from hydropower are less than 2% of GDP[73]. Solar and wind projects are in the news, but why is possibly ASEAN's largest wind farm to be built with Thai finance and the power exported to Vietnam?[74] It seems Lao PDR will package and sell any energy project for profit rather than diversify and create a sustainable energy transition of its own.

Key Country Themes

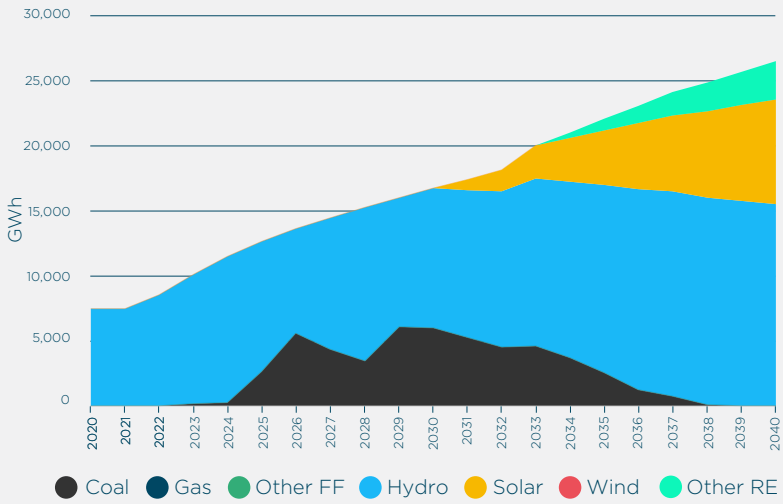
Toxic Lignite
It's not just coal power, it's the dirtiest form of domestic lignite.[75]

Greater Mekong Subregion Economic Cooperation
Lao PDR should be the beneficiary of a sub-regional approach to grids and development. This should not be a vehicle for increased regional hegemony and the need for overseas finance.

No Transparent Auctions, FiTs, or Pricing
Lao PDR urgently needs to develop transparent frameworks, pricing, and PPAs for solar and wind. In this respect, it is way behind Vietnam and falling behind Cambodia.

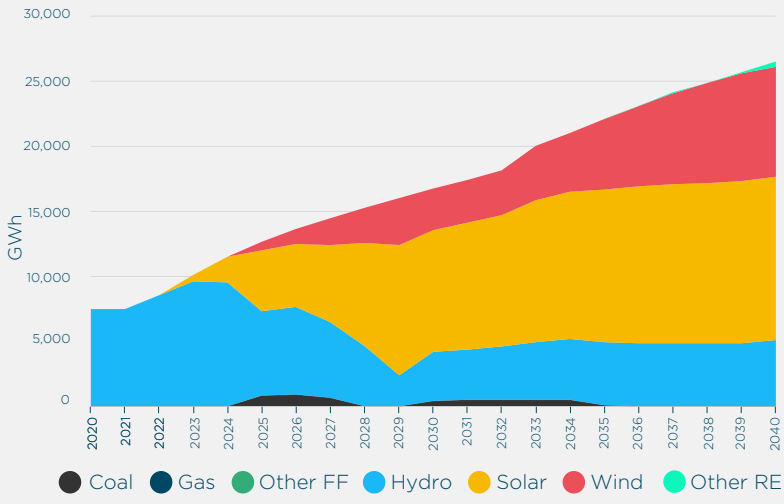
Business as Usual Case

- Without changing course, Lao PDR will increase its addiction to coal exports and hydropower in our BAU Case
- Stalling energy demand from importers as a consequence of the Covid-19 crisis means Lao PDR will be building coal power generation which is only gradually exported
- We currently expect solar to arrive too little too late in the 2030s



Best RE Case

- Investment in solar, then wind, then storage, as a complement to hydro would be 19.5 GW of solar and 4.7 GW of wind by 2030
- Energy security would put the people of Lao PDR first
- Overseas investment should prioritize the economy of Lao PDR rather than exploit its vulnerabilities to mega projects and natural resources in more toxic IPPs. For example, in the Best RE Case for Cambodia, Thailand, and Vietnam, power exports would be from different sources and not fossil fuels



Cambodia

Grade: D-

Key Takeaways

The fastest rate of economic growth in the region will drive fast energy demand

Low solar development, but currently has the region's lowest solar tariff and an emerging auction system

Coal and hydropower dominate the generation mix, with coal to continue to increase

EDC, the state-owned utility, is money-making and not incentivized to produce cheapest energy possible

Country Snapshot

Energy Transition
With economic and social development a priority, Cambodia continues to see growing energy demand with no long-term planning. Cambodia needs to avoid locking in additional coal power capacity. As it develops solar projects, this can be avoided. But with infrequent and opaque public planning processes, this opportunity is rather obscured. Pricing and projects require increased transparency to give investors certainty and continue to develop national energy security.

Energy Planning
Cambodia cannot afford to kick-start the solar market with high FiTs, but has successfully run an auction for utility-scale solar projects. As these projects and this market design move forward (with support from the ADB, in particular), increased planning and policy must be part of a clearer and well-developed framework in the next PDP. In particular, Cambodia needs a clear and ambitious target for RE and to view the energy transition in the context of least cost and sustainable development instead of pricing for profit. And with climate change increasingly affecting hydropower generation, better dry season planning is urgently needed.

Covid-19 Response
No mention of solar/wind in economic stimulus or "green and just recovery" for Covid-19.

Best RE Case

%RE

2030

90%

GW

Solar Target

6.5

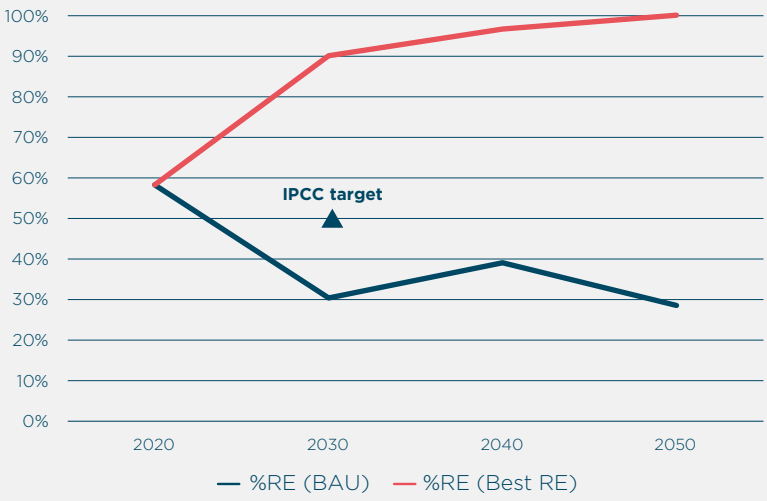
Wind Target

0

Business as Usual Case

Actual Planned Coal Capacity
1.4 - 1.8 GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020

Ambition: Increase 2030 RE Target to 50%

Solar/Wind: Improve Market Development, especially transparency of regulatory frameworks

1.5° Achievable?: ***Possible*** if recommendations are adopted

Cambodia

Grade: D-

Country Overview

Cambodia is the fastest growing country in the region (7% real GDP growth in 2019) and has the lowest Human Development Index score (0.581). Rapid growth of energy demand driven by social and economic development and 100% electrification (currently 91.6%) are clear priorities.[76] The power sector is largely coal and hydropower, but solar and wind are needed to balance the energy system during the dry season as hydropower will become increasingly unreliable as climate change impacts worsen.[77] Cambodia has been reliant on imports, especially for oil power generation, and will be importing further coal power generation from Lao PDR in the 2020s.[78] In itself, this creates an inability to be on a 1.5° pathway. Coal power expansion both domestically and from generation of overseas coal power have to stop. If this happened Cambodia could be well placed on a 1.5° pathway driven by solar expansion and by virtue of its hydropower capacity - while still satisfying its growing energy demand.

Key Country Themes

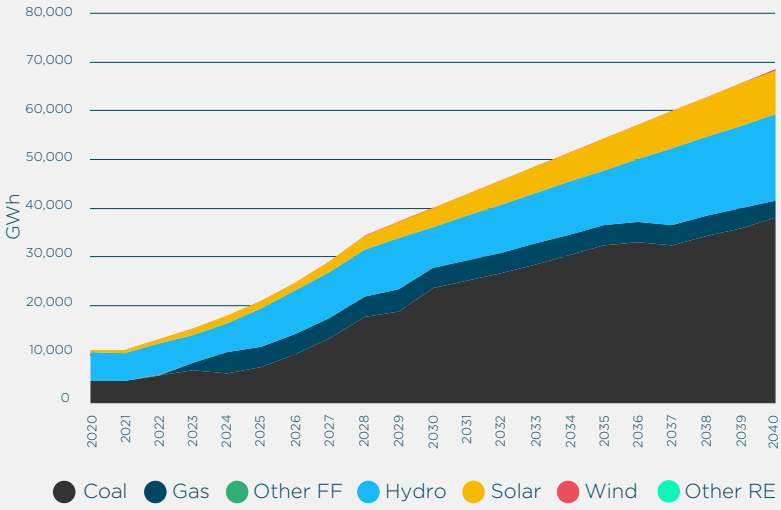
Poor Energy Security in Dry Season
Cambodia relies on energy imports in the dry season due to low hydropower output, and although this reliance has decreased over the last decade due to coal and hydropower builds, the country is now locking itself into a high-emissions future.[79] At the same time, solar and wind remain almost entirely untapped despite high solar potential.

Region's Lowest Solar Tariff
An auction for 60 MW of solar capacity secured a record-low bid of 3.877c/kWh from a Thai developer in 2019.[80] While the auction was successful, it was facilitated by ADB instead of the local authorities, and the low price runs the risk of negatively impacting the pricing of future projects.

Hydro + Solar/Wind Optimization
Cambodia is optimizing its hydropower capacity with solar to improve supply during the dry season, with up to 410 MW of new solar projects.[81] Integration of solar and wind into existing capacity and the need for storage in the country are both crucial.

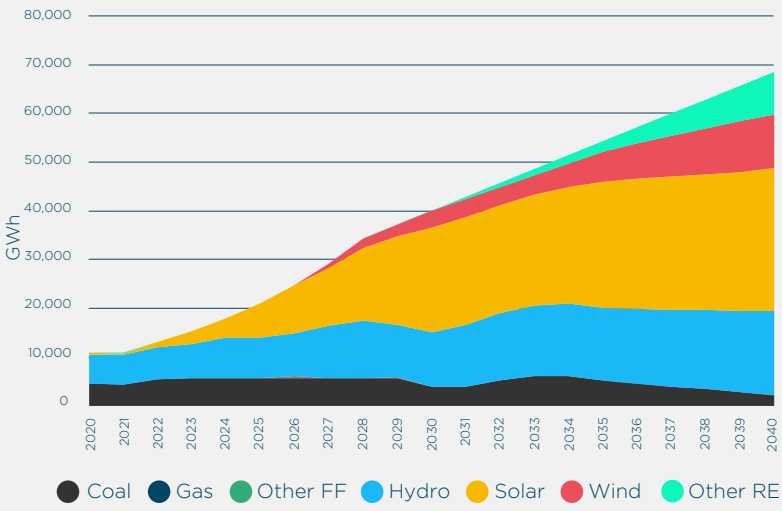
Business as Usual Case

- Cambodia develops a mix of coal, gas, hydropower, and solar by 2030 but the build and import of coal power from Lao PDR dominates the mid 2020s
- Even in the BAU Case, Cambodia will develop solar in the long-term
- Like its neighbors, the challenge is to avoid fossil fuels
- Like Vietnam, we expect the next PDP to be a critical point for increasing solar ambition even in the BAU Case



Best RE Case

- Minimal hydropower expansion, in combination with the development of solar, would keep Cambodia on a progressive pathway to 1.5°. We assume future imports from Lao PDR are not from coal
- Over the next decade, expected solar development is the equivalent of what Vietnam has achieved in the last two years
- With overseas finance and sponsors (especially Thailand and Vietnam) lining up to build solar projects in Cambodia, it would appear Cambodia is well-positioned to develop solar projects with competitive auctions
- With overseas finance and sponsors (especially Thailand and Vietnam) lining up to build solar projects in Cambodia, it would appear Cambodia is well-positioned to develop solar projects with competitive auctions



Myanmar

Grade: D-

Key Takeaways

RE potential exists but Myanmar lacks consistent public policy and incentives for developers

Erratic rainfall recently has Myanmar rethinking its significant reliance on hydropower

High revenue from cross-border gas trading represents an incentive to develop new gas projects

Abysmal electrification levels add social development imperative to shifting toward RE

Country Snapshot

Energy Transition
Low rainfall in the region has put added stress on hydropower plants, which make up nearly 60% of Myanmar's energy generation.[82] This has led the government to rush to construct new capacity, which has been primarily filled by gas plants or other large hydropower.[83] The country has no mechanisms for increasing solar or wind power, although a solar tender was recently announced as an electrification push and Covid-19 stimulus effort.[84]

Energy Planning
This is where Myanmar truly falters. The government has public statements supporting solar and wind development, and has received international development aid for energy projects, but decisions happen behind closed doors on a project-by-project basis. There are no public, standard PPAs, FiTs, tax incentives, government programs, etc., and no public plans to begin support. So the country continues to fall back on gas.[85]

Covid-19 Response
A large stimulus package was announced in March 2020 that included a carve out for rooftop solar panels and 1 GW of tender contracts for solar capacity. While this represents a positive shift toward a green recovery, triple the amount of new gas capacity is expected to be commissioned by next year.[86]

Best RE Case

%RE

2030

68%

GW

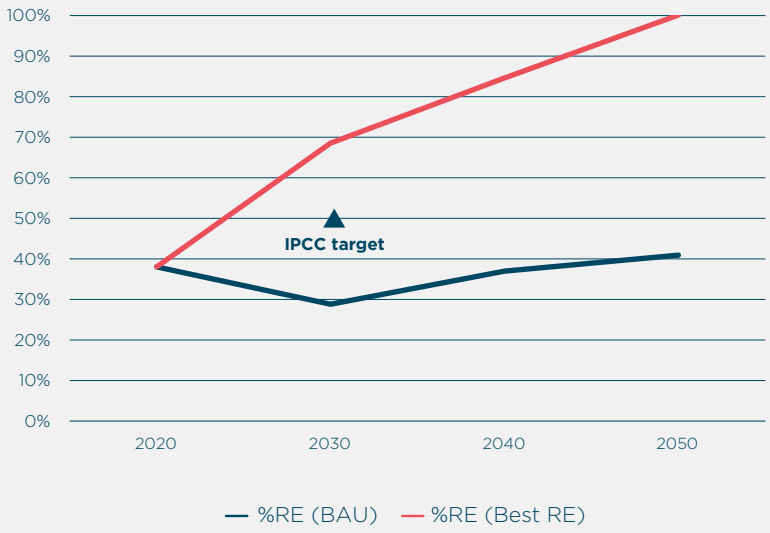
Solar Target

13.9

Wind Target

1.7

Energy Model Targets



Key Recommendations

Fossil fuels: Confirm exclusion of new coal power and create exclusion policy for gas power starting from 2020

Ambition: Increase 2030 RE Target to 50%

Solar/Wind: Improve Market Design, especially regulatory frameworks and pricing

1.5° Achievable?: ***Possible*** if recommendations are adopted

Myanmar

Grade: D-

Country Overview

Myanmar is a country that has historically relied on hydropower to meet its energy needs, but as demand has grown, gas projects have been developed, locking in carbon emissions. Excess power that has been generated by gas plants in the past has been exported to surrounding countries, including China and Thailand, and is a key element of Myanmar's national economy.[87] There is low foreign investment due to a general lack of legal framework for solar and wind that would create transparency and minimize associated project risks. Industrial growth and progress on electrification largely relies on support from multilateral development banks. A draft RE law is said to be in progress, but is yet to be public. Otherwise, modest goals for solar and wind exist, and are aimed at 12% by 2025, but only around 170 MW of solar capacity exists in the country today and no wind power plants are currently in operation, according to official plans.[88]

Key Country Themes

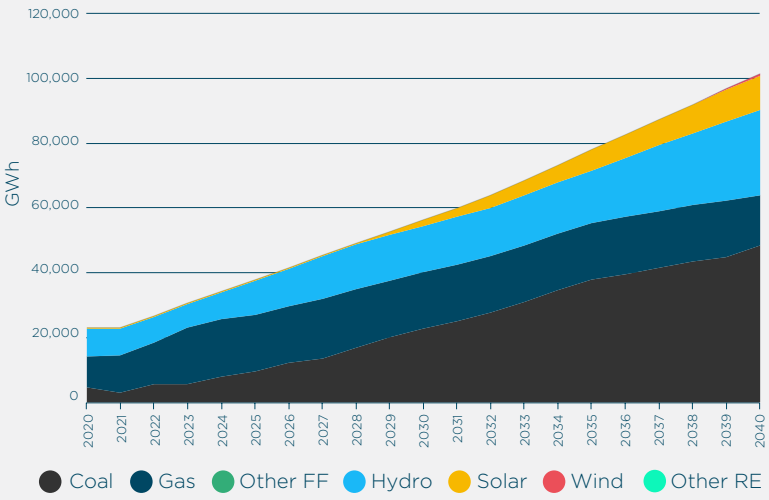
Low Energy Mix Diversification
With over 95% of installed capacity made up by either hydropower or gas, reliance on both becomes risky for energy security.[89] When low rainfall levels place the burden solely on gas, the export of which makes up the largest contributor to the country's national budget, energy security may quickly collapse.

Electrification Challenge
As of March 2020, Myanmar has electrification of only 40-50%.[90] Poor energy planning, inadequate grid development, and the supply shift to gas have all led to sudden exponential increases in the cost of electricity. This is leading to an increase in off-grid solutions.

Low Electricity Tariffs
The government was previously supplying electricity at a loss for several years, eventually culminating in substantial tariff hikes in 2019.[91] While this has fueled demand for rooftop solar, it has also exposed serious flaws in the country's energy planning and has not shifted the popular perception that harmful large-scale hydropower projects are still considered to be lowest cost.[9293]

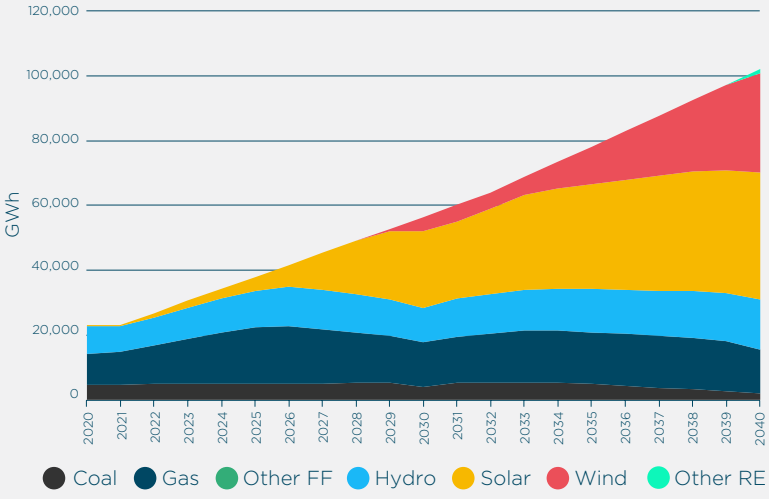
Business as Usual Case

- PDPs from Myanmar have several unclear or unrealistic targets, so future capacity is manually projected in this model based on current capacity and extrapolates its carbon intensity and current preferences
- The 2018 Energy Policy includes mention of LNG and RE to meet growing demands, but there is no specific RE law or tariff structures publicly available
- This means the BAU Case expands coal, gas, and hydropower in that order



Best RE Case

- 68% of RE is achievable by 2030 with flatlining coal, gas, and hydropower. The difference between the BAU Case and Best RE Case is significant
- This exists well within Myanmar's solar potential
- In the model Myanmar meets its 100% electrification goal by 2030
- The 2018 Energy Policy has a projected demand target in 2030 of 11,776 MW. Otherwise, there is little information on projected energy forecasts



Indonesia

Grade: F

Key Takeaways

Coal elites are blocking an energy transition and causing systemic failure

Coal overcapacity and subsidies to coal power block solar and wind development

Poor pricing and frameworks and ad hoc decision making for RE reflect institutional barriers

It is impossible for Indonesia to get on a 1.5° pathway before the 2030s

Country Snapshot

Energy Transition
Indonesia has built a fleet of CFPPs to the point of overcapacity with generous subsidies and guarantees for both fuel contracts and IPP sponsors to further expand its coal economy.[94] There is no energy transition in sight.

Energy Planning
The current PDP suggests that hydropower (10.93%), geothermal (9.63%), and other RE (2.64%) could total 23.2% of generation by 2028. These promises have been made before but RE plant construction perennially remains at the end of each PDP10-year period and is rarely delivered. Each new PDP has consistently overestimated growth, demand, and by extension, generation and RE content. Additionally, solar and wind are ignored. 48% of the additional power in the current PDP is CFPPs, nearly doubling the existing capacity. No amount of empty commitments to ultra-supercritical coal technology or emissions reduction can act as a smokescreen to this toxic coal power pipeline, which will maintain the dominant mix of fossil fuels in the energy system.

Covid Response
There will be no Green Recovery in Indonesia – quite the opposite. The introduction of the Omnibus Bill of Job Creation and new Mining Bill will set back Indonesian environmental and social safeguards even further, including worsening already weak environmental impact assessments.[95] Additionally, the government is planning bailouts worth billions of dollars for the state-owned oil & gas firm Pertamina and utility company PLN[96].

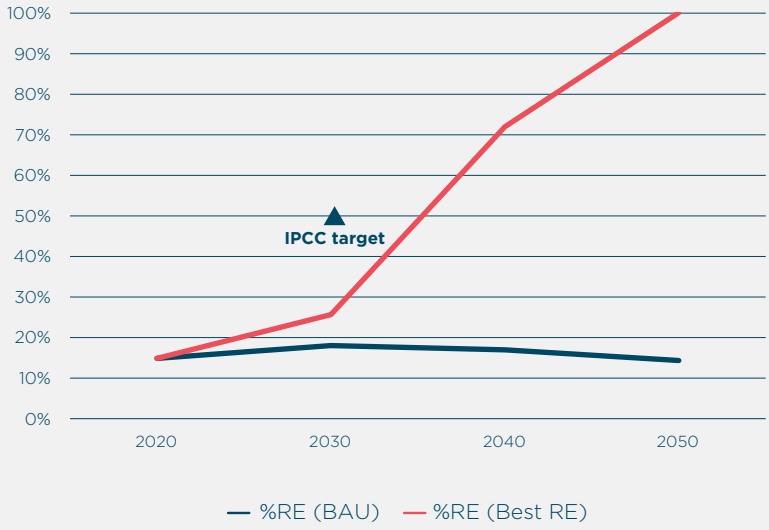
Best RE Case

	2030	
%RE	**26%**	
GW	**Solar Target**	**Wind Target**
	31.5	**2.0**

Business as Usual Case

Actual Planned Coal Capacity
25.4 - 31.3 GW

Energy Model Targets



Key Recommendations

Fossil fuels: Create exclusion policy for new coal and gas power starting from 2020

Ambition: 2030 RE Target failure. Create 50% RE Target urgently

Improve Market Development: especially removing pricing links to subsidised coal power

1.5° Achievable?: ***Impossible*** without system change

Indonesia

Grade: F

Country Overview

Indonesia is one of the largest coal exporters in the world.[97] As such, it has a large and powerful coal oligarchy in key positions in both the power sector and government. Greenpeace Indonesia and other NGOs have examined the corruption that connects the public sector with coal mining and made it clear that this represents a systemic source of failure in energy planning and energy transition.[98] Jakarta, which is surrounded by more than 20 units of CFPPs within a 100-km radius, is now the most polluted city in the region and one of the most polluted capital cities in the world. Vested and corrupt interests that dominate mining and coal power in Indonesia make it a laggard in solar and wind. Coal power will continue to be well-subsidised as demonstrated by Overseas Development Institute's report into G20 fossil fuel subsidies including the state-owned utility PLN.[99] PLN continues to produce PDPs that fail to deliver solar and wind development.

Key Country Themes

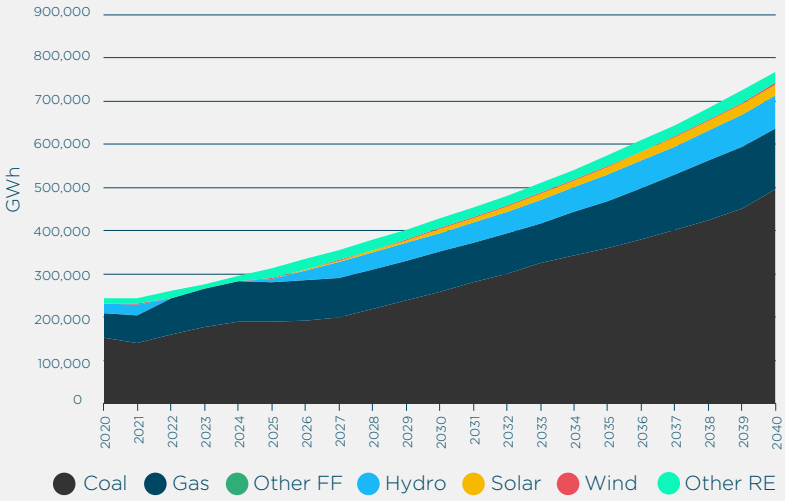
PLN's Financial Troubles
PLN, the state-owned utility running the power sector, has a monopoly on electricity distribution in Indonesia and generates the majority of the country's power. It continues to experience mounting debt and relies on state subsidies, and is now slated to receive a significant Covid-19 bailout.[100]

Frameworks That Don't Work
Less attractive tariffs, BOOT scheme, unbalanced risk allocation, and module price (local content requirements) still affect the bankability of solar projects. Pricing in particular is linked to national targets which do not account for subsidies in coal power.[101] This is the key bottleneck.

RE Potential
Indonesia's land mass and position offer the largest solar potential in the region estimated at over 200 GW technical potential (and up to 500 GW theoretical) but only 0.02% of solar potential has been realized and 2.3% of total RE.[102][103]

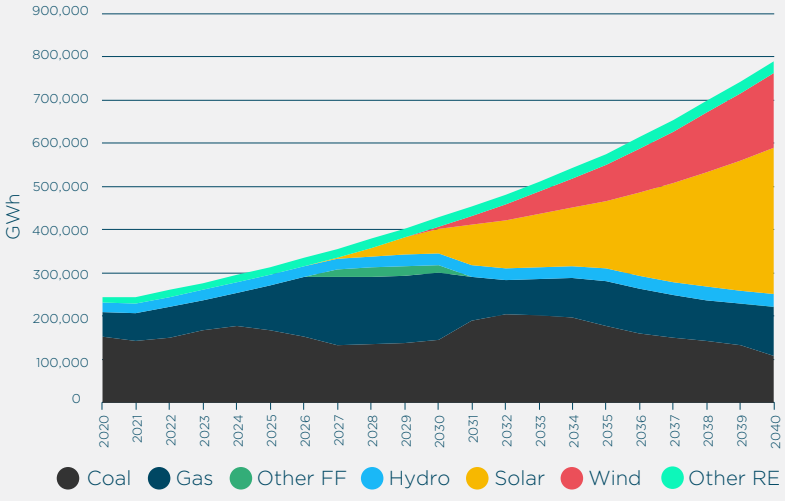
Business as Usual Case

- Indonesia's coal fleet would more than double in the next ten years
- The development of RE is very narrow and fails to prioritize solar and wind
- There are only token wind and solar projects which have long lead times to market



Best RE Case

- Assuming that overcapacity persists, even with average coal plant lifetimes, it is impossible to deliver a 1.5° pathway by 2030, even with 34 GW of solar
- The best case for 2030 is to focus exclusively on solar as well as some planned hydropower with minimal onshore wind, with no impact on costs per unit
- A new 35 GW program mirroring the current political ambition should be 100% solar[104]



Scorecard Explained

Energy Transition

1. Will the country be **50% RE by 2030 (BAU)** in a business as usual scenario?
   In the model's BAU Case, the countries with a 50% share of RE in their energy generation mix by 2030 receive a 🟢
   Source: GP/IESYS modelling

2. Will the country be **100% RE by 2050 (BAU)** in a BAU scenario?
   In the model's BAU Case, the countries with a 100% share of RE in their energy generation mix by 2050 receive a 🟢
   Source: GP/IESYS modelling

3. For each country, **is 50% RE by 2030 (RE) possible?**
   In the model's Best RE Case, the countries with a 50% share of RE in their energy generation mix by 2030 receive a 🟢. The test represents an analysis of the best 10-year energy transition outcome. A 🟢 means a possibility of being on a 1.5 degrees pathway, a 🔴 means a country will not be on a 1.5 degrees pathway in 2030, even with the best 10-year energy transition outcome. A 🔴 here is one of the most important features of the scorecard.
   Source: GP/IESYS modelling

4. For each country, **is 100% RE by 2050 (RE) possible?**
   In the model's Best RE Case, the countries with a 100% share of RE in their energy generation mix by 2030 receive a 🟢. The test represents an analysis of the best 30-year energy transition outcome, the deadline for completing an energy transition. A 🟢 means a possibility of being on a 1.5 degrees pathway.
   Source: GP/IESYS modelling

5. Is there a **transition from fossil fuels?**
   For coal and gas power, we take data from the last five years (2015-2020) and the current proposed coal and gas power project pipeline from individual PDPs and Global Energy Monitor. If the country has continued to install new fossil fuel capacity and has additional fossil fuels in the pipeline, the country receives a 🔴. If fossil fuels were installed but there is no planned capacity in the pipeline, the country receives a 🟡. If fossil fuels have not been installed in recent years and there is no planned capacity in the pipeline, the country receives a 🟢.
   Source: PDPs, Global Energy Monitor

6. Is there **solar/wind market development?**
   For solar and wind power, we take data from the last five years (2015-2020) from BNEF. If the country has made significant additions to solar and wind installed capacity (>3 GW), the country receives a 🟢. If moderate additions have been made (1-3 GW), the country receives a 🟡. If little to no solar and wind additions have been made (<1 GW), the country receives a 🔴.
   Source: BNEF

Energy Policy

7. Are there **policies for fossil fuel exclusion?**
   If the country has public policies noting fossil fuel exclusions or restrictions, the country receives a 🟢.
   Source: BNEF

8. Are there **working solar/wind policies and pricing?**
   While several of the countries have policies and pricing mechanisms that promote solar and wind, many do not actually apply the policies or they create institutional barriers to project development and project risk management – hence the rider "working" policies and pricing. If the country has meaningful and transparent mechanisms in place and has proven their effectiveness, the country receives a 🟢. If public mechanisms are in place, but their effectiveness is unproven or they are not frequently utilized, the country receives a 🟡. If there are no meaningful mechanisms in place, the country receives a 🔴.
   Source: ASEAN Policy Briefs, IRENA Southeast Asia Report, GP Public Policy Analysis, IEEFA

9. **Is solar/wind financing competitive?**
   The myth that solar and wind are risky and high cost is common in the region, and pricing has often reflected that. It also reflects international overseas finance for coal power, large subsidies for coal power projects, sovereign guarantees for projects in the recipient country, and public insurance and risk mitigation available to sponsors from overseas. With this lack of a level playing field for solar and wind, this question analyzes the premium between local interest rates for solar and wind and coal and gas in each country, in addition to analyzing other forms of pricing support such as sovereign guarantees and the involvement of large financial institutions both domestic and overseas.

   In markets where these premiums are higher for solar and wind, this is evidence that financial and other barriers exist due to a lack of adequate financial market design or development. Taking all of these factors into account, if the premiums are low, the country receives a 🟢. If the premiums are high, but would still attract finance, the country receives a 🟡. If the premiums are high or unworkable, the country receives a 🔴.
   Source: BNEF, GP Public Policy Analysis

Covid-19 Recovery

10. Are **solar/wind part of a Covid-19 recovery plan** or a Green and Just Recovery?
    As a response to the economic downturn created by the Covid-19 outbreak, economic stimulus packages or recovery plans have been common in the last six months, not least in Southeast Asia.[105] Many consultancies and NGOs have highlighted the ability of RE projects to create more jobs quickly and create cheaper electricity.[106] [107] [108] Around the world, many countries are aiming to achieve a green and just recovery and placing RE at the center of their Covid-19 recovery plans. If there is no plan to include solar or wind in the recovery, whether the country has announced a recovery plan or not, the country receives a 🔴. If there is no public recovery plan, but steps have been taken to support RE amidst this crisis, the country receives a 🟡. If solar and wind are included in a public recovery plan, the country receives a 🟢.
    Source: Greenpeace Public Policy Analysis, ASEAN Policy Briefs

Scorecard

	Vietnam	Philippines	Malaysia	Thailand	Lao PDR	Cambodia	Myanmar	Indonesia
Energy Transition								
50% RE by 2030 (BAU)?	🔴	🔴	🔴	🔴	🟢	🔴	🔴	🔴
100% RE by 2050 (BAU)?	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Is 50% RE by 2030 (Best RE) possible?	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🔴
Is 100% RE by 2050 (Best RE) possible?	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Is there a transition from fossil fuels?	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Is there solar/wind market development?	🟢	🟡	🟡	🟢	🔴	🔴	🔴	🔴
Energy Policy								
Are there policies for fossil fuel exclusion?	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Are there working solar/wind policies and pricing?	🟢	🟢	🟢	🟡	🔴	🟡	🔴	🟡
Is solar/wind financing competitive?	🟡	🟢	🟢	🟢	🔴	🔴	🔴	🟡
Covid-19 Recovery								
Are solar/wind part of a Covid-19 recovery plan?	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🔴
Ranking	**C-**	**D+**	**D+**	**D+**	**D-**	**D-**	**D-**	**F**

Conclusion

Southeast Asia will witness one of the biggest global increases in energy demand by 2030 and it is crucial that this growth is driven by solar and wind. Not only is the region's coal power pipeline catastrophic for local air pollution and global emissions, but any coal-fired or gas-fired power plant built now makes a 1.5 degrees pathway impossible, according to the IPCC.

Not one country analyzed here received a 'passing' grade (of C or above), and each failed to prove that they are able to achieve a 1.5 degrees pathway without significant market and regulatory changes. While some of the countries have stronger frameworks in place currently, each has a long way to go to obtain a 'passing' grade in this scorecard. Despite this, each country also has:

- The opportunity to increase ambition to get on a 1.5 degrees pathway, most by 2030;
- The social, economic, and sustainable development imperative to quit coal and gas generation;
- The ability to break the market design and market development bottlenecks of solar and wind projects to produce working frameworks and pricing; and
- The natural resource potential to kick-start an energy transition rather than go back to business as usual as a response to the Covid-19 crisis.

In the last two years, Vietnam has proven that rapid, large-scale solar introduction is possible and that institutional leadership remains crucial. We believe Thailand, the Philippines, and Malaysia can follow Vietnam's lead immediately.

Our scorecard and modelling of 2030 show that while parts of the region could be a global leader in the next ten years, many problems are evident, such as Indonesia's addiction to coal power and the misconception and mislabelling of gas as a transition fuel in several countries. In this context, it is vital that ASEAN and every county in the region revisit their respective targets for RE, especially post-Covid-19, while power projects are stalled as a result of the crisis, and also work to lead the region toward a green and just recovery so that each country can emerge with stronger, more distributed, and more resilient energy systems.

Lastly, there are no substitutes for solar and wind and no room for more promotion of fossil fuels. Progress has to be measured in capacity of utility-scale solar and wind projects. Even one coal power plant, such as Cambodia's proposed deal with Lao PDR or any of Vietnam's huge pipeline of coal-fired power plants can derail climate ambition.

Covid-19 has triggered rich discussion of environment and economy, though at times this discussion has framed a false choice between the two. Opportunities in the RE industry hold distinct value in both environmental and economic systems. An energy transition built on solar and wind power delivers jobs, economic growth, energy access, low-cost electricity rates, clean air, and more resilient value chains. The ambition to develop 50% RE by 2030 offers immediate direction to this economy and environment dialogue, where it can catalyze recovery from Covid-19 in the short-term and build the economic strength and climate resilience Southeast Asia needs for the future.

No matter what stage a country is in with respect to its RE development – Now is the time to #BuildBackBetter

Appendices

Solar energy in Thailand
© Athit Perawongmetha / Greenpeace

Appendix 1: Glossary

ASEAN	Association of Southeast Asian Nations
BAU	Business as Usual
BNEF	Bloomberg New Energy Finance
CFPP	Coal-fired Power Plant
DPPA	Direct Power Purchase Agreement
EGAT	Electricity Generating Authority of Thailand
ERC	Energy Regulatory Commission of Thailand
EVN	Vietnam Electricity
FiT	Feed-in-Tariff
GDP	Gross Domestic Product
GW	Gigawatt
IEA	International Energy Agency
IES	Intelligent Energy Systems
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
Lao PDR	Lao People's Democratic Republic
LCOE	Levelized Cost of Energy
MW	Megawatt
NEPC	National Energy Policy Council (NEPC) of Thailand
NREP	National Renewable Energy Program
PDP	Power Development Plan
PEP	Philippines Energy Plan
PLN	Perusahaan Listrik Negara
PPA	Power Purchase Agreement
RE	Renewable Energy (includes all RE technologies)
SDG	Sustainable Development Goal
SPP	Small Power Plants
VSPP	Very Small Power Plants

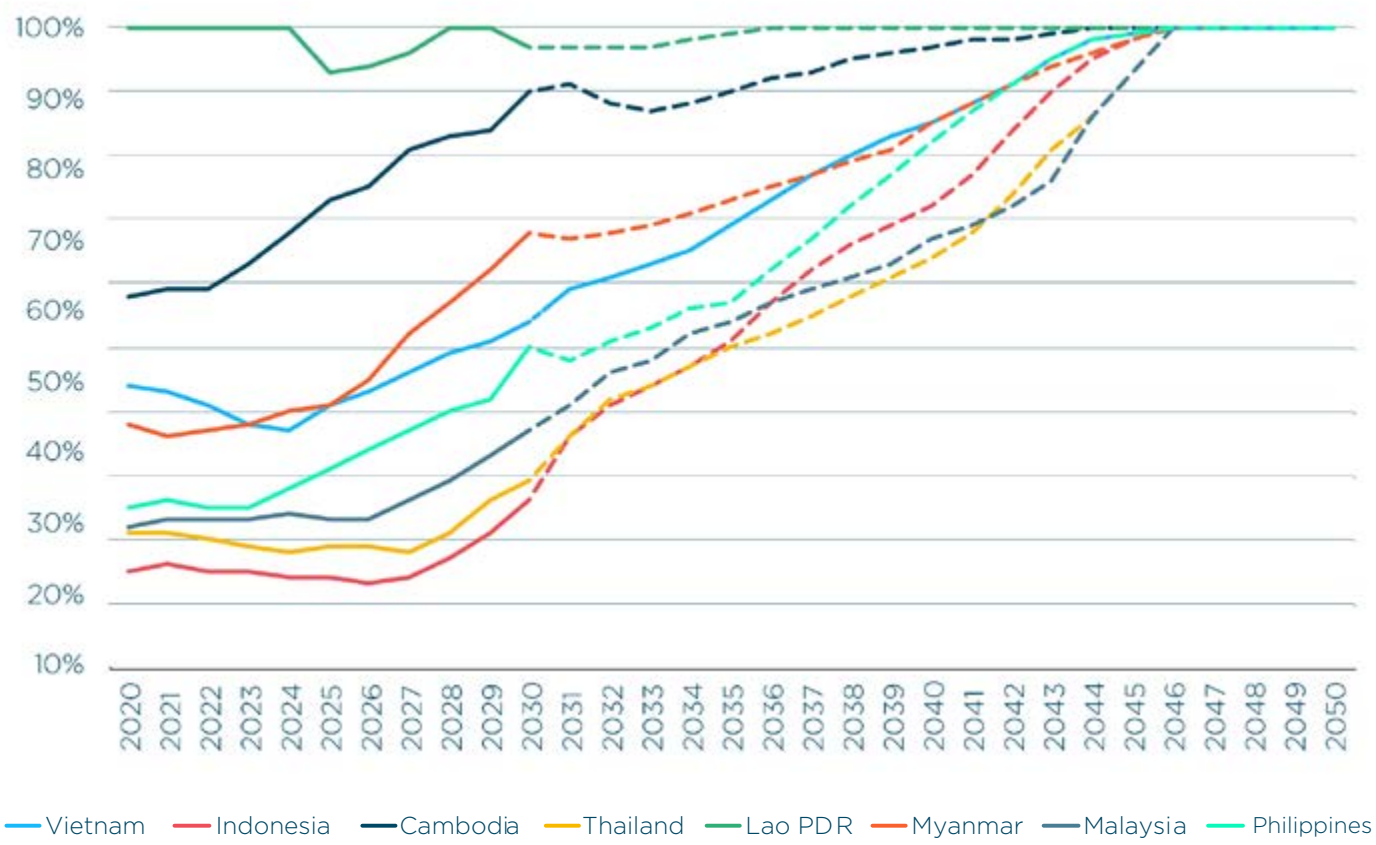
Appendix 2:
Possible Country Profile Format

Key Recommendations Table

	Vietnam	Philippines	Malaysia	Thailand	Lao PDR	Cambodia	Mayanmar	Indonesia
Fossil fuels								
Create exclusion policy for new coal and gas power starting from 2020	✓	✓		✓	✓	✓		✓
Confirm exclusion of new coal power and create exclusion policy for gas power starting from 2020			✓				✓	
Ambition								
Increase 2030 RE Target to 50%	✓	✓				✓	✓	
Prioritise solar and wind over other RE especially hydropower					✓			
Ambition: 2030 RE Target failure. Create 50% RE Target urgently.			✓	✓				✓
Solar/wind								
Improve Market Design					✓		✓	
Improve Market Development			✓	✓		✓		✓
Improve Grid Development	✓	✓						
1.5 ° Achievable?								
Probable, if recommendations are adopted	✓	✓						
Probable, if recommendations are adopted, but after 2030 target			✓					
Possible, if recommendations are adopted					✓	✓	✓	
Possible, if recommendations are adopted, but after 2030				✓				
Impossible without system change								✓

Appendix 3: Demands Table

Southeast Asia's Best RE Case by Country



Endnotes

1 Ritchie, Hannah. “Who Has Contributed Most to Global CO2 Emissions?” Our World in Data, 2019, ourworldindata.org/contributed-most-global-co2.

2 “Boiling Point.” The Impact of Climate Change in Southeast Asia – IMF Finance & Development Magazine, 2018, www.imf.org/external/pubs/ft/fandd/2018/09/southeast-asia-climate-change-and-greenhouse-gas-emissions-prakash.htm.

3 “How a Post-Pandemic Stimulus Can Both Create Jobs and Help the Climate.” McKinsey & Company, 27 May 2020, www.mckinsey.com/business-functions/sustainability/our-insights/how-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate.

4 “Global Climate Risk Index.” GermanWatch, Dec. 2019, germanwatch.org/sites/germanwatch.org/files/20-2-01e Global Climate Risk Index 2020_14.pdf.

5 “Philippines Commission on Human Rights Finds Fossil Fuel;Companies Have Legal and Moral Responsibility to Act on Climate Crisis.” Oxfam International, 11 Dec. 2019, www.oxfam.org/en/press-releases/philippines-commission-human-rights-finds-fossil-fuel-companies-have-legal-and-moral.

6 Levin, Kelly. “8 Things You Need to Know About the IPCC 1.5˚C Report.” World Resources Institute, 10 Oct. 2018, www.wri.org/blog/2018/10/8-things-you-need-know-about-ipcc-15-c-report.

7 “Global and Regional Coal Phase-out Requirements of the Paris Agreement: Insights from the IPCC Special Report on 1.5°C.” Climate Analytics, 2019, climateanalytics.org/media/report_coal_phase_out_2019.pdf.

8 “Energy – United Nations Sustainable Development.” United Nations, www.un.org/sustainabledevelopment/energy/.

9 “Global Coal Plant Tracker.” End Coal, endcoal.org/global-coal-plant-tracker/.

10 “Analysis: Will China Build Hundreds of New Coal Plants in the 2020s?” Carbon Brief, 30 Mar. 2020, www.carbonbrief.org/analysis-will-china-build-hundreds-of-new-coal-plants-in-the-2020s.

11 “ASEAN 2025: Forging Ahead Together.” ASEAN, 2015, www.asean.org/storage/2015/12/ASEAN-2025-Forging-Ahead-Together-final.pdf .

12 “Secretary-General's Remarks at Closing of Climate Action Summit.” United Nations, 2019, www.un.org/sg/en/content/sg/statement/2019-09-23/secretary-generals-remarks-closing-of-climate-action-summit-delivered.

13 Climate Council / 29 July 2015. “New Report from Oxfam Explores Why Renewable Energy Is the Future.” Climate Council, 7 May 2018, www.climatecouncil.org.au/new-report-from-oxfam-explores-why-renewable-energy-is-the-future/.

14 “How a Post-Pandemic Stimulus Can Both Create Jobs and Help the Climate.” McKinsey & Company, May 2020, www.mckinsey.com/-/media/McKinsey/Business Functions/Sustainability/Our Insights/How a post-pandemic stimulus can both create jobs and help the climate/How-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate.pdf.

15 IEA. “Southeast Asia Energy Outlook 2019 – Analysis.” IEA, www.iea.org/reports/southeast-asia-energy-outlook-2019.

16 Koh, Hannah. “'Half of Southeast Asia's Renewable Energy Projects Are Unbankable'.” Eco, Eco-Business, 2 Nov. 2017, www.eco-business.com/news/half-of-southeast-asias-renewable-energy-projects-are-unbankable/?source=post_page.

17 “ASEAN's Renewable Energy Challenges.” The ASEAN Post, 9 Dec. 2019, theaseanpost.com/article/aseans-renewable-energy-challenges.

18 “Vietnam Becomes Southeast Asia's Hottest Solar PV Market.” Wood Mackenzie, 1 Nov. 2019, www.woodmac.com/press-releases/vietnam-becomes-southeast-asias-hottest-solar-pv-market/.

19 Bridle, Richard, et al. “Indonesia's Coal Price Cap: A Barrier to Renewable Energy Deployment.” International Institute for Sustainable Development, 2019, www.iisd.org/publications/indonesia-coal-price-cap.

20 “Future of Solar Photovoltaic: Deployment, Investment, Technology, Grid Integration and Socio-Economic Aspects.” IRENA, Nov. 2019, irena.org/-/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Future_of_Solar_PV_2019.pdf.

21 IEA. “Southeast Asia Energy Outlook 2019 – Analysis.” IEA, www.iea.org/reports/southeast-asia-energy-outlook-2019.

22 “ADB-Supported Solar Project in Cambodia Achieves Lowest-Ever Tariff in ASEAN.” Asian Development Bank, 25 Nov. 2019, www.adb.org/news/adb-supported-solar-project-cambodia-achieves-lowest-ever-tariff-asean.

23 “Analysis: Global Coal Power Set for Record Fall in 2019.” Carbon Brief, 27 Mar. 2020, www.carbonbrief.org/analysis-global-coal-power-set-for-record-fall-in-2019.

24 Leisch, Jennifer, and Jaquelin Cochran. “Wind and Solar on the Power Grid: Myths and Misperceptions.” National Renewable Energy Laboratory, 2015, www.nrel.gov/docs/fy15osti/63045.pdf.

25 “Will Climate Change Spell the End of Coal and Hydropower in the Mekong?” ASEAN Today, 8 Oct. 2019, www.aseantoday.com/2019/10/will-climate-change-spell-the-end-of-coal-and-hydropower-in-the-mekong/.

26 “Environmental, Climate and Social Guidelines on Hydropower Development.” European Investment Bank, 2019, www.eib.org/attachments/eib_guidelines_on_hydropower_development_en.pdf.

27 “Modelling the Impacts of Climate Change and Development Infrastructure on Mekong Flow, Sediment Regimes and Water Quality.” Mekong River Commission, 2018, mrcmekong.org/assets/Publications/Council-Study/Modelling-the-impacts-of-climate-change_Council-Study.pdf?fbclid=IwAR2EPm00PQZvPDkpaijgjb04UoezR30d44Zcr6PorDfFzK2SLdFFFjblBA0.

28 “Renewable Energy Snapshot: Myanmar.” Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.

29 Thant, Htoo. “Warning of Blackouts next Summer, Govt Regulates Hydropower Plant Operations.” The Myanmar Times, 4 Nov. 2019, www.mmtimes.com/news/warning-blackouts-next-summer-govt-regulates-hydropower-plant-operations.html.

30 Varela, Milan N.G., and Michele S Zangrandi. “Indonesia: Current Account Assessment.” World Bank Group, 2015, documents1.worldbank.org/curated/en/559731468187799610/pdf/98206-WP-P131151-Box391506B-PUBLIC-SEMEFPA-report-Indonesia-Current-Account-Assessment-July-2015.pdf.

31 “Thai Banks Finance Lao Hydropower Project.” WLE Mekong, Vientiane Times, 27 Mar. 2014, wle-mekong.cgiar.org/thai-banks-finance-lao-hydropower-project/.

32 “Laos Plans New Coal-Fired Power Plant in Sekong Province.” IEA Clean Coal Centre, 11 June 2020, www.iea-coal.org/laos-plans-new-coal-fired-power-plant-in-sekong-province/.

33 Velasco, Myrna M. “Delays in Coal Deliveries to Trigger Power Rate Spikes.” Manila Bulletin, 7 May 2020, mb.com.ph/2020/05/07/delays-in-coal-deliveries-to-trigger-power-rate-spikes/.

34 GP Indonesia

35 Intelligent Energy Systems, www.iesys.com/.

36 “Vietnam Solar Competitive Bidding Strategy and Framework.” World Bank, documents.worldbank.org/en/publication/documents-reports/documentdetail/949491579274083006/vietnam-solar-competitive-bidding-strategy-and-framework.

37 “Global Coal Plant Tracker.” End Coal, endcoal.org/global-coal-plant-tracker/.

38 "Vietnam Offshore Wind: Where to from Here?" Linklaters, Allens, May 2020, www.allens.com.au/globalassets/pdfs/insights/linklaters-insights/linklaters-insight_vietnam-offshore-wind-report-may20.pdf.

39 Pham, Linh. "Vietnam's Imported Coal Doubles to 32 Million Tons in 2019." Hanoi Times, 3 Jan. 2020, hanoitimes.vn/vietnams-imported-coal-doubles-to-32-million-tons-in-2019-300685.html.

40 Ha, Tim. "Vietnam Considers Scrapping Half of Coal Power Plant Pipeline in Favour of Gas and Renewables." Eco-Business, 28 July 2020, www.eco-business.com/news/vietnam-considers-scrapping-half-of-coal-power-plant-pipeline-in-favour-of-gas-and-renewables.

41 "Vietnam to Stop New Coal-Fired Thermal Power Projects in 2020-2030." The Saigon Times, 15 Aug. 2020, english.thesaigontimes.vn/78074/vietnam-to-stop-new-coal-fired-thermal-power-projects-in-2020-2030.html.

42 "New Regulation Tightens Vietnam Sovereign Guarantees." Allen & Overy, 21 Mar. 2017, www.allenovery.com/en-gb/global/news-and-insights/publications/new-regulation-tightens-vietnam-sovereign-guarantees.

43 Cooper, Giles T. "Vietnam's PM Decides to Do Away with Solar FiTs in Favor of Auctions." Lexology, 22 Nov. 2019, www.lexology.com/library/detail.aspx?g=d678255d-6616-474c-a446-1aa535441c0a.

44 "New Strategy to Help Vietnam Scale Up and Better Utilize Solar Power." World Bank, 13 Feb. 2020, www.worldbank.org/en/news/press-release/2020/02/13/new-strategy-to-help-vietnam-scale-up-and-better-utilize-solar-power.

45 "Future Skills and Job Creation through Renewable Energy in Vietnam." Co-Benefits, 18 Oct. 2019, www.cobenefits.info/resources/future-skills-and-job-creation-through-renewable-energy-in-vietnam/.

46 "Republic Act No. 9513: GOVPH." Official Gazette of the Republic of the Philippines, 16 Dec. 2008, www.officialgazette.gov.ph/2008/12/16/republic-act-no-9513/.

47 Fernandez, Hannah A. "Coal Does Not Make Sense in the Philippines, Says Former UN Climate Chief." Eco-Business, 7 Aug. 2019, www.eco-business.com/news/coal-does-not-make-sense-in-the-philippines-says-former-un-climate-chief/.

48 Ahmed, Sara Jane. "Philippines Power Sector Can Reach Resilience by 2021." Institute for Energy Economics and Financial Analysis, June 2020, ieefa.org/wp-content/uploads/2020/06/Philippines-Power-Sector-Can-Reach-Resilience-by-2021_June-2020.pdf.

49 Ahmed, Sara Jane. "Philippines Power Sector Can Reach Resilience by 2021." Institute for Energy Economics and Financial Analysis, June 2020, ieefa.org/wp-content/uploads/2020/06/Philippines-Power-Sector-Can-Reach-Resilience-by-2021_June-2020.pdf.

50 "Renewables Readiness Assessment: The Philippines." International Renewable Energy Agency, Mar. 2017, www.irena.org/publications/2017/Mar/Renewables-Readiness-Assessment-The-Philippines.

51 Ahmed, Sara Jane, and Colin Steley. "Paying Less for More - How Auctions Can Transform the Philippines Power Sector." Institute for Energy Economics and Financial Analysis, Feb. 2020, ieefa.org/wp-content/uploads/2020/02/Paying-Less-for-More-Auctions-in-the-Philippines_Februay-2020.pdf.

52 "Peninsular Malaysia Gas Industry Outlook 2019." Suruhanjaya Tenaga Energy Commission, 2019, www.st.gov.my/en/contents/files/download/106/Peninsular_Malaysia_Gas_Industry_Outlook_2019.pdf .

53 "Feed-in Tariff (FIT)." Sustainable Energy Development Authority Malaysia, www.seda.gov.my/reportal/fit/.

54 Martin, Jose R. "Malaysia Eyes Pandemic Recovery with 1GW New Solar Tender." PV Tech, 1 June 2020, www.pv-tech.org/news/malaysia-eyes-pandemic-recovery-with-1gw-new-solar-tender.

55 Hashim, Sabar. "Malaysia's Recent Development in RE & ASEAN Power Connectivity." UNESCAP, 2020, www.unescap.org/sites/default/files/Mr. Sabar Md Hashim - Malaysia Presentation.pdf.

56 "Peninsular Malaysia Electricity Supply Industry Outlook 2019." Suruhanjaya Tenaga Energy Commission, 2019, www.st.gov.my/en/contents/files/download/106/PENINSULAR_MALAYSIA_ELECTRICITY_SUPPLY_INDUSTRY_OUTLOOK_2019.pdf .

57 Kumar, Maggie, and Jonathan Stern. "Gas Industry Reform and the Evolution of a Competitive Gas Market in Malaysia." The Oxford Institute for Energy Studies, 2020, www.oxfordenergy.org/wpcms/wp-content/uploads/2020/03/Gas-Industry-Reform-and-the-Evolution-of-a-Competitive-Gas-Market-in-Malaysia-NG-158.pdf .

58 Basu, Medha. "How Malaysia's Tenaga Plans to Cope with Disruption." GovInsider, 23 Sept. 2019, govinsider.asia/smart-gov/malaysia-tnb-fazlur-rahman-smart-grid-renewables/.

59 Teoh, Shannon. "Oil and Gas Woes Hampering Muhyiddin's Economic Recovery Plans for Malaysia." The Straits Times, 22 June 2020, www.straitstimes.com/asia/se-asia/oil-and-gas-woes-hampering-muhyiddins-economic-recovery-plans-for-malaysia.

60 "Peninsular Malaysia Electricity Supply Industry Outlook 2019." Suruhanjaya Tenaga Energy Commission, 2019, www.st.gov.my/en/contents/files/download/106/PENINSULAR_MALAYSIA_ELECTRICITY_SUPPLY_INDUSTRY_OUTLOOK_2019.pdf .

61 Basu, Medha. "How Malaysia's Tenaga Plans to Cope with Disruption." GovInsider, 23 Sept. 2019, govinsider.asia/smart-gov/malaysia-tnb-fazlur-rahman-smart-grid-renewables/.

62 Inn, Toh Kar. "Govt May Ask Petronas to Pay Special Dividend Again." The Star Online, 17 Mar. 2020, www.thestar.com.my/business/2020/03/17/govt-may-ask-petronas-to-pay-special-dividend-again.

63 "Regional Distribution of Solar Module Production 2018." Statista, 2020, www.statista.com/statistics/668749/regional-distribution-of-solar-pv-module-manufacturing/.

64 "Statistical Data." Electricity Generating Authority of Thailand, www.egat.co.th/en/information/statistical-data?view=article.

65 "Annual Report 2016." Thailand Energy Regulatory Commission, 2016, www.erc.or.th/ERCWeb2/Upload/Document/annual report/Annual Report- ERC 2016.pdf.

66 "Statistical Data." Electricity Generating Authority of Thailand, www.egat.co.th/en/information/statistical-data?view=article.

67 "Why Does the South of Thailand Need Coal-Fired Power Plants?" *Electricity Generating Authority of Thailand,* www.egat.co.th/en/news-announcement/egat-reasons-why/why-does-the-south-of-thailand-need-coal-fired-power-plants.

68 Wiriyapong, Nareerat. "Power Shift." Bangkok Post, 9 Mar. 2020, www.bangkokpost.com/business/1874634/power-shift.

69 "Renewable Energy Snapshot: Thailand." Norton Rose Fulbright, July 2019, www.nortonrosefulbright.com/en/knowledge/publications/2f5545da/asia-renewables-snapshot-thailand.

70 Rujivanarom, Pratch. "Can Laos Afford to Be the 'Battery of Asia'?" *National Thailand,* 24 Feb. 2019, www.nationthailand.com/national/30364687.

71 "Thai Banks Finance Lao Hydropower Project." WLE Mekong, Vientiane Times, 27 Mar. 2014, wle-mekong.cgiar.org/thai-banks-finance-lao-hydropower-project/.

72 Greenpeace East Asia, Energy Modelling 2020

73 "Lao People's Democratic Republic Energy Sector Assessment, Strategy, and Road Map." Asian Development Bank, Nov. 2019, www.adb.org/sites/default/files/institutional-document/547396/lao-pdr-energy-assessment-2019.pdf.

74 Praiwan, Yuthana. "BCPG Eager to Build Asean's Largest Wind Farm in Laos." Bangkok Post, 29 July 2020, www.bangkokpost.com/business/1959159/bcpg-eager-to-build-aseans-largest-wind-farm-in-laos.

75 Lee, Nathan, et al. "Assessment of Data Availability to Inform Energy Planning Analyses." *USAID-National Renewable Energy Laboratory Partnership*, Jan. 2018, www.nrel.gov/docs/fy18osti/70334.pdf.

76 "The World Bank in Cambodia: Overview." World Bank, Apr. 2020, www.worldbank.org/en/country/cambodia/overview.

77 Beilfuss, Richard, and Tran Triet. "Climate Change and Hydropower in the Mekong River Basin: a Synthesis of Research." Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ) GmbH, 2014, www.giz.de/en/downloads/giz2014-en-study-climate-change-hydropower-mekong.pdf.

78 "ADB-Supported Solar Project in Cambodia Achieves Lowest-Ever Tariff in ASEAN." Asian Development Bank, 25 Nov. 2019, www.adb.org/news/adb-supported-solar-project-cambodia-achieves-lowest-ever-tariff-asean.

79 "Energy Demand and Supply of Cambodia 2010-2018." Ministry of Mines and Energy, Cambodia, Economic Research Institute for ASEAN and East Asia, 2018, www.eria.org/uploads/media/Research-Project-Report/Energy-Demand-and-Supply-of-Cambodia-2010-2018.pdf.

80 "ADB-Supported Solar Project in Cambodia Achieves Lowest-Ever Tariff in ASEAN." Asian Development Bank, 25 Nov. 2019, www.adb.org/news/adb-supported-solar-project-cambodia-achieves-lowest-ever-tariff-asean.

81 Petrova, Veselina. "Cambodia's Grid-Connected PV Capacity Grows to 150 MW." Renewables Now, 13 Apr. 2020, renewablesnow.com/news/cambodias-grid-connected-pv-capacity-grows-to-150-mw-report-694725.

82 "Renewable Energy Snapshot: Myanmar." Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.

83 Thant, Htoo. "Large Hydropower Projects to Continue in Myanmar: Govt." Myanmar Times, 29 July 2020, www.mmtimes.com/news/large-hydropower-projects-continue-myanmar-govt.html.

84 Bellini, Emiliano. "Myanmar Launches 1 GW Solar Tender." Pv Magazine International, 19 May 2020, www.pv-magazine.com/2020/05/19/myanmar-launches-1-gw-solar-tender/.

85 "Renewable Energy Snapshot: Myanmar." Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.

86 "Myanmar Plans to Add 3 GW of New Gas-Fired Capacity by 2021." Enerdata, 5 Feb. 2018, www.enerdata.net/publications/daily-energy-news/myanmar-plans-add-3-gw-new-gas-fired-capacity-2021.html.

87 "Myanmar's (Burma) Landmark Election: Decisive for Myitsone Dam." SIWI, 30 Sept. 2015, www.siwi.org/latest/myanmars-burma-landmark-election-decisive-myitsone-dam/.

88 "Renewable Energy Snapshot: Myanmar." Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.

89 "Renewable Energy Snapshot: Myanmar." Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.r

90 "Renewable Energy Snapshot: Myanmar." Norton Rose Fulbright, 2019, www.nortonrosefulbright.com/en/knowledge/publications/d63c2e71/renewable-energy-snapshot-myanmar.

91 Htwe, Chan Mya, et al. "Myanmar Announces First Power Tariff Hike in Five Years." Myanmar Times, 26 June 2019, www.mmtimes.com/news/myanmar-announces-first-power-tariff-hike-five-years.html.

92 Kean, Thomas. "Electricity Price Hike Fuels Demand for Solar Power in Myanmar." Frontier Myanmar, 19 Sept. 2019, www.frontiermyanmar.net/en/electricity-price-hike-fuels-demand-for-solar-power-in-myanmar/.

93 Htwe, Chan Mya, and Htoo Thant. "Myanmar's Electricity Losses Shrink; More Investments, Spending Needed to Meet Demand." Myanmar Times, 10 June 2020, www.mmtimes.com/news/myanmars-electricity-losses-shrink-more-investments-spending-needed-meet-demand.html.

94 "Indonesia's Coal Dynamics: Toward A Just Energy Transition." Institute for Essential Services Reform, Mar. 2019, iesr.or.id/wp-content/uploads/2019/08/Indonesias-Coal-Dynamics_Toward-a-Just-Energy-Transition.pdf.

95 Jong, Hans Nicholas. "With New Law, Indonesia Gives Miners More Power and Fewer Obligations." Mongabay Environmental News, 13 May 2020, news.mongabay.com/2020/05/indonesia-mining-law-minerba-environment-pollution-coal/.

96 Prasidya, Yunindita. "State Firm Dividends Rise as Govt Scrambles to Rescue Economy." The Jakarta Post, 6 July 2020, www.thejakartapost.com/news/2020/07/06/state-firm-dividends-rise-as-govt-scrambles-to-rescue-economy.html.

97 "Indonesia's Coal Dynamics: Toward A Just Energy Transition." Institute for Essential Services Reform, Mar. 2019, iesr.or.id/wp-content/uploads/2019/08/Indonesias-Coal-Dynamics_Toward-a-Just-Energy-Transition.pdf.

98 "Pengaruh Elite Politik Dalam Pusaran Bisnis Batubara." Greenpeace Indonesia, 17 Dec. 2018, www.greenpeace.org/indonesia/siaran-pers/1016/pengaruh-elite-politik-dalam-pusaran-bisnis-batubara/.

99 "G20 Coal Subsidies: Tracking Government Support to a Fading Industry." ODI, 1 June 2019, www.odi.org/publications/11355-g20-coal-subsidies-tracking-government-support-fading-industry.

100 Diela, Tabita. "Indonesian Government Plans $8.6 Billion Coronavirus Bailout for State Firms." Reuters, 17 May 2020, www.reuters.com/article/us-indonesia-economy-capital/indonesian-government-plans-8-6-billion-coronavirus-bailout-for-state-firms-idUSKBN22T06U.

101 Bridle, Richard, et al. "Indonesia's Coal Price Cap: A Barrier to Renewable Energy Development." International Institute for Sustainable Development, May 2019, www.iisd.org/sites/default/files/publications/indonesia-coal-price-cap.pdf.

102 Puspa, Anitana W. "Renewable Energy Development: Large Potential of Solar Power Underoptimised." PwC Indonesia, 28 Feb. 2019, www.pwc.com/id/en/media-centre/infrastructure-news/march-2019/large-potential-of-solar-power-underoptimised.html.

103 "A Roadmap for Indonesia's Power Sector." Institute for Essential Services Reform, Feb. 2019, www.agora-energiewende.de/fileadmin2/Partnerpublikationen/2019/2019-03-07-SPM_Roadmap_for_Indonesia_Power_Sector.pdf.

104 "Indonesia Clean Energy Outlook." Institute for Essential Services Reform, Dec. 2019, iesr.or.id/wp-content/uploads/2019/12/Indonesia-Clean-Energy-Outlook-2020-Report.pdf .

105 Lowder, Travis, et al. "Covid-19 and The Power Sector in Southeast Asia: Impacts and Opportunities." National Renewable Energy Laboratory, June 2020, www.nrel.gov/docs/fy20osti/76963.pdf.

106 "How a Post-Pandemic Stimulus Can Both Create Jobs and Help the Climate." McKinsey & Company, 27 May 2020, www.mckinsey.com/business-functions/sustainability/our-insights/how-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate.

107 "Pembukaan Lapangan Kerja Di Sektor Energi Terbarukan: Solusi Menuju 'Better Normal'." Greenpeace Indonesia, 2 July 2020, www.greenpeace.org/indonesia/siaran-pers/5277/pembukaan-lapangan-kerja-di-sektor-energi-terbarukan-solusi-menuju-better-normal/.

108 "One Million Solar Rooftops by 2023." Greenpeace Southeast Asia, 23 July 2020, www.greenpeace.org/southeastasia/press/43736/one-million-solar-rooftops-by-2023/.

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

GREENPEACE

Greenpeace Southeast Asia
www.greenpeace.org/southeastasia

Greenpeace Thailand
1371 Capital Mansion Building,
Ground Floor Phaholyothin Road,
Samsen-nai
Phayathai, Bangkok 10400
Thailand
+66 2 357 1921
info.th@greenpeace.org

Greenpeace Philippines
Room 302 JGS Building
#30 Scout Tuason Street
1103 QC
Philippines
+63 2 332 1807
info.ph@greenpeace.org

Greenpeace Malaysia
Level 6, L6-12, Menara Sentral Vista
150, Jalan Sultan Abdul Samad,
Brickfields, Kuala Lumpur,
Malaysia 50470
+603-2276 2022
info.my@greenpeace.org

Greenpeace Indonesia
Mega Plaza Building Lt. 5,
Jl. HR. Rasuna Said Kav. C3
Kuningan, Jakarta Selatan 12920
Indonesia
+62 21 521 2552
info.id@greenpeace.org