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SOUTHEAST ASIA'S GREEN ECONOMY 2024

MOVING THE NEEDLE

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Reference

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Authors & Acknowledgments

Authors

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Dale Hardcastle
Global Sustainability Innovation Center Director and Partner, Bain & Company

Yukiko Tsukamoto
Partner, Bain & Company

Berakah Hyunbin Lee
Senior Manager, Bain & Company

Kimberly Tan
Head of Investments, GenZero

Tracy Wong Harris
Head of Sustainable Finance Asia, Standard Chartered

Justin Ma
Executive Director, Standard Chartered

Kyung-Ah Park
Head, ESG Investment Management & Managing Director, Sustainability, Temasek

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Bain & Company

Gerry Mattios, Expert Partner
Gwyneth Fries, Senior Manager
Jongmin Park, Manager
Jinwoo (Mark) Jang, Consultant
Berlinda Lim, Senior Associate Consultant
Jaeeun Kil, Associate Consultant
Seunghyun Jang, Associate Consultant
Jessy Chua, Director, SEA Market Reputation
Michele Koe, Manager, SEA Market Reputation
Yan Xin Tay, Manager, SEA Market Reputation

GenZero

Hui Qing Soh, Chief of Staff
Chloe Lim, Assistant Vice President

Standard Chartered

Evonne Lee, Co-Head, CIB Marketing, Asia and Sponsorships, Singapore
Christina Soon, Director, Communications and Business Content
Gladys Goh, Associate Director, Brand & Marketing
Phyllis Goh, Associate Director, Communications

Temasek

Anh Vu Nguyen, Director
Keith Lin, Director
Allan Arthur Leyeza Cabrera, Vice President
Remus Tan, Assistant Vice President
Gladys Tan, Assistant Vice President

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01 Introduction

Foreword by Bain & Company

Satish Shankar

Regional Managing Partner,
Asia-Pacific,
Bain & Company

The past 12 months have reinforced the need for concerted global action on climate change, and specifically for greater urgency and commitment from governments across the world. This has been equally true across Southeast Asia where, encouragingly, there has been a steady uptick in commitments from all stakeholders. Four countries in ASEAN have raised climate commitments, and seven are now considering carbon pricing measures to promote action. There has been a four-fold increase in corporate commitments to set science-based targets, and many leaders have outlined ambitious multi-billion-dollar investment programs to decarbonize their businesses.

Yet in climate action, as in business and life, the real test of a strategy is not the targets we set, but the concrete steps we take to accelerate progress and deliver the impact we have committed to. The green transition in SEA is at a tricky juncture where bold ambition is meeting the realities of the day. Southeast Asia governments are grappling with the challenges of rising energy demand (that will grow by nearly 42% over the decade to 2030), a burgeoning middle class, strong pressure not to increase energy and electricity prices, and the need to deliver just and equitable growth—before even considering ambitious plans to decarbonize and build the industries of tomorrow.

Corporates and investors are keen to play their part. Yet uncertainties about the transition path and supporting regulation and policies (central to any translation of climate commitments to reality) make it difficult to take decisive action at scale and invest the billions of dollars that are needed to ensure a speedy and effective transition. To break this logjam, the largest corporates and investors, including the multilateral financial institutions, need to act with urgency and conviction to lead the way.

Despite the uncertainties, there is much that can be done in the “here and now.” There are several actions that are “no regrets” moves and tap proven levers for decarbonization across various industries. Similarly, there are policies that governments can implement to address nature loss and protect carbon sinks that don't require difficult trade-offs.

This year's Green Economy report speaks to both the challenges on the road to net zero and the immediate actions we can take today to accelerate the transition. While the challenges are considerable, there is much room for optimism, as at least the first wave of available levers can meet much of the region's decarbonization commitments to 2030 if executed with collective commitment and collaboration. In parallel, a focus on defining longer-term solutions that governments, corporations, and investors align on will deliver just and sustainable growth in this dynamic region.

We invite all stakeholders to work together to reaffirm their commitment to the green transition and take action today.

Foreword by GenZero

Kimberly Tan

Managing Director and Head of Investment Group,
GenZero

As a decarbonization-focused investor located in Singapore, GenZero is deeply committed to deploying capital to bridge the gap between Southeast Asia's Net Zero ambitions and concrete achievement.

We believe that an acceleration of effort by countries, corporates and investors is imperative as Southeast Asia remains woefully off-track despite significant progress in 2023. Emissions increased by 13% or 400 $MtCO_2e$ in 2023 and will continue to increase as primary energy consumption increases alongside GDP growth. Renewable energy investment in Southeast Asia increased by 9% in 2023. However, renewable energy constitutes less than 10% of electricity generation in the region. Total green investment increased by 20% from $5.2 billion to $6.3 billion in 2023 but remains far short of the $1.5 trillion needed to fund the Southeast Asia's transition by 2030.

It is therefore critical that all stakeholders act collectively and decisively to drive the system-level change required to accelerate and scale decarbonization across Southeast Asia. We remain optimistic about the region as a destination for green investment given the ample headroom for increased deployment of commercially ready and cost-effective technologies from low penetration levels today. We believe this could unlock incremental annual revenues of $300 billion by 2030 and present a meaningful opportunity to invest into companies with fit-for-purpose technologies and business models which could become the new market leaders in the green economy. However, capital flows have been hampered by the overall lower bankability of Southeast Asian projects, greater offtake risk and lack of political commitment to long-term policies which hinder investor willingness to take long-term bets. We believe that governments must develop more coherent policies and frameworks and more targeted incentives to allow Southeast Asia to compete globally for finite investment dollars amidst robust industrial policy by other markets.

GenZero is a double bottom-line investor. The success of our investments is not measured solely in terms of financial returns but also in terms of the positive climate impact we generate. It is with this mindset that we invested into Rize.Farm alongside Temasek, Breakthrough Energy Ventures and Wavemaker Impact. Rize.Farm is a technology-enabled platform that reduces methane emissions in rice cultivation by providing the right economic incentives across the value-chain, from input financing to market aggregation, to drive the adoption of sustainable cultivation techniques by smallholder rice farmers. We believe that Rize.Farm's use of finance and technology to scale the dissemination and implementation of better agronomic practices will improve the livelihood of smallholder farmers while also reducing greenhouse gas emissions, and is a good example of a business where financial success and positive climate impact are deeply intertwined.

To further fuel the shift towards clean energy and sustainable fuel projects across the region, we signed a Memorandum of Understanding with Keppel Limited at COP28. The partnership aims to explore opportunities to drive the early retirement of coal-fired power plants, and to advance Southeast Asia's transition to renewable alternatives like solar and geothermal energy. As a financial investor, we are acutely aware that commercial acumen and capital is not enough and must be married with operating capability and know-how to drive real change in Southeast Asia's transition.

GenZero also recognizes the potential that carbon markets have in channeling financing to support the scaling and adoption of sustainable solutions and practices in Southeast Asia. We are heartened by the steady progress made by Southeast Asian countries in establishing national carbon markets and registries, as well as the related policy frameworks and infrastructure to support trading and investment. We believe this will enable the scale up of nature-based solutions projects in Southeast Asia, and constitute the foundation for the use of carbon credits within blended finance models to create additional revenue streams that can lower the cost of financing the transition.

The report goes beyond a description of the current state of play, to offer a proposed path to action and specific initiatives for countries, corporates, and investors. We hope that this catalyzes concrete action that can bend the emissions curve for Southeast Asia to get to Net Zero by 2050.

Foreword by Standard Chartered

Patrick Lee

CEO,
Singapore and ASEAN,
Standard Chartered

What will it take for a nation to reach net zero? Rather than a singular effort, it's increasingly clear that a collective determination to navigate complexity and build shared action towards a green and sustainable economy is the way forward.

This ambition is what brings us together, alongside our partners, to develop this Green Economy report, as we explore what a just transition truly looks like on the road to a net-zero future. The report seeks to offer knowledge and insight to propel us towards sustainable goals and shine a light on opportunities and progress across public, private and regional pathways. The report identifies a list of market-ready, high-impact investable ideas that currently hold momentum, of which further uptake can bring clear advantages to the region and build scalable, long-term solutions for the future.

As a region, ASEAN is the fourth largest energy consumer in the world. Energy demand in ASEAN has increased on average by around 3% a year over the past two decades, and this trend is set to continue up until 2030, according to the International Energy Agency. Governments across ASEAN have set out long-term plans for a more secure and sustainable future, with many having already announced net-zero emissions and carbon neutrality targets, which will help propel energy efficiency improvements and the transition to a clean energy economy. But to accelerate progress, we need to move further and faster. This will require bold action, knowledge of the market and stakeholder support from government, philanthropy and the private sector.

For Standard Chartered, sustainability is a core part of our strategy, echoed through the Bank's commitment to supporting the transition across ASEAN. With a long-standing presence in parts of the world where sustainable finance can have a significant impact, we facilitate the movement of capital to where it is needed most. We apply our knowledge across our market footprint and the innovative mindset of our teams to create financial solutions that help to address challenges and support sustainable growth. We're committed to mobilizing $300 billion of sustainable finance and continue to make progress towards our goal of achieving net zero in our operations by 2025, and in our financing by 2050. These ambitions aim to catalyse finance to scale impact and climate solutions where they are most needed.

In collaboration with the Singapore government's Green Plan 2030, Standard Chartered has actively contributed to multiple initiatives in the country's sustainable finance ecosystem, including supporting the development of carbon markets as well as sustainable trade and data solutions through initiatives such as Climate Impact X, Transition Credits Coalition (TRACTION) and SGTraDex. Across the rest of the region, we also work with governments in Indonesia and Vietnam on the Just Energy Transition Partnership (JETP) to help deliver on collective ambitions to reach net zero by 2050.

With Singapore's growing leadership in green finance, the role the nation plays as a connector for the region is crucial, with great strides to come with the nation's plans to become a blended finance hub, which will help to lower the cost of capital for energy-transition projects by leveraging a mix of grants, concessional loans and commercial capital, to achieve substantive and inclusive outcomes.

As the only international bank present in all 10 ASEAN markets, Standard Chartered is well positioned to leverage its network from Singapore as an Asia super-connector, to provide the necessary expertise and help catalyse available capital to drive climate action. Transformation will not happen overnight, but if we work together and adopt a different lens to find breakthrough opportunities and solutions, we can accelerate the transition towards a sustainable, thriving future.

Foreword by Temasek

Kyung-Ah Park

Head, ESG Investment Management & Managing Director, Sustainability, Temasek

The global community has made notable progress on climate action in the past year, with unprecedented collective commitment to transition away from fossil fuels and more than 110 governments pledging at the United Nations' COP28 climate summit to triple the world's renewable energy capacity and double energy efficiency by 2030. Yet, the pace and scale of climate action is still wholly insufficient. 2023 left its mark as the hottest year on record, with carbon emissions from fossil fuels hitting a new high and a record 63 number of billion-dollar weather disasters costing over $300 billion in the same year.

Southeast Asia has an outsized role to play in the global net zero ambition and decarbonization. Many communities across Southeast Asia today continue to lack access to clean and reliable energy. On the other hand, the region's biodiversity and abundance of natural resources as well as strategic importance as an industrial hub allows it to leverage nature-based solutions and new technologies for a once-in-a-generation opportunity to ride the green growth wave.

As an investor seeking to deliver sustainable returns over the long term, Temasek has stepped up to deploy capital towards companies with pivotal technologies or innovative nature-based solutions that support the region's journey towards net zero. For example, we worked with Breakthrough Energy Ventures, GenZero and Wavemaker Impact last year to establish Rize.Farm, an agri-tech startup that aims to decarbonise rice cultivation—the region's leading source of methane emissions—starting with Indonesia and Vietnam as its first two markets. Rize.Farm is building a platform that will identify and implement the most effective strategies to reduce greenhouse gas emissions in rice cultivation and the right economic incentives to drive the adoption of sustainable cultivation techniques.

Southeast Asia faces the dual, often conflicted challenge of addressing the rising need for affordable and reliable energy while simultaneously cutting emissions. Alongside the development of green solutions, accelerating the green transition in Southeast Asia will require financing mechanisms for both the managed phaseout of coal and adoption of new technologies in hard-to-abate sectors. A key part of this puzzle is the deployment of 'accelerators,' including enabling policies and strong public-private partnerships, that can unlock green investment and transition financing.

Temasek is a knowledge partner of the Transition Credits Coalition (TRACTION) launched by the Monetary Authority of Singapore (MAS) to study the early retirement of coal-fired power plants in Asia through high-integrity transition carbon credits. We also signed a Memorandum of Understanding with Allied Climate Partners, International Finance Corporation and MAS, as part of the Financing Asia's Transition Partnership (FAST-P), with the intent to establish a green investments partnership to address climate finance gaps and increase the bankability of green and sustainable projects in Asia.

Pentagreen Capital, our joint venture with HSBC focused on debt financing, has started to catalyse financing for sustainable infrastructure projects in the region. In September 2023, it signed its first transaction with Citicore Solar Energy Corporation, structuring a $100 million mezzanine construction green loan with an initial $30 million committed for a portfolio of six solar power projects with gross capacity of 490 MW across the island of Luzon in the Philippines.

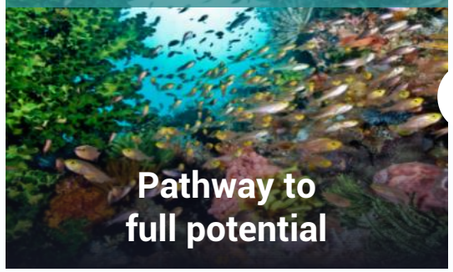
Amidst the challenges the region faces in its decarbonisation journey, we believe that there are also tremendous opportunities in its green economy that can be seized by leveraging the right levers, tools and partnerships.

We hope this report will provide useful insights into the very concrete and investable opportunities in Southeast Asia that can drive immediate progress for the region's green economy, as well as the areas where policies, innovative solutions and collaboration can help to unlock these win-win opportunities to accelerate Southeast Asia's just and inclusive transition.

We invite you to be part of this endeavour to support, catalyse and grow the region's green economy opportunities, so that every generation prospers.

The 2024 Green Economy Report is the 5th report in this series

2020



Assess SEA's green economy potential and strategic pathways

- SEA's Green Economy Potential
- Deep Dive: 5 Sectors
- Deep Dive: 6 Countries

2021

Develop a collective action plan for SEA to capture economic opportunities

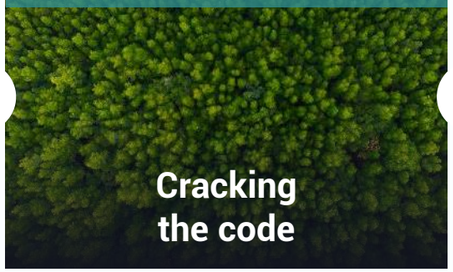
- Year of transition and climate action (Intro)
- Defining the road to net net zero
- Catalyzing the journey
- Unlocking capital for sustainability
- Leading by doing (Conclusion)

2022

Identify investable opportunities to accelerate the net zero transition

- Moving from promises to action (Intro)
- Where to invest
- The current disconnect
- Recommendation

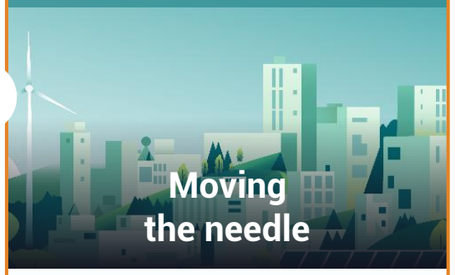
2023



Understand SEA's progress vs. climate commitments and how to unlock its potential in energy transition and nature

- Progress towards decarbonization
- Accelerating the energy transition
- Valuing nature for impact
- Recommendation and call for action

2024



Identify actionable and investable business opportunities and accelerators

- Progress towards decarbonization
- Top decarbonization ideas
- Accelerators to further unlock the full potential

This report answers key questions about Southeast Asia's green transition and trajectory

I State of Play

Where do **SEA countries stand** in meeting their climate commitment? **Are we on track for 2030?**

II Investable Ideas

What **decarbonization ideas today offer the greatest impact, deployability and investability?**

III Accelerators

What **accelerators can we act on to unlock the potential** of ideas sooner?

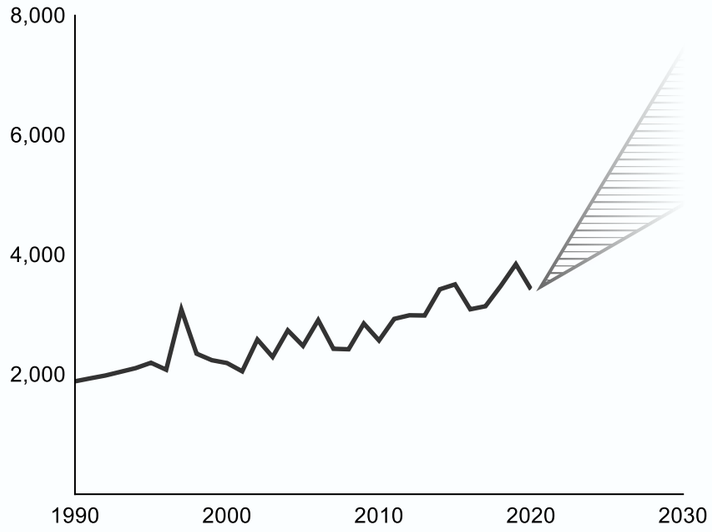
IV Country Insights

What **actions should each country take** given different environments, competing priorities, and readiness?

While SEA only accounts for ~7% of global emissions, its emissions are steadily increasing, and are expected to rise rapidly unless steps are taken to reduce its emissions intensity

Emissions of SEA are still rising …

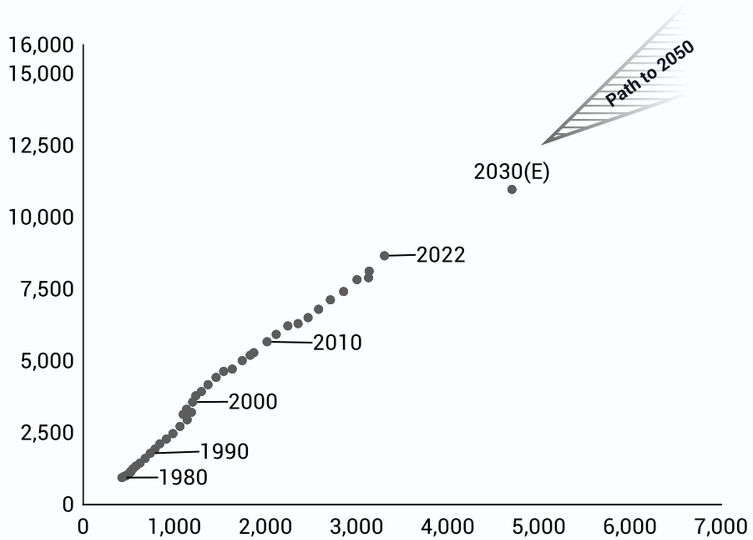
SEA annual greenhouse gas emissions[1]
(MtCO2e)



Year

… as primary energy grows

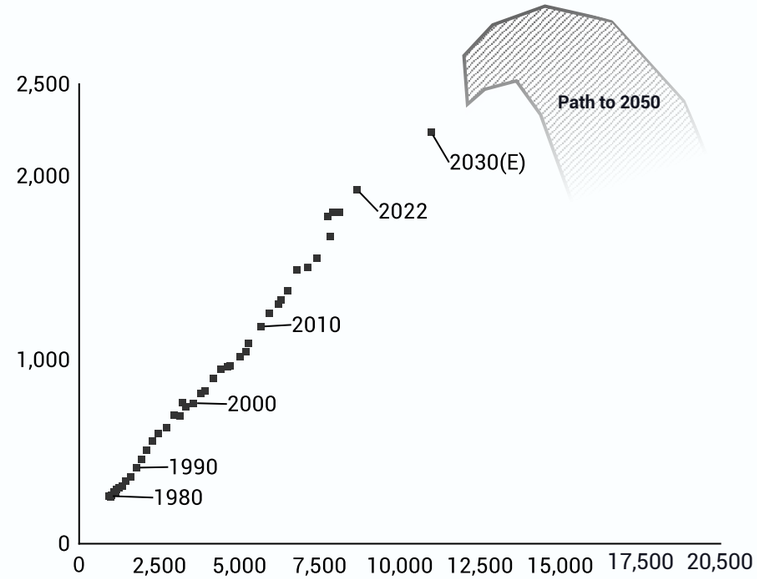
SEA primary energy consumption[2]
(TWh)



SEA GDP
(USD B, Real GDP, Base: 2010)

SEA needs to bend the emissions curve

SEA CO_2 emissions[2]
(Mt)



SEA primary energy consumption
(TWh)

Notes: 1) Actual GHG emissions data used until 2020; 2) Primary energy consumption and CO2 emissions in 2030 refers to stated policies scenario from IEA; primary energy consumption in 2022 for Brunei, Cambodia, Laos, and Myanmar was calculated by multiplying YoY between 2021-22 of ASEAN6 | Sources: Climate Watch; Our World in Data; IEA; IHS Markit; Bain analysis

SEA faces unique challenges that will need a systems level change to decarbonize and transition

Structural constraints & challenges hinder the pace of progress

Dual need to balance growth and transition

GDP per capita is low at $6K in 2023 (vs. $63K in N. America)

Growing economies & middle class will need ~50% more power demand in 2040

About ~60% of coal power stations are young[1]

Just transition to ensure access to clean and affordable energy for all stakeholders

Legacy fossil fuel dependence

Economy is ~35% dependent on energy-intensive sectors

Fossil fuels continue to provide affordable access to baseload power (~75% of power sector dependent on fossil fuels)

Grid constraints hinder ability to leverage solar/wind

>60M employment in energy-intensive industries

Uneven opportunities & limited cooperation

Mismatch due to geographical dispersion of renewable resource potential vs. demand

Lack of cross regional grid connections and cooperative mechanisms

Often limited incentives for carbon reduction

Continued incentives favoring fossil fuels by most governments

Investor pressure across SEA is lacking

Current policy incentives insufficient

Complex, fragmented ecosystem of players

Inadequate access to financing

Insufficient returns for investment with higher perceived risks (e.g., currency fluctuation, regulatory)

Majority state-owned grid infrastructure limits private sector participation

Note: 1) Coal plants under 20 years
Sources: IMF; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Just Transition | SEA needs to consider all stakeholders as it transitions to a green economy

Provide access to affordable and reliable clean energy

Minimize job displacement and support reskilling and redeploying workers

(e.g., JETP[1] could create potential 383K jobs in Indonesia from 2023 to 2030)

Ensure inclusive community decision-making

Focus on nature and biodiversity co-benefits

Note: 1) Just Energy Transition Partnership
Source: Comprehensive Investment and Policy Plan 2023, Lit. search; Bain analysis

Transition potential | SEA has a clear opportunity to leverage the coming transition for competitiveness and economic growth—not just decarbonization

As-is

Tension

between growth and costs of just transition

Decarboni-zation

- Rising GHG[1] emissions
- Achieve net-zero targets

Economic growth

- Low GDP per capita
- Address poverty and job security (job losses/ transition concerns)

Note: 1) Greenhouse gas

Investable Ideas

- Green fuel source
- Process optimization
- Improved farming practices
- Nature-based solutions
- Greener transport
- Energy efficient buildings

Accelerators

- Policy & incentives
- Innovative finance mechanism
- Private corporate investment
- Cluster/ pilot development
- Regional collaboration

To-be

Balanced ecosystem

aligning economic growth with just transition goals

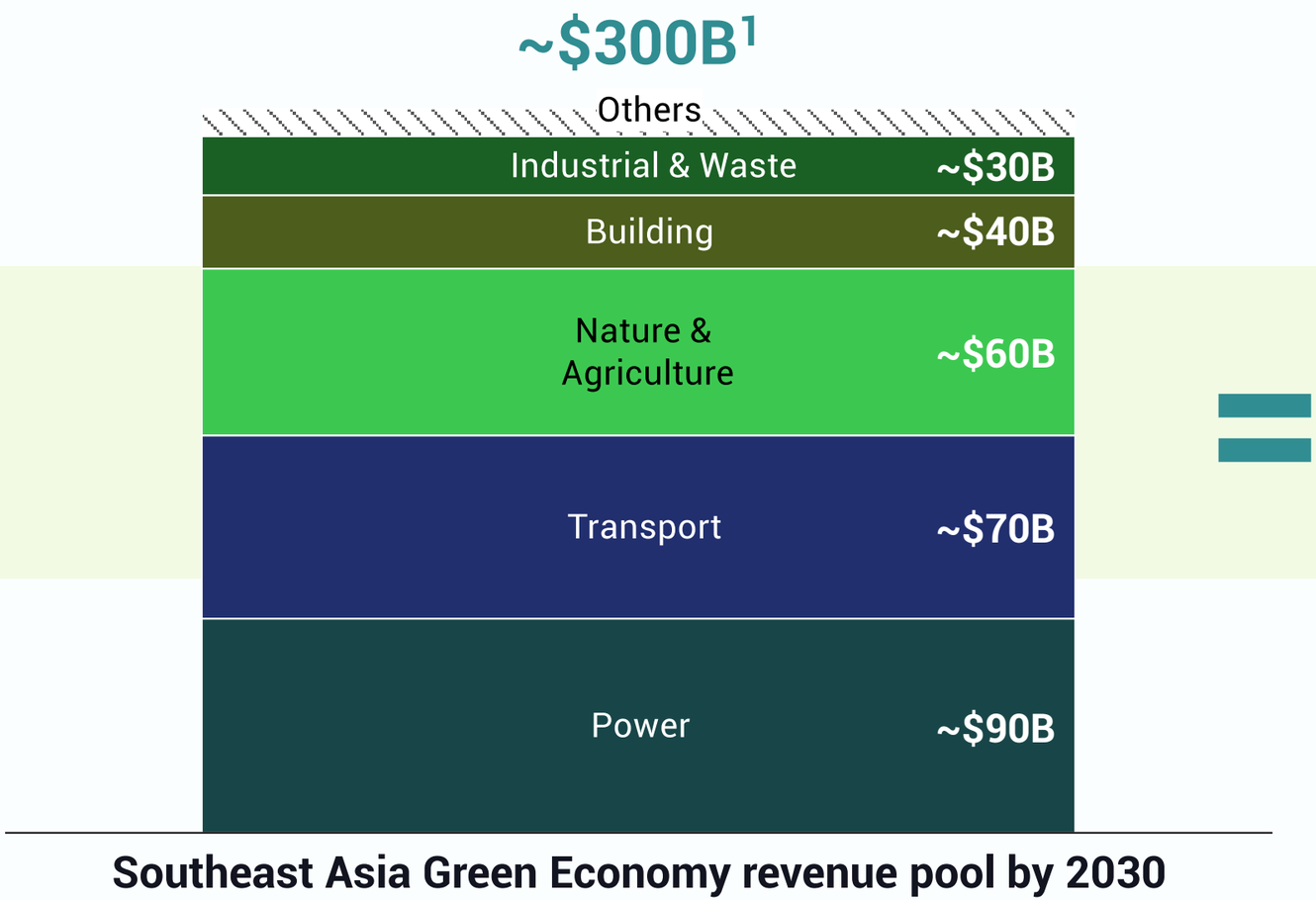
Decarboni-zation

- Reduce GHG emissions

Economic growth

- Economic growth including new revenue pool and job creation

Size of prize | Unlocking the region's green economy could be worth another $300B annually by 2030



Southeast Asia Green Economy revenue pool by 2030

of 2030F SEA GDP

Notes: 1) Gross new revenue— updated the size of prize data from 2020 and 2022 report; Others—Carbon trading market; annual gross new revenue does not include economic losses from green transition such as job losses, businesses shut down from coal plants phase-out, or economic losses of decreasing sales of ICE vehicles | Sources: IEA; OECD; IRENA; BNEF; MAS; Climate Watch; Lit. search; Bain analysis

Key Recommendations

Focus attention on investable decarbonization ideas

Invest behind proven ideas with high impact (abatement potential) and deployability (scale and time to impact/decarbonization)

Scale up policies and incentives to enable corporate action

Accelerate policies like carbon pricing, clusters for green transition[1], disclosure, and regional collaboration; actively promote interoperable frameworks that support cross border finance and capital at the lowest cost

Promote innovation in finance to catalyze investment

Scale innovative finance mechanisms (e.g., blended finance, carbon credits, project financing) to ensure various investors have sufficient drive/business cases to invest

Advance country and regional plans for the transition path

Investors want certainty on the next wave of transition and how industries will evolve; certainty backstops investment ideas and greater focus on what we can do today is an imperative to accelerate action

Note: 1) Ring-fenced green investment targeting industrial zones (e.g., Samalaju Industrial Park in Bintulu, Malaysia)

Why Now? | SEA has a window of opportunity that it needs to seize today

Time is short to deliver 2030 commitments

Achieving NDCs[1] requires action now, given lead times (e.g., to upgrade transmission & grids, build renewables), **and requires new financing solutions**

First steps known and achievable

No new technologies or solutions required to decarbonize as SEA is still early in its decarbonization journey (e.g., focus on renewables and energy efficiency)—the easiest emissions to tackle

Opportunity to ride growth wave with green solutions

Region is today experiencing economic expansion with new investments and infrastructure, presenting an opportunity for green solutions

Geopolitical and corporate tailwinds favor action in SEA

USA, EU, and China all seek to influence pace of change; **SEA to emerge as a center** for green exports, markets & investments

Note: 1) Nationally determined contribution

Key numbers of this report

Today

Rising commitments

6 out of 10

countries have shown progress on taxonomy, emissions reporting, or carbon markets

2x

growth per annum in SEA companies who committed or set SBTi targets

~$6.3B

Private green investments in SEA vs. $5.2B in 2022

Reality on the ground

5 out of 10

countries' net-zero roadmaps are conditional on securing funding

20 out of 100

of the top emitting corporates have announced corporate level roadmaps

~75%

of power sector still dependent on fossil fuels for generation

By 2030

Material action needed

~2.4 GtCO2e

unconditional reduction in emissions from forecasted level in 2030

Significant, consistent investment is needed up to 2030

~$1.5T

estimated cumulative investment needed to meet 2030 targets

Path ahead with benefits beyond decarbonization

13

top investable ideas identified

~$150B

additional annual new revenue from top investable ideas by 2030

~$300B

additional annual new revenue from green economy by 2030

Notes: All dollar amounts are quoted in USD; SBTi = Science Based Target initiative

01 State of Play

SEA has a critical role to play in global climate action and decarbonization

Major contributor to global GHG emissions

4th largest energy consumer in the world[1]

~7% increase in GDP vs. global increase of 4%[2]

~55% contribution to global emissions from land use change and forestry[3]

Many levers ready to drive impactful decarbonization

~75% of electricity derived from fossil fuels[4]

11 automobiles for every 100 people[5]

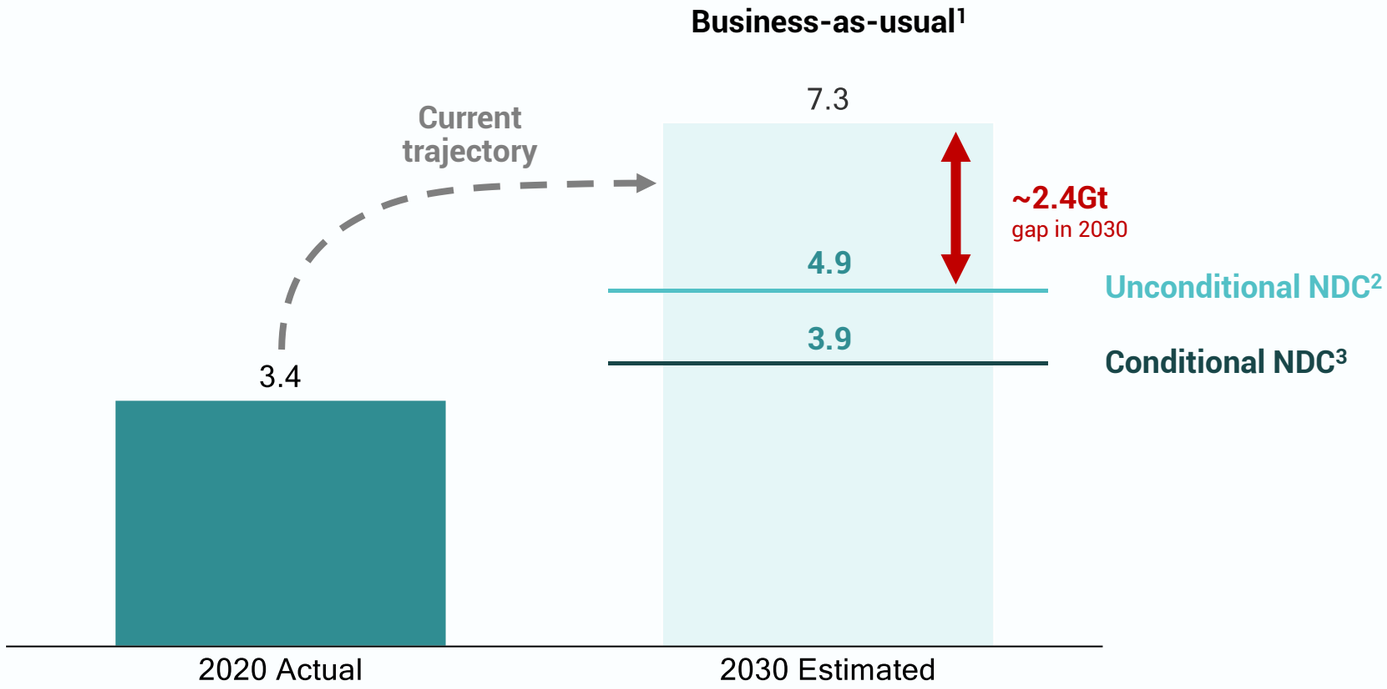
~60% of land area is forest, declining 1% annually in last five years[6]

Notes: 1) Comparing primary energy (energy available as resources before it has been transformed) consumption in 2022 in ASEAN6 with other individual countries in the world, accounts for 5% of the global primary energy consumption; 2) In 2022; 3) in 2020; 4) Electricity generated by coal, natural gas, oil, and other non renewables in 2021; 5) In 2022, 33 units of motorcycle out of 100 people; 6) Refer to land with >=30% canopy density cover; GHG = greenhouse gas
Sources: Euromonitor; Our World in Data; World Bank; Climate Watch; IRENA; Global Forest Watch; Asia Automotive Analysis; Lit. search; Bain analysis

SEA has committed to cut emissions by ~32% by 2030 urgent need for accelerated action to shift trajectory

Emissions outlook

GHG emissions in SEA region
($GtCO_2e$)



Leading indicators in 2022–23 emissions suggest further rise

National emissions data is limited by multi-year lag; however, trajectory of industrial emissions level, regional energy consumption, and GDP growth all suggest little change in emissions trajectory

SEA needs to deliver a material reduction vs. business-as-usual

~32% reduction in emissions is required by 2030 to meet NDC target; more need to start today to deliver a successful outcome with only five years to go

Notes: 1) Projected emissions level should there be no significant change in technology, economics, or policies such that historical trends continue; 2) Emissions level committed by SEA countries that can be reached with own resources and capabilities and without international support; 3) Emissions level committed by SEA countries that can be reached subject to international support and/or other conditions; GHG = greenhouse gas; NDC = Nationally Determined Contribution—a country's official commitment to greenhouse gas emissions reduction as submitted to the UNFCCC
Sources: UNFCCC Country NDCs; Climate Watch; EU EDGAR; Bain analysis

SEA renewed its commitments at COP28 and pushed for greater global support for transition

Examples not exhaustive

Key SEA commitments in COP28

Accelerating energy transition

Reaffirmed commitments to renewable energy

Cambodia
Announced to increase the use of **renewable energy to 70% by 2030**—up from 52% in 2022

Malaysia
Highlighted the goal to elevate **the share of renewable energy in power installed capacity from 50% to 70% in 2050**

Sought solution for early coal phase out

Indonesia
Agreed to early retirement[1] of 660 MW coal-fired power plant Cirebon-1, under **ETM[2] program** of ADB3

Cambodia
Closed 700 MW Botum Sakor coal fired power project, which received $1.5B in funding, and replaced with 800 MW LPG factories

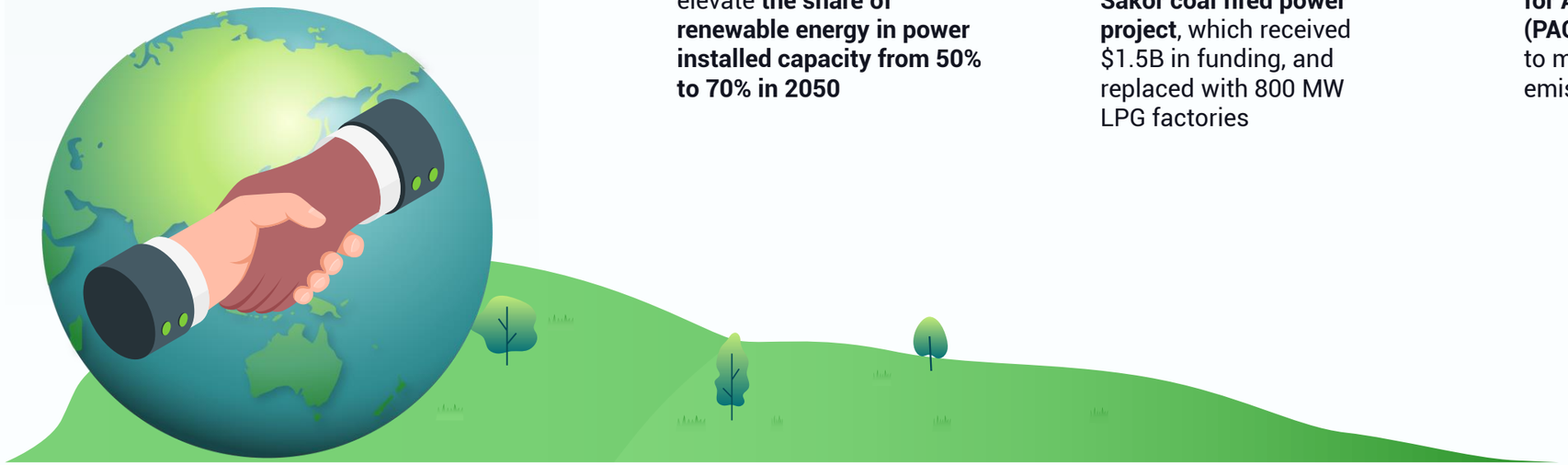
Upgrading climate finance

New funding commitments and initiatives from both domestic/foreign investors

Philippines
ADB[3] announced to allot $10B (2024–2029) and Canada committed on climate finance (run until 2026)

ASEAN
The USAID[4] Partnerships for Asia's Green Investment (PAGI) activity announced to mobilize **~$160M** for emissions reduction in SEA

Singapore
Launched blended finance initiative, **Financing Asia's Transition Partnership (FAST-P)**, which will aim to mobilize **up to $5B**



Notes: 1) Seven years earlier than planned; 2) Energy Transition Mechanism; 3) Asian Development Bank; 4) United States Agency for International Development
Sources: ADB; Lit. search; Bain analysis

SEA countries' maturity towards transition evaluated

Dimensions		Key questions for each SEA country
Ambition 01	Target-setting and quality	**Is there a net zero target? Is it legally binding? Is it sufficient** to hit 1.5°C?
	Target cascading	**Are the targets cascaded** to each sector? To leading corporates?
Progress 02	Emissions level and decarbonization levers	What is the **current state of emissions levels?** What **level of progress has been reached across each major lever?** (Energy, Nature, Agriculture)
Roadmap 03	National sector-level roadmap	Do **clear short-term and long-term sectoral roadmaps** exist to reach target?
	Corporate roadmap	Do **top emitting corporates have roadmaps** to achieve targets?
Accelerator 04	Regulatory framework	Are there **necessary standards and regulations** in place?
	Financial prerequisites	Are there **necessary taxes, incentives, and carbon pricing mechanisms**?
	Infrastructure and technology	Are the **existing infrastructure and implemented technology sufficient**?
Investment 05	Size of green investment	**What is the total size of investment** to green economy **by category, investor type, and country? Where is it headed?**

Scope: Our assessment covers 10 SEA countries, ~100 corporates across 3 major emission sectors

Countries

10 SEA countries are covered[1]

- Brunei
- Cambodia
- Indonesia
- Lao PDR
- Malaysia
- Myanmar
- Philippines
- Singapore
- Thailand
- Vietnam

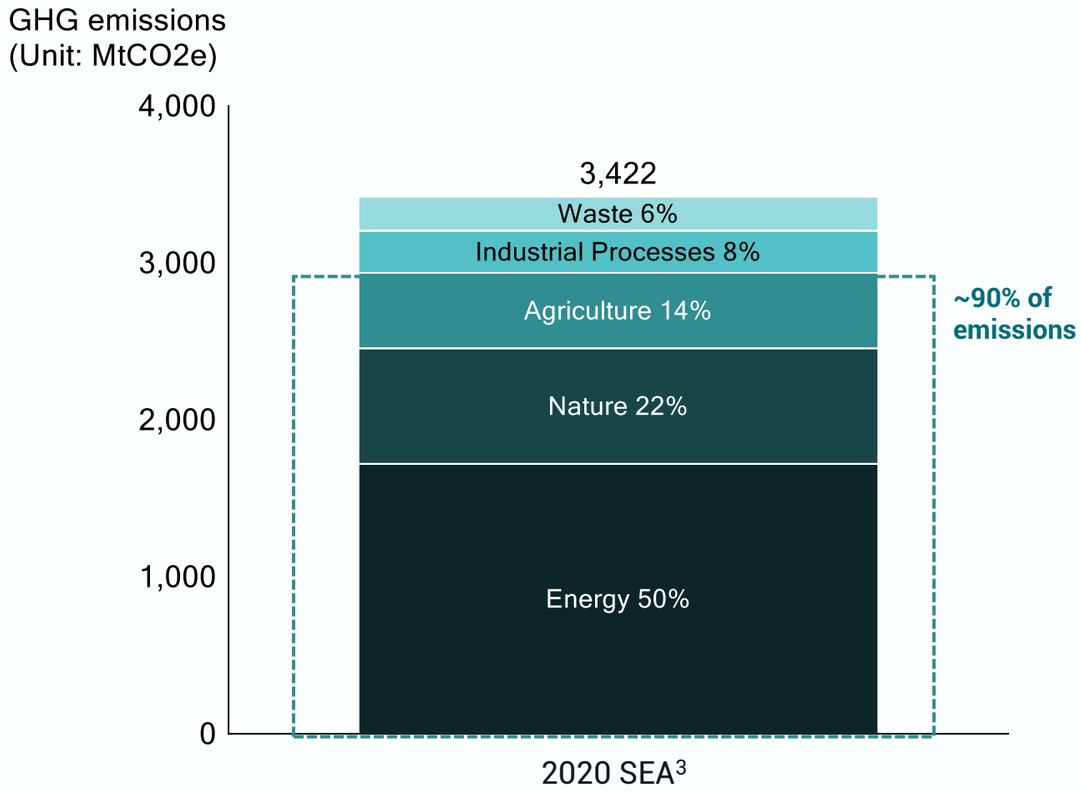
Corporates

~10 corporates[2] in each country with high GHG emissions

Top 10 corporates with high reported GHG emissions levels in each country

Sectors

Energy, nature, and agriculture sectors



Notes: 1) Timor-Leste is not covered due to low GHG emissions level (less than 5 MtCO2e); 2) 6 corporates were examined for Vietnam and 5 corporates for Myanmar, Cambodia, Laos PDR, and Brunei due to the limited number of corporates officially disclosing their emissions levels; 3) Latest GHG emissions data available; GHG = greenhouse gas | Sources: Climate Watch; Lit. search

Assessment results

Overall Assessment

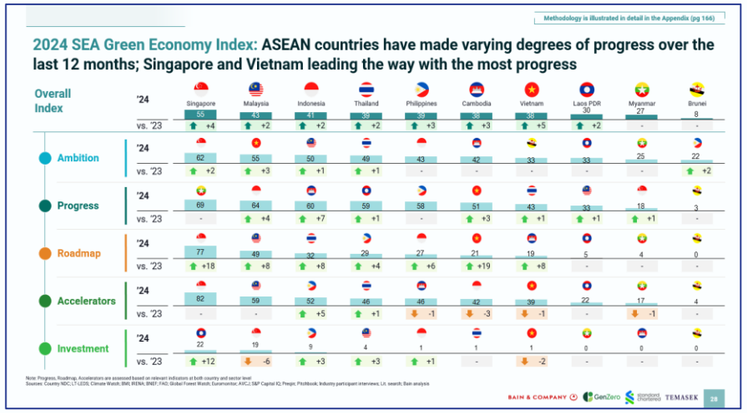
Significant progress in defining **"what needs to be done"** as more countries established roadmaps
Yet, "how to get it done" still unclear due to insufficient regulations and incentives to facilitate the implementation of plans

Ambition	Additional 15 of top 100 emitting corporates set new net zero/emissions reduction target in 2023. Now more than half of the ~100 companies have a target	All country level targets have remained the same as the previous year, **resulting in no country having targets sufficient for 1.5℃**
Progress	**7/10 of the countries showed progress** in one or more of the following dimensions: adopting renewable energy and electric vehicles, preserving forestland, and enhancing health of cropland soil	**Progress made is still insufficient. Renewable energy is still less than 10% of installed capacity** in most countries
Roadmap	**Ahead of COP28, 5/10 of the countries updated sectoral roadmaps, emphasizing "energy transition"** and **specific KPI[1] targets and milestones**	Most newly announced roadmaps **rely on catalytic capital from foreign investors** to realize **Only 20/100 of the top emitting corporates announced corporate level roadmaps**
Accelerator	**6/10 of countries have shown progress on taxonomy, emissions reporting, or development of local and regional carbon markets**	**Only 1/10 of the countries has sufficient regulatory framework,** including legal mandates to promote renewable energy investment
Investment	Green investment **increased by 20%** versus 2022 levels in 2023 ($6.3B) Investment amount from domestic investors took over that of foreign investors in 2023	Overall investment amount still too small to achieve targets **Contribution from corporate investments are larger** while investments from PE/VCs[2] decreased

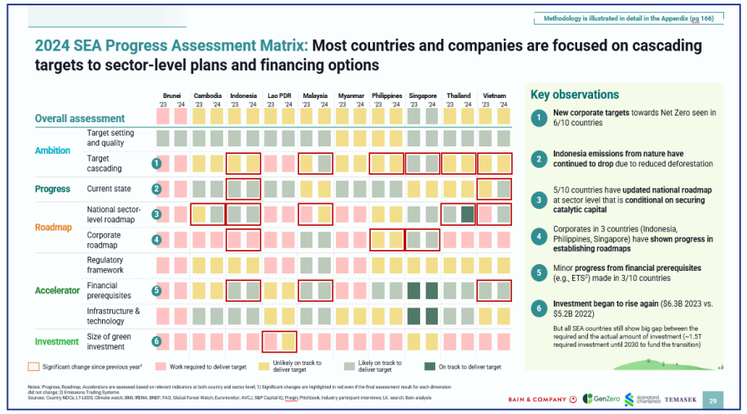
Note: 1) Key performance indicator; 2) Private equity/venture capital

Introducing the SEA Green Economy Index and progress matrix

SEA Green Economy Index



SEA Progress Assessment Matrix



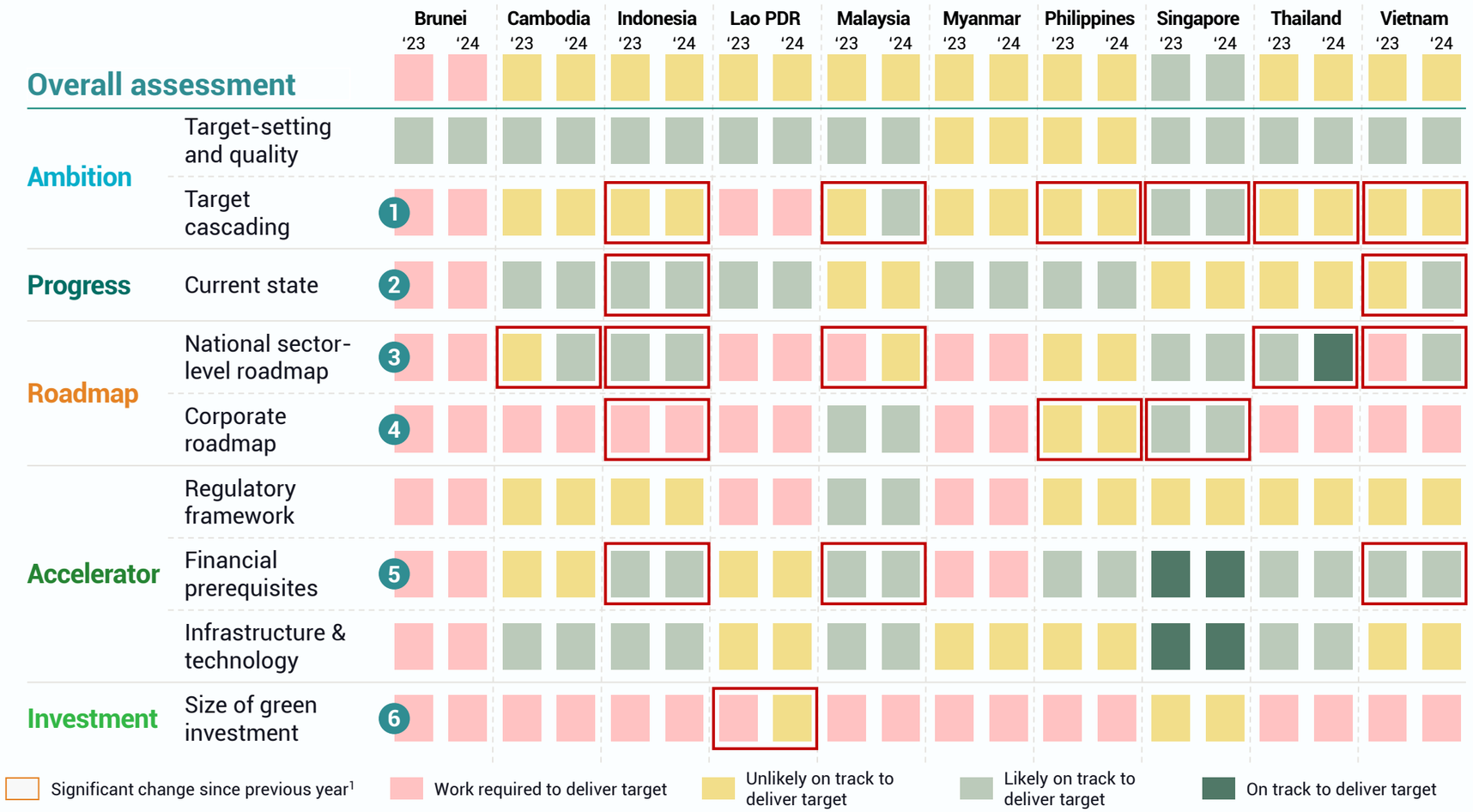
What is it?	1. Index of **decarbonization maturity** 2. Assessed **across five different dimensions**: Ambition / Progress / Roadmap / Accelerators / Investment	1. Heatmap assessment of **status of decarbonization progress towards 2030 NDC targets** 2. Assessed **across five different dimensions**: Ambition / Progress / Roadmap / Accelerators / Investment
How to interpret?	1. Provides how each country is **performing year on year and relative to peers** on decarbonization maturity 2. Clarify **potential areas of improvement** for each country	1. Provides **year-on-year progress** of the country in effective delivery of climate targets 2. Clarifies **potential areas of improvement** for each country

2024 SEA Green Economy Index: ASEAN countries have made varying degrees of progress over the last 12 months; Singapore and Vietnam leading the way with the most progress

	'24 / vs. '23	Singapore	Malaysia	Indonesia	Thailand	Philippines	Cambodia	Vietnam	Laos PDR	Myanmar	Brunei
Overall Index	'24	55	43	41	39	39	38	38	30	27	8
	vs. '23	+4	+2	+2	+2	+3	+3	+5	+2	-	-
Ambition	'24	62	55	50	49	43	42	33	33	25	22
	vs. '23	+2	+3	+1	+1	-	-	-	-	-	+2
Progress	'24	69	64	60	59	58	51	43	33	18	3
	vs. '23	-	+4	+7	+1	-	+3	+1	+1	+1	-
Roadmap	'24	77	49	32	29	27	21	19	5	4	0
	vs. '23	+18	+8	+8	+4	+6	+19	+8	-	-	-
Accelerators	'24	82	59	52	46	46	42	39	22	17	4
	vs. '23	-	-	+5	+1	-1	-3	-1	-	-1	-
Investment	'24	22	19	9	4	1	1	1	0	0	0
	vs. '23	+12	-6	+3	+3	+1	-	-2	-	-	-

Note: Progress, Roadmap, Accelerators are assessed based on relevant indicators at both country and sector level
Sources: Country NDC; LT-LEDS; Climate Watch; BMI; IRENA; BNEF; FAO; Global Forest Watch; Euromonitor; AVCJ; S&P Capital IQ; Preqin; Pitchbook; Industry participant interviews; Lit. search; Bain analysis

2024 SEA Progress Assessment Matrix: Most countries are focused on cascading targets to sector-level plans and developing financing options



Key observations

1. **New corporate targets** towards net zero seen in 6/10 countries
2. **Indonesia emissions from nature have continued to drop** due to reduced deforestation
3. 5/10 countries have **updated national roadmap** at sector level that is **conditional on securing catalytic capital**
4. Corporates in 3 countries (Indonesia, Philippines, Singapore) have **shown progress in establishing roadmaps**
5. Minor **progress from financial prerequisites** (e.g., ETS[2]) made in 3/10 countries
6. **Investment began to rise again** ($6.3B 2023 vs. $5.2B 2022)

   But all SEA countries still has big gap between the required and the actual amount of investment (~$1.5T required investment until 2030 to fund the transition)

Notes: Progress, Roadmap, Accelerators are assessed based on relevant indicators at both country and sector level; 1) Significant changes are highlighted in red even if the final assessment result for each dimension did not change; 2) Emissions Trading Systems
Sources: Country NDCs; LT-LEDS; Climate watch; BMI; IRENA; BNEF; FAO; Global Forest Watch; Euromonitor; AVCJ; S&P Capital IQ; Preqin; Pitchbook; Industry participant interviews; Lit. search; Bain analysis

PROGRESS ASSESSMENT

More high-GHG emitting corporates have set net-zero targets across 6 SEA countries

Likely to be sufficient | Unlikely to be sufficient

		Singapore	Malaysia	Indonesia	Thailand	Philippines	Vietnam
Corporates[1] with target		9/10	7/10	6/10	7/10	5/10	3/6[2]
Newly added in 2022		+2	+1	+2	+2	+1	+1
Emissions reduction target	**'30**	Jardine Cycle & Carriage: 30% SBS Transit: 20%	YTL Power (YTL GROUP): 60%	INDOCEMENT: 65% Astra: 30%	GULF: N/A RATCH GROUP: 70%[3]	ACEN: 73.6%	Vinamilk (EST 1976): 15%
	'50	N/A Net zero	Net zero	N/A	Net zero Carbon neutral	Net zero	Net zero

*"**In alignment with the Singapore Green Plan 2030, we establish sustainability goals and targets** in emissions, energy, and resource efficiency."*

SBS Transit

2022 Sustainability report

*"We have set a high-level target for our Group **in line with the Malaysian Government's goal."***

YTL Power YTL GROUP

2022 ESG Report

*"Our **pivot towards renewables galvanizes our position as a formidable regional player** as the world takes urgent action to achieve a cleaner energy ecosystem."*

ACEN

2022 Integrated report

Notes: Scope of emissions, baseline year: Jardine Cycle&Carriage—Scope 1&2, 2019; SBS Transit—Scope 1&2, 2022; YTL—Scope 1, 2010; Indocement—CO2, 1990; Astra, United Tractors—Scope 1&2, 2019; Gulf Energy—definition not found; Ratch Group—scope 1&2, 2014; Acen—Scope 1, 2021; Vinamilk—Scope 1&2, 2021; 1) Top 10 emitting corporates 2) 6 corporates were examined for Vietnam due to the limited number of corporates officially disclosing their emissions levels; 3) By 2025

Sources: Lit. search; Bain analysis

Emissions: Final data for 2020 quantify stable or rising emissions in most countries; further rising after

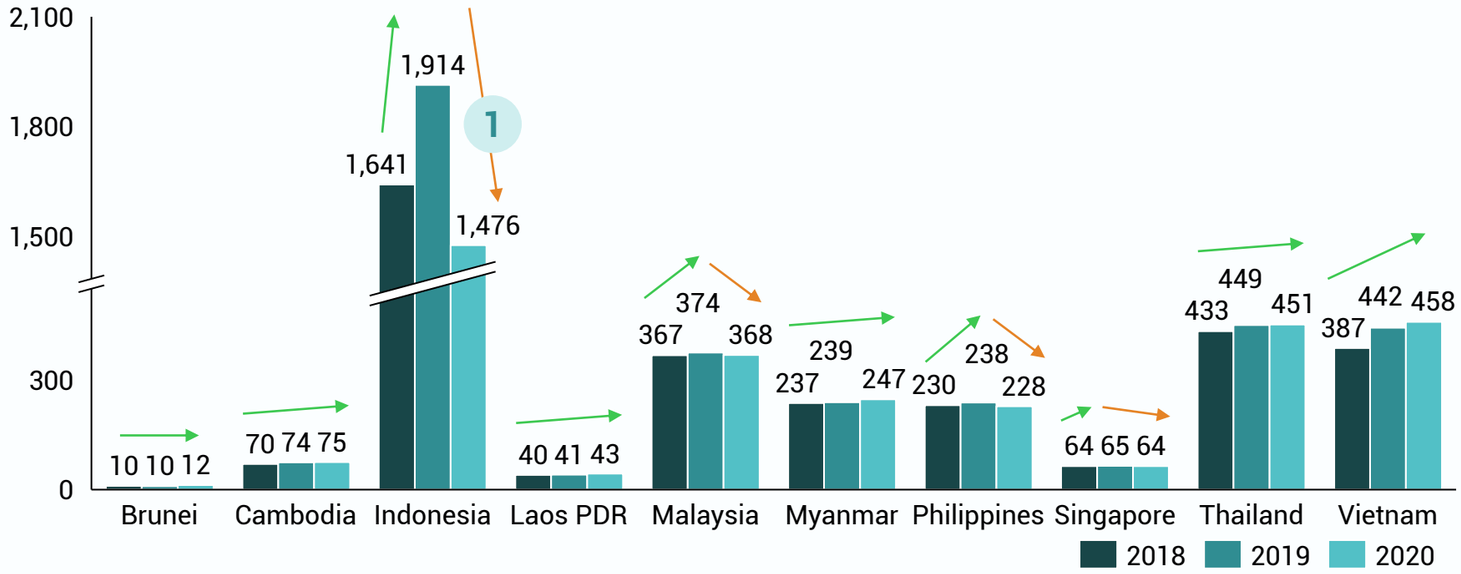
Emission

GHG emissions

Sector

Percentage of renewables | Percentage of EV | Change in tree cover | Nutrient use efficiency

(GHG emissions, MtCO2e)



Notes: GHG = greenhouse gas; EV = electric vehicles
Sources: Climate Watch; EU EDGAR; Lit. search; Bain analysis

Key takeaways

The overall emissions level in the region is showing consistent and predictable growth

Excluding emissions from nature, emissions level showed a rising trend of 2% and 5% in 2021 and 2022, respectively

Even Indonesia, which had a significant decrease in emissions in 2020, demonstrated a significant increase with a CAGR of 6% in 2021-2022

1 The current emissions level in the region is highly likely not on pace to meet the 2030 reduction target

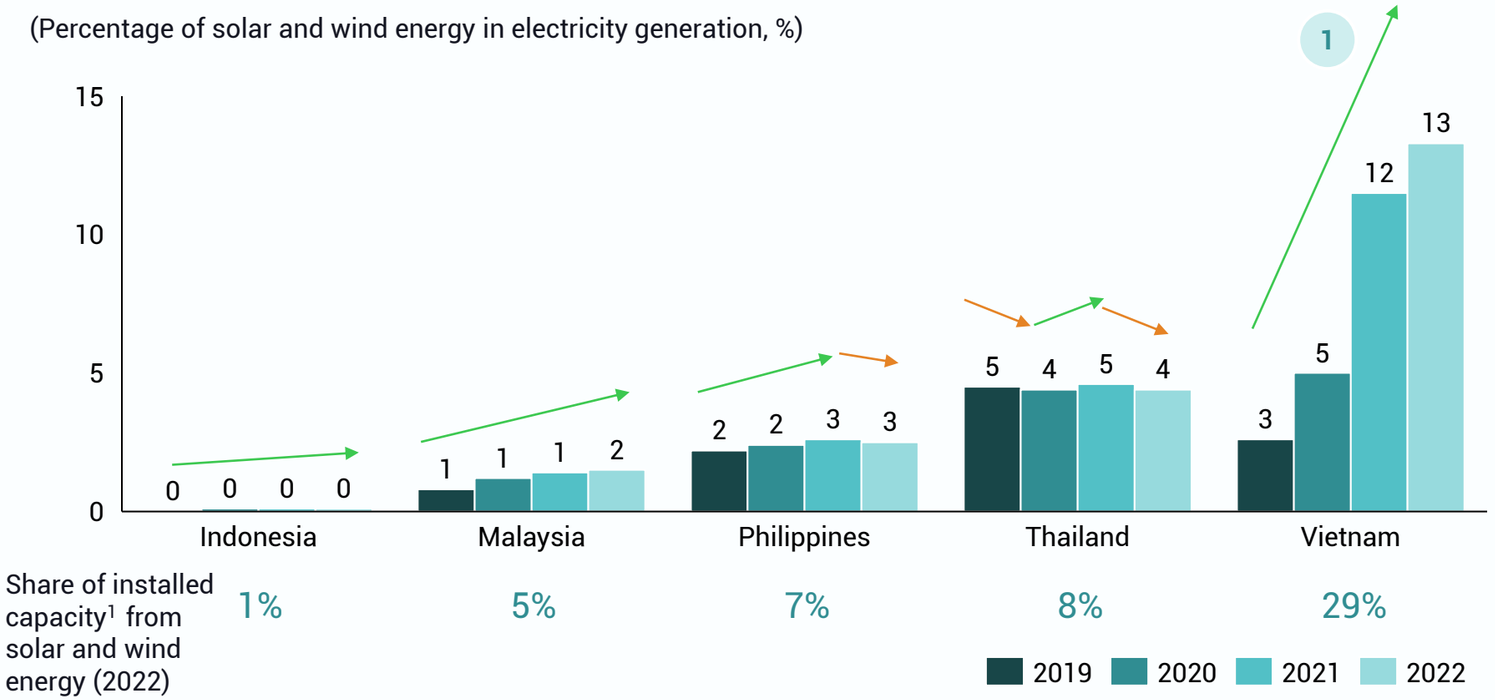
As per the 2020 official data, a few countries including Indonesia showed a temporary decrease, but they seem to have rebounded since 2021

All other leading indicators for emissions in the region show a steadily rising trend, thus the latest data for up to 2023 is certain to show increasing emissions

Share of renewable energy: SEA's solar and wind generation remain low at ~4%; only Vietnam shows material increase

Emission | **Sector**

GHG emissions | **Percentage of renewables** | Percentage of EV | Change in tree cover | Nutrient use efficiency



Notes: 1) Share of total renewable energy of installed capacity includes installed capacity of solar, wind, hydro, geothermal, and biomass; GHG = greenhouse gas; EV = electric vehicles
Sources: IRENA; BNEF; EMBER; Lit. search; Bain analysis

Key takeaways

Most countries are slow to increase share of renewable energy

The impact of renewable energy is expected to be offset by the continuous increase in energy demand, more readily supplied by fossil fuels, in the region

1 **Vietnam** only shows significant growth due to **high feed-in-tariff and favorable climatic conditions** characterized by abundant sunlight and strong wind speeds

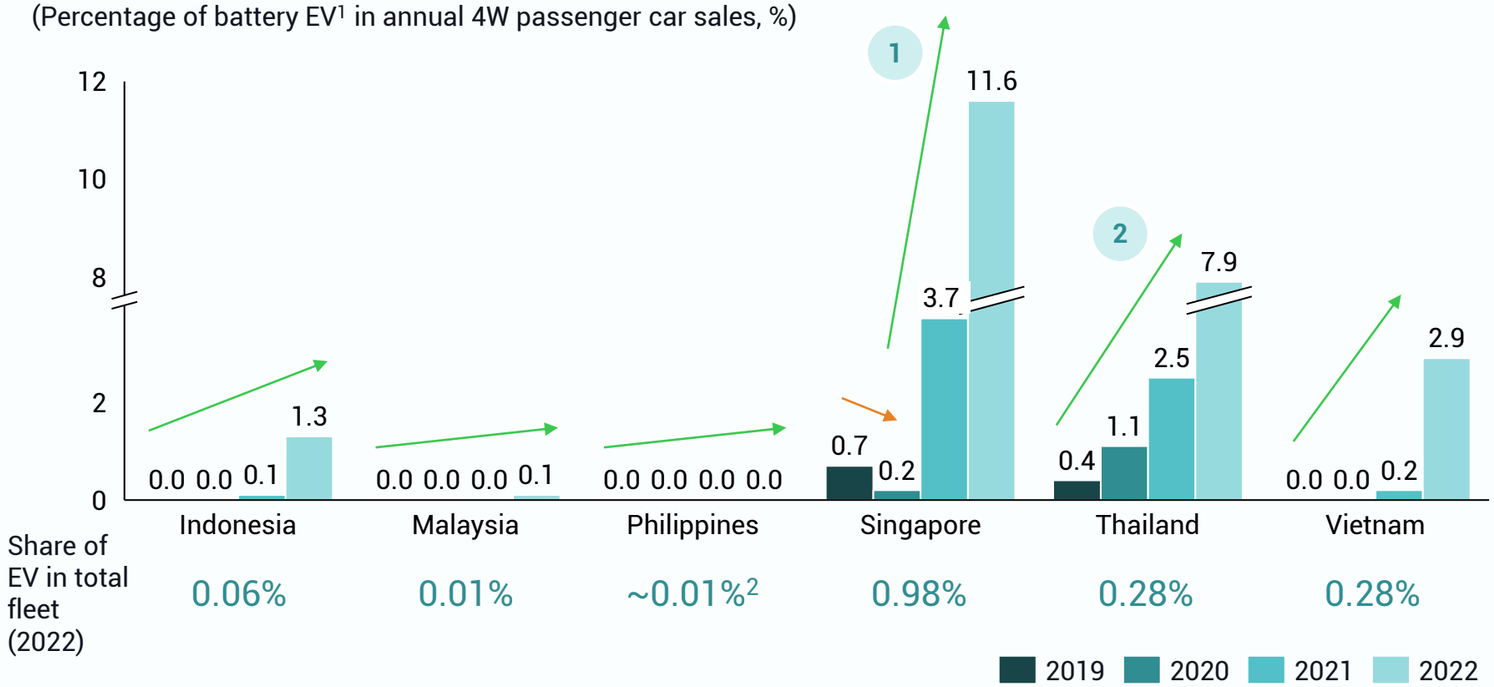
In contrast, Thailand shows no clear upward trend due to low feed-in-tariff and limited potential in wind energy

EV penetration: Takeoff in EVs spotlights potential, importance of government incentives and infrastructure

Emission | **Sector**

GHG emissions | Percentage of renewables | **Percentage of EV** | Change in tree cover | Nutrient use efficiency

(Percentage of battery EV[1] in annual 4W passenger car sales, %)



Key takeaways

EV market continues to grow across all countries

1. Singapore experienced a temporary dip due to insufficient infrastructure but **began to stabilize from 2022, with the implementation of more charging stations**[3]

2. **380% increase** in battery EV sales in Thailand in 2023

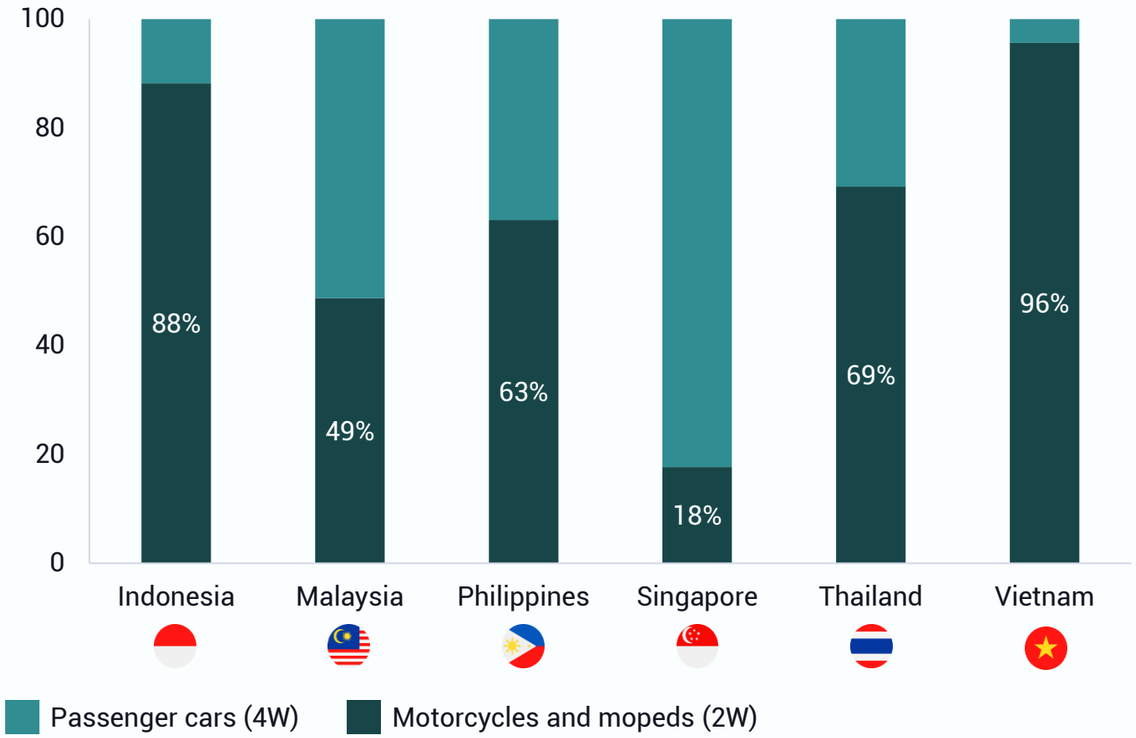
Has been providing incentives for EV production[4] and offering wide options of affordable EVs from Chinese car makers[5]

Notes: Electric 2W shows faster market penetration compared to 4W in most ASEAN countries—% of electric 2W in total 2W sales in Indonesia, Malaysia, Philippines, and Vietnam in 2022 is 1-7%p higher than that of 4W shown in the graph (e.g., % of E2W in Vietnam in 2022 reaches ~10%); 1) Not including plug-in hybrid cars; 2) Data for the Philippines unavailable, but highly likely to be lower than 0.01% when considering trajectory; 3) Singapore's Urban Redevelopment Authority and Land Transport Authority awarded a pilot tender for 600+ EV charging points in public car parks in 2021 and uncertainties in EV tax breaks could also have affected the increase of EV registration as EV Early Adoption Incentive was announced to end in Dec 2023, and incentives for cleaner commercial vehicles were halved in April 2023; 4) Incentives for EV production result in ~$4.3B investments from Japanese automakers; 5) Chinese manufacturers could offer a low price as they could access the market duty-free due to China-ASEAN free trade agreement; GHG = greenhouse gas; EV = electric vehicles | Sources: BMI Fitch; BNEF; Marklines; Lit. search; Bain analysis

EV penetration: A significant opportunity for 2-wheeler EV adoption in SEA

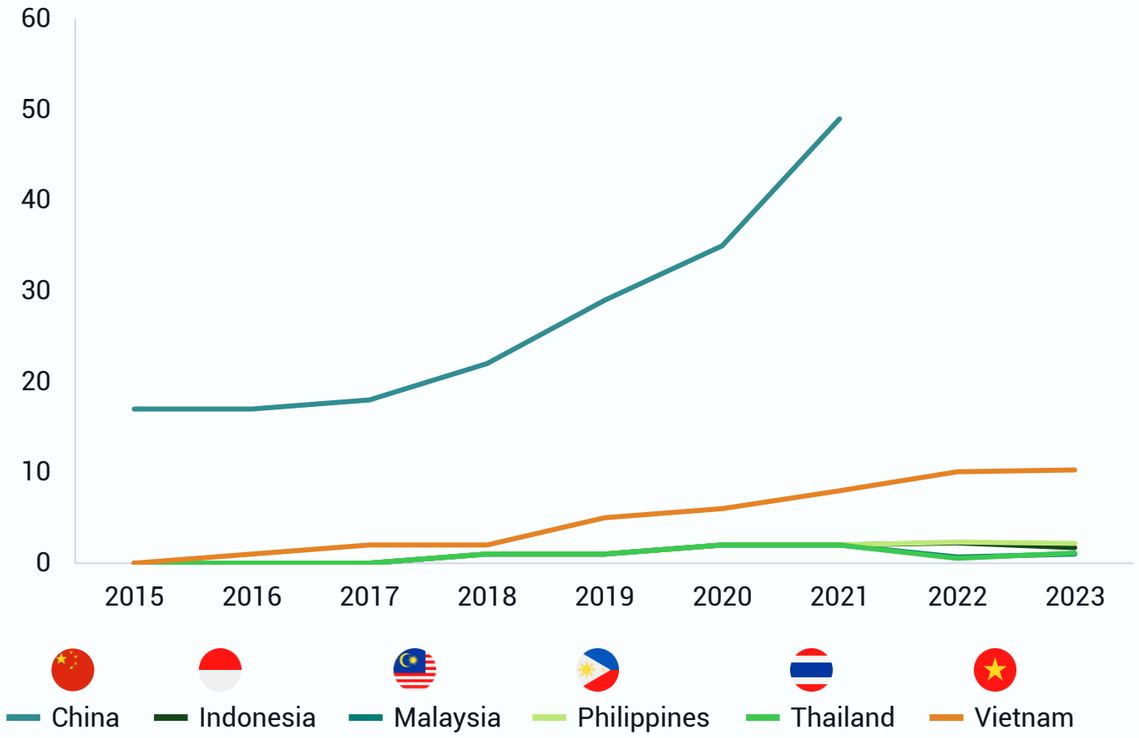
2-wheeler is the major passenger vehicle use

Share of passenger vehicles in use by vehicle type (%)



2-wheeler EV penetration has headroom to grow in SEA

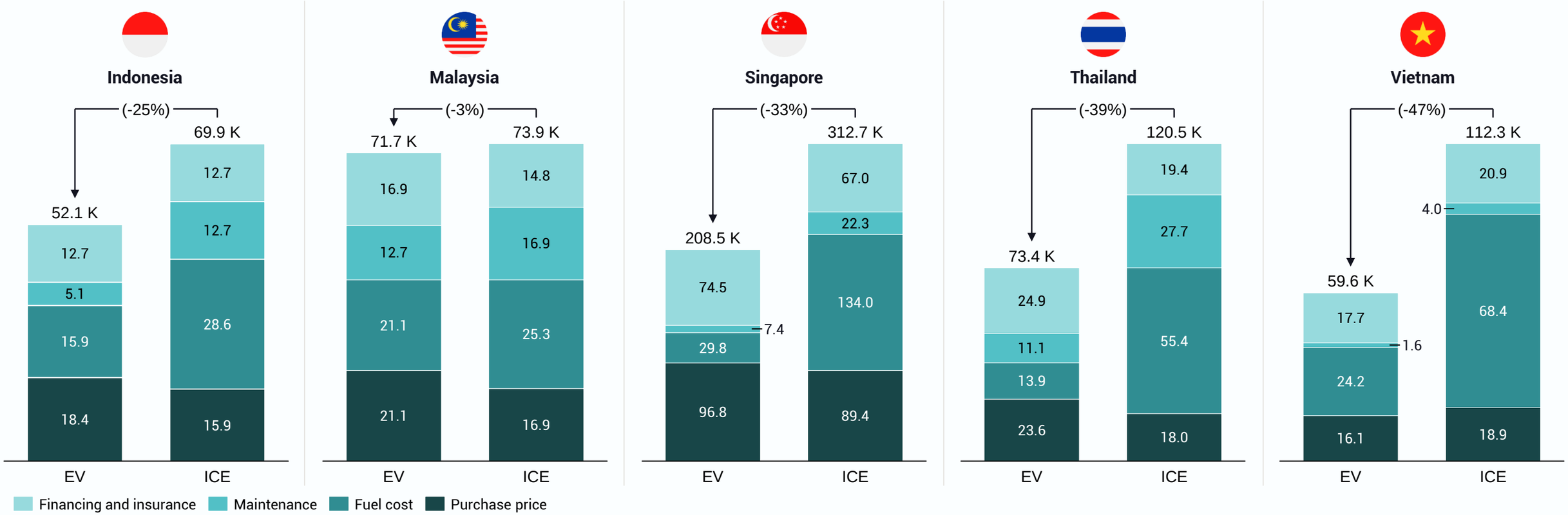
Electric 2W sales share (%)



Notes: 1) Absence of data for 2022 and 2023, but noted decline in electric 2W sales following reduction of government incentives;
2) Reference developing Asia sales given limited data from 2015 to 2021; EV = electric vehicles
Sources: Euromonitor; IEA; Marklines

EV penetration: From a consumer point of view, the total cost of ownership of EV 2-wheelers is already cheaper than ICE, presenting a business case to transition to EV models

2-wheeler total cost of ownership analysis (USD)



EV/ICE purchase price premium (%)

Indonesia: 16% | Malaysia: 25% | Singapore: 8% | Thailand: 31% | Vietnam: -15%

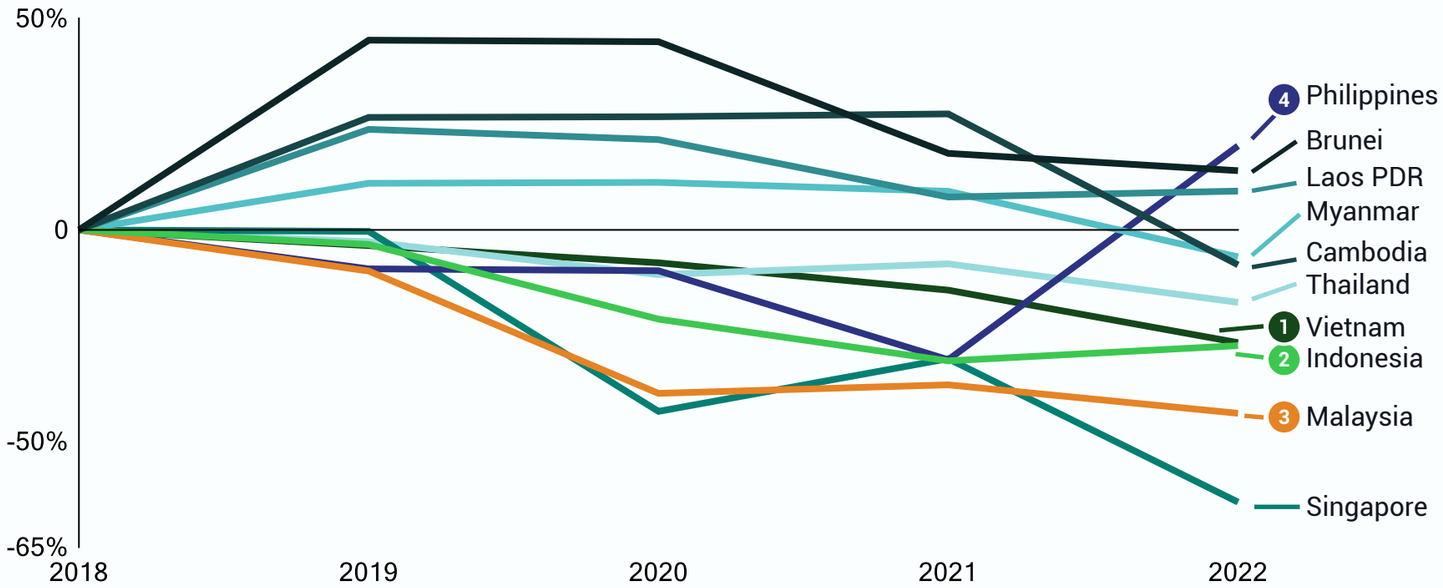
Note: The ICE 2W uses Yamaha Y15ZR equivalents in each market while EV uses EGAT model in TH, Scorpio model in SG, Dat Bike model in VN, Eclimo model in MY and Gesits model in ID. The model assumes 100% battery swapping/out-of-home charging, if home charging was assumed the parity to ICE would be more favorable; EV = electric vehicles; ICE = internal combustion engine | Source: Lit search

Deforestation: Almost all countries across SEA are seeing steady reduction in deforestation due to effective policies

Emission | **Sector**

GHG emissions | Percentage of renewables | Percentage of EV | **Change in tree cover** | Nutrient use efficiency

(Amount of tree cover loss compared to 2018[1])



Notes: Tree cover loss in the chart includes >=30% canopy density threshold; 1) Calculated by (the amount of tree cover loss in a specific year) / (the amount of tree cover loss in 2018) – 1; 2) Vietnam Forests and Deltas, payments for forest environmental services; 3) Covers 66 million hectares; 4) Includes market-based Forest Carbon Offset mechanism ; GHG = greenhouse gas; EV = electric vehicles
Sources: Global Forest Watch; Lit. search; Bain analysis

Key takeaways

Deforestation continues but the rate of forest loss is slowing

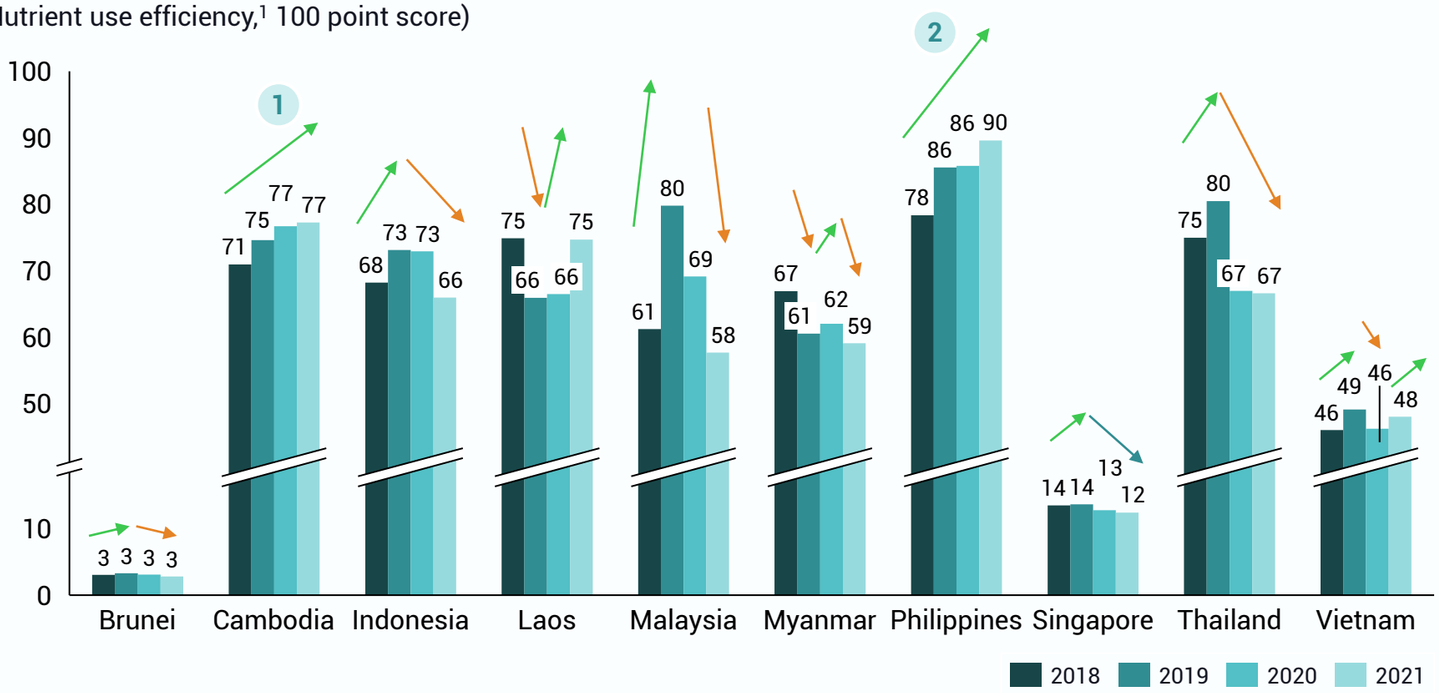
1. Vietnam continues to implement **regulations[2] for forest conservation**
2. **Indonesia has announced permanent moratorium** on the conversion of forest and peatlands[3] to other uses in 2019
3. **Malaysia has established Malaysia Forest Fund** in 2021, which implemented REDD+ Finance Framework[4]
4. **Further deforestation in the Philippines** due to continued commodity-driven forest loss from mining, forestry and other urbanization activities

Soil health: No clear improvement in soil health, signifying importance of alternative farming methods

Emission | **Sector**

GHG emissions | Percentage of renewables | Percentage of EV | Change in tree cover | **Nutrient use efficiency**

(Nutrient use efficiency,[1] 100 point score)



Notes: Nutrient use efficiency (nutrient output divided by nutrient input) indicates cropland nutrient deficits that limit crop production or nutrient excessiveness that leads to more pollution from leaching/runoff; 1) The difference between each efficiency value of cropland nitrogen, phosphorus, and potassium and the optimal state of 100% were calculated, and then calculated the average of these differences; 2) Circular Strategy on Environment (2023), Roadmap for sustainable consumption and production (2022); 3) Actual amount of productivity enhancement in the target area is disclosed in Philippines Rural Development Project Implementation Status & Results Report; GHG = greenhouse gas; EV = electric vehicles | Sources: FAOSTAT; World Bank; Lit. search; Bain analysis

Key takeaways

No improvement in the overall soil health in SEA

1. Cambodia emphasizes the **importance of preserving soil and water** in recently announced sectoral roadmap[2]

2. **Philippines Rural Development Project** significantly enhanced **farm and fishery productivity**[3] by supporting smallholders from ~1,200 projects

   Under the Organic Agricultural Act, the Philippines provides tax incentives to organic agriculture entities and explicit support for the deployment and development of organic fertilizers

Five countries made progress in net-zero roadmap; Delivery will be conditional on securing funding

Key takeaways from national sector-level roadmaps announced in 2023

	What works well	What could be challenging
Emergence of "energy transition" roadmap Indonesia, Malaysia, Vietnam, Thailand	**Defines "energy transition" as key intermediate state** of decarbonization with more practical solutions Regards **renewable energy as the most critical power source**, not just as one of many	While "transition" has become a key concept in the region, some countries still lack roadmaps explicitly addressing it
Prioritized initiatives based on specific criteria Indonesia, Malaysia, Vietnam	Heightens validity of proposed initiatives by **presenting prioritization criteria**[1]	Top priority is boosting renewable energy capacity, which overshadows prerequisites in the grid and tariffs
Specific targets and milestones for each initiatives Indonesia, Malaysia, Vietnam, Singapore	**Enhances achievability of goals** by setting KPI targets and milestones, and assigning responsible champions for each initiative in many countries	Some countries still lack targets and milestones for NDCs
Financing target and plan Malaysia	**Increase the potential for attracting investment** by presenting financing objectives and plans after recognizing the crucial need for investment	Most plans rely on funds from external investors for material challenge to resolve to deliver

Note: 1) Mainly includes greenhouse gas emissions abatement potential and cost effectiveness
Sources: Expert interviews; Lit search; Bain analysis

Details are illustrated in Country Insights section (pg 133)

More concrete and feasible financing needed to make plans realistic

Evaluation of energy roadmaps

Key Elements

Emergence of "energy transition" roadmap
- Has energy transition roadmap
- No roadmap for energy transition but for RE
- Only high-level power/energy plan

Prioritized initiatives
- Prioritized initiatives with concrete criteria
- Prioritization made, but criteria unclear or only for certain sub-sector
- Only a long list of initiatives included

Specific targets and milestones
- Quantified targets, milestones for all initiatives
- Quantified targets, milestones partially set
- Limited coverage of targets and milestones

Financing target and plan
- Financing target/plan for all types of investors
- Target without further plans; target/ plan for limited types of investors
- Only high-level plans without quantified targets

Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Only high-level power/energy plan		JETP CIPP[1] (2023)	Renewable Energy Development Strategy (2011)	Nat'l. Energy Transition Roadmap (2023)	Only high-level power/ energy plan	Nat'l. Renewable Energy Program (2022)	Only high-level power/energy plan	Nat'l Energy Plan (2023~[2])	PDP8[3], JETP RMP[4] (2023)
Only a list of initiatives without priorities	Defined for energy efficiency in NEEP[5] (2023)	JETP CIPP[1] (2023)	Only a list of initiatives without priorities	Nat'l. Energy Transition Roadmap (2023)	Only a list of initiatives without priorities	Mandatory/ voluntary pathway separately presented in roadmap above (2022)	Energy Story (2019)	Recommendations drawn from analysis in Clean Energy Transition (2023)	JETP RMP[4] (2023)
N/A No quantified target/ milestones	Defined for energy efficiency in NEEP5 (2023)	JETP CIPP[1] (2023)	Targets for a few initiatives & qualitative milestones in roadmap above (2011)	Nat'l. Energy Transition Roadmap (2023)	N/A No quantified target/ milestones	Targets set for RE capacity, FIT in roadmap above (2022)	Green plan[6] (2021)	Targets set for % RE in multiple sectors but not for initiatives in AEDP[7] (2018)	PDP8[3], JETP RMP[4] (2023)
N/A	N/A	Financing plans from foreign catalytic funds in JETP CIPP[1] (2023)	Has investment targets for each sector in roadmap above (2011)	Nat'l. Energy Transition Roadmap (2023)	N/A No quantified target/ milestones	Only high-level strategic financing plans in roadmap above (2022)	Has investment targets in Green Finance Action Plan (2019)	Only few finance initiatives without quantitative measures	Financing plans from foreign catalytic funds in JETP RMP[4] (2023)
No financing target/plan for energy sector set									

Notes: 1) Comprehensive Investment and Policy Plan; 2) Report in the progress of drafting; 3) Power Development Plan 8; 4) Just Energy Transition Partnership Resource Mobilization Plan; 5) National Energy Efficiency policy; 6) Roadmaps related to energy transition in Singapore have limitations as they are predicated on collaboration with other countries in SEA and other regions; 7) Alternative Energy Development Plan | Sources: UNFCCC; Lit. search; Bain analysis

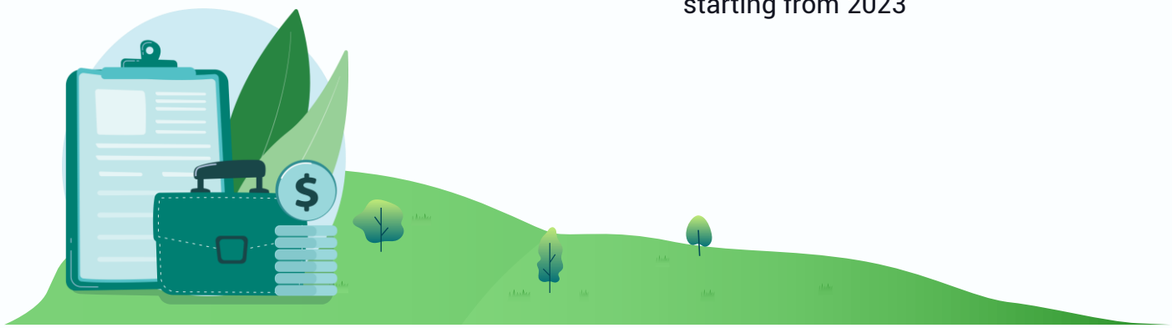
Progress made in policy, finance, and infrastructure enablers to accelerate pace of transition

Disclosure and standards

Regional taxonomy being updated or newly launched

Updated version of ASEAN taxonomy was announced including new assessment method of economic activities

Singapore
MAS[1] launched Singapore-Asia Taxonomy for Sustainable Finance to establish a framework for CFPPs[3] phase-out



Emissions reporting mandatory for 6/10 countries, with 2 starting from 2023

Brunei
BNCCC[2] issued **directive on mandatory GHG emissions reporting for government department and private companies** starting from 2023

Philippines
Additional annual **report on sustainability**, including GHG emissions reporting, is **mandatory for all publicly listed companies** starting from 2023

Carbon pricing

Progress on carbon tax and ETS seen in 4/10 countries[4]

Indonesia
Ministry of Energy newly launched **mandatory Emissions Trading System** for power sector in 2023

Malaysia
Started to **review carbon pricing instrument** in 2023 and plans to complete reviewing process by 2024

Singapore
Increased carbon tax from S$5/tonne to S$25/tonne from 2024–25

Allow **5% of emissions to be offset** with international carbon credits

Vietnam
DCC[5] announced that **development of carbon pricing instrument and Emissions Trading System** has begun and will be operational by 2028

Infrastructure

New initiatives in place to improve grid capacity in 4/10 countries

Indonesia
Announced **transmission lines and grid deployment** as an investment focus area in CIPP,[6] recently unveiled roadmap of JETP[6]

Thailand
EGAT,[8] Thailand's state power company, developed **new centers that can support additional 8 MW renewable energy**

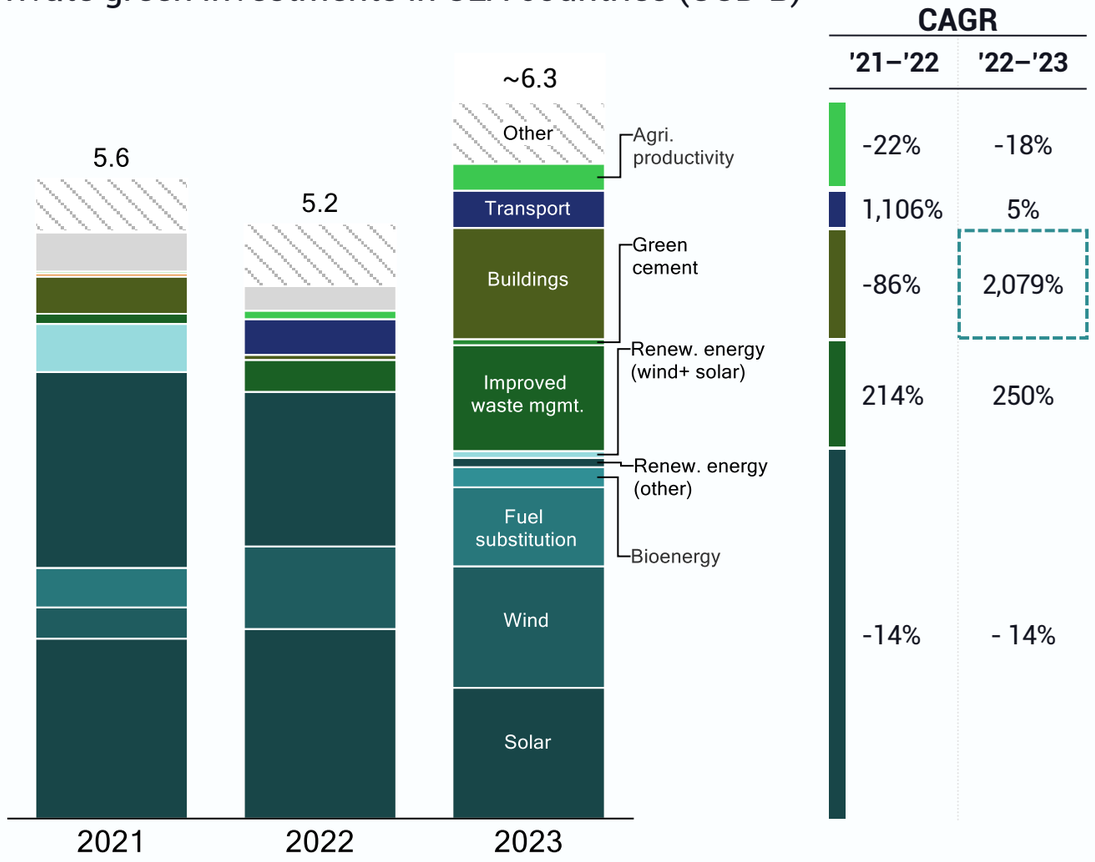
Laos PDR
The World Bank approved **Power Distribution Improvement Project** to increase capacity and efficiency of domestic electricity grid

Vietnam
Announced plans to **develop grid infrastructure** for renewable energy usage

Notes: 1) Monetary Authority of Singapore; 2) Brunei Darussalam's National Climate Change Committee; 3) CFPP = coal-fired power plant; 4) Singapore's index score remains the same as it already had carbon tax; 5) Department of Climate Change; 6) Comprehensive Investment and Policy Plan; 7) Just Energy Transition Partnerships; 8) Energy Generating Authority of Thailand
Sources: Expert Interview; Lit. search; Bain Analysis

Investments by theme: Power remains the largest emissions category across the region; wind power, alternative fuels, and green data centers show significant increase YOY

Private green investments in SEA countries (USD B)



	CAGR '21–'22	CAGR '22–'23
Agri. productivity	-22%	-18%
Transport	1,106%	5%
Buildings	-86%	2,079%
Renew. energy (wind+ solar)	214%	250%
Renew. energy (other)		
Fuel substitution		
Bioenergy		
Wind	-14%	- 14%
Solar		

Nature/agriculture
Investment increase in **agricultural productivity**
E.g., $200M investment in eFishery, which provides services to increase efficiency in fishing

Transport
EV continue to be attractive, mostly in SG
E.g., $50M Ilectra Motor group invested by venture capitals and a corporate

Buildings
Increase in investments for green data centers driven by release of energy efficiency regulation[1] in Malaysia and Singapore
E.g., $530M investment in Nusajaya and Kulai data center in Malaysia
E.g., $402M acquisition in PT Teknologi Data Infrastruktur by Singtel

Industrial/waste
Investments in waste management increased with **efforts toward water treatment and plastic recycling**
E.g., $682M Three-River System Wastewater Project in the Philippines
E.g., $60M Central Java PET Recycling Facility in Indonesia

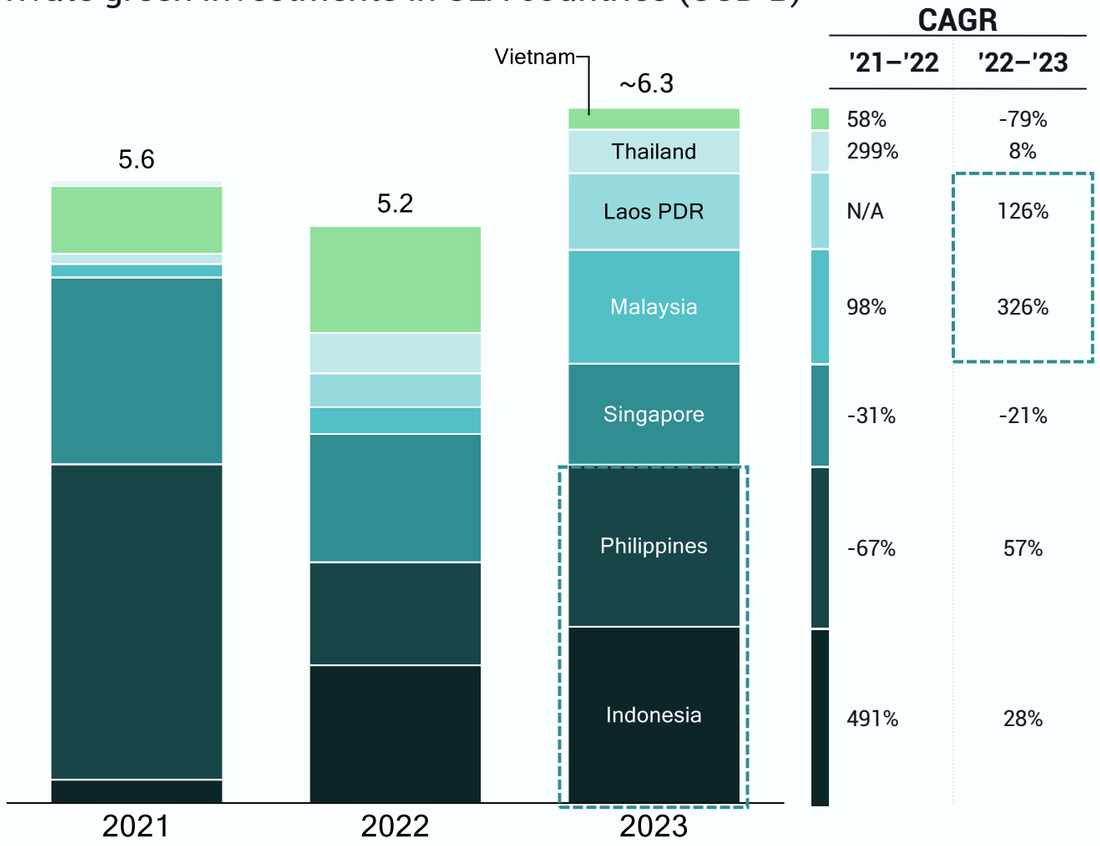
Power
The **biggest category in SEA**

More opportunities pursued around wind power systems
Due to geological limitation of solar power system, shift from solar to wind is seen in the region (e.g., $692M Monsoon Wind Project in Laos PDR)

Notes: Figures include private sector deal transactions which are categorized as "closed" and "effective" and >$10M in size, including private placements and excluding IPOs. Used allocation methodology from the previous report. Amount not representative of overall private sector investment; Of the total investment of $692M for the Monsoon Wind Power Project in Laos PDR, $300M is duplicated in data for 2022 and 2023; Transactions tagged as Other account for 9% of the total investment; 1) Alternative protein; 2) Malaysia: passed Energy Efficiency and Conservation Act requiring mandatory audits and energy saving measures to companies with certain amount of energy consumption, Singapore: launched Built Environment Industry Transformation Map (ITM) and planning to introduce Mandatory Energy Improvement (MEI) regime by the end of 2024, including building energy efficiency requirements, led by The Building and Construction Authority | Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Lit. search; Bain analysis

Investments by country: Indonesia and Philippines ~50% of investment; largest growth in Malaysia

Private green investments in SEA countries (USD B)



Vietnam
Due to wait for PDP8[1] and clarity on the pricing mechanism, no large-scale investment in renewable energy in 2023, unlike the past years with big solar and wind projects

Thailand
Although the number of investments decreased, **large-scale investment (~$350M) in the wind sector** has been made, maintaining a similar level as last year

Laos PDR
A large-scale project to unlock Laos's renewable potential is being carried out by foreign investors

E.g., $692M Monsoon Wind project invested by ADB[2], JICA[3], and 8 others

Malaysia
Showed significant increase by attracting large-scale (~$530M) **green financing for data centers** in Johor and Kulai

Singapore
Showed decrease as there were **no large solar deals >$100M**, and many of the companies invested in **operations outside of Singapore**

Philippines
Investments toward infrastructure for green energy by domestic investors are brisk, leading to an increase in investments

E.g., $682M Three-River System Wastewater project invested by Manila Water

Indonesia
Steadily growing in investments whereas rest of the region experiencing fluctuations driven by large, one-off deals

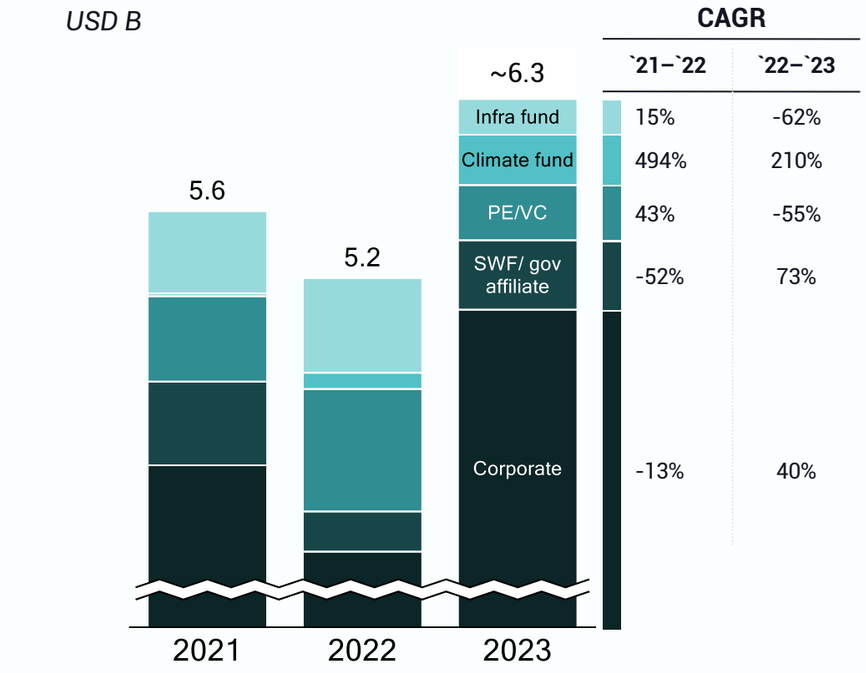
E.g., $60M investment in Central Java PET Recycling Facility by ALBA Group

Notes: Figures include private sector deal transactions which are categorized as "closed" and "effective" and >$10M in size, including private placements and excluding IPOs. Used allocation methodology from the previous report, calculating the investment size of a country based on where the target company of the deal is operating. Amount not representative of overall private sector investment; Of the total investment of $692M for the Monsoon Wind Power Project in Laos PDR, $300M is duplicated in data for 2022 and 2023; 1) Power Development Plan 8; 2) Asian Development Bank; 3) Japan International Cooperation Agency | Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Lit. search; Bain analysis

Investments by investor: Domestic corporates and investors playing a larger role; climate funds also growing

Private green investments by investor type[1]

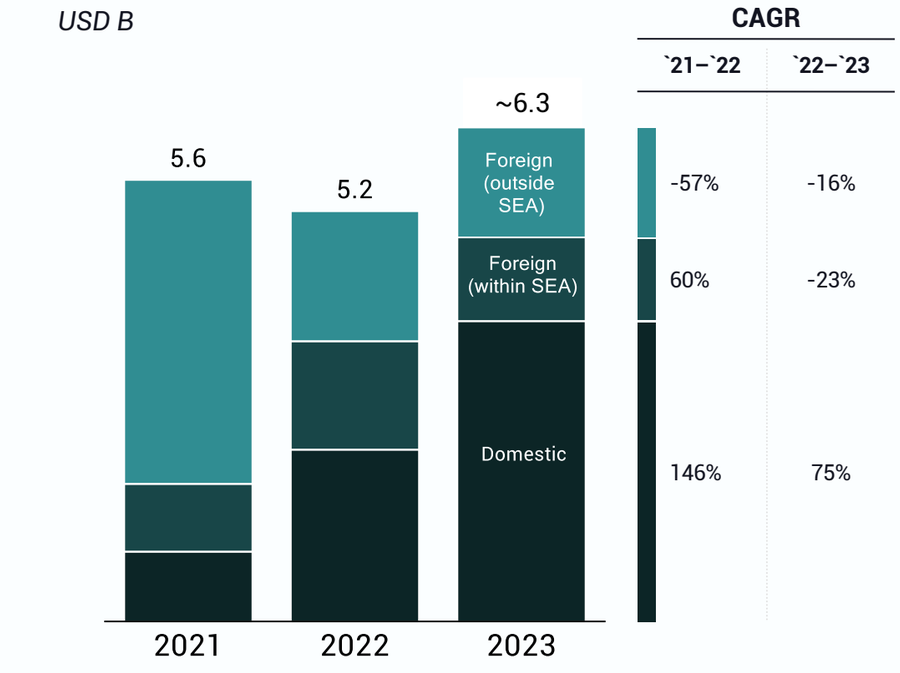
Majority of green investments are made by corporates



	2021	2022	2023
% Corporate	73%	69%	80%
% SWF/ gov. affil.	9%	5%	7%
% Private funds	18%	27%	13%

Private green investments by investor origin[2]

More domestic investments within SEA region while consistent decline in foreign investments



	2021	2022	2023
% Domestic	16%	42%	61%

Notes: 1) (Investor type) Corporates invest in more large-size deals compared to other investor types, and more investment in green start-ups is led by the growth of climate funds (e.g., $200M investment in eFishery, an aqua-tech start-up); 2) (Investor origin) Increase in the share of domestic investments is aligned with national and corporate level green targets and roadmaps, and investments from foreign countries continue to decline
Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Lit. search; Bain analysis

Notable new investments in 2023

Lao PDR

Monsoon Wind Project

Accelerating the region's energy transition by unlocking the potential of Laos's wind power

$692 million

ASEAN's **first cross-border, largest wind project** launched in 2023, offering 600 MW capacity

Generated electricity will be **exported to Vietnam for 25 years**

- Expected to reduce 27% of carbon emissions in Vietnam by 2030

Financing package provided by 10 foreign investors

- Comprises loan A and B (36%), catalytic financing (7%), parallel loans (55%), grant (1%)
- Investors include 4 corporates, 3 state-owned banks, 2 infra funds, and 1 climate fund

Singapore

Green Loan financing for Singtel data centers

Advancing digital sustainability and energy efficiency in green-certified data centers

$401 million

Two data centers[1] of Singtel secured green loan to support the operations and refinance borrowings

Both are on the way to implement **liquid cooling and AI for energy efficiency**

- Could attract the fund as they have acquired the highest level of green building certification by BCA[2]

Five-year loan secured, coordinated by 4 domestic investors

- 4 investors are all corporate

Philippines

Solar Power New Energy Corp. (SPNEC)

Spearheading the nation's energy transition by building the world's largest solar project

$286 million

Meralco, an electricity distributor, **invested in SPNEC, a developer of solar farms**

SPNEC will be used to **carry out the largest solar project** in the world

- The planned solar project in Luzon is expected to develop 3500 MW of solar panels and 4000 MWh of BESS

Controlling stake of SPNEC acquired by Meralco

- 50.5% of the shares acquired by MGen, Meralco's renewable energy development arm

Notes: 1) DC West, DC Kim Chuan; 2) Building and Construction Agency
Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Lit. search; Bain analysis

Recommendations going forward

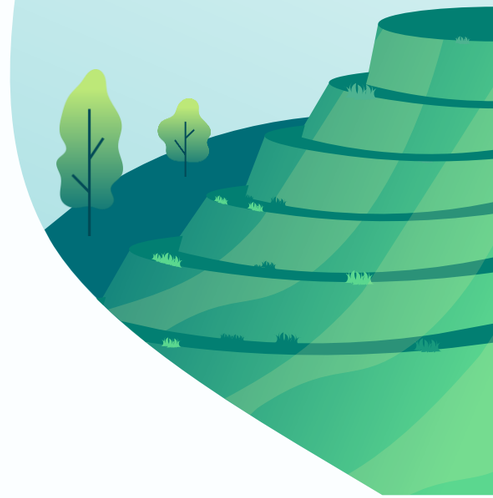
We need to better define the “how” and build the ecosystem to close the investment gap

Countries and companies need **concrete plans to deliver on 2030 commitments**

Investment needs to be mobilized via **enhanced collaboration between public & private sectors**

To scale investment, a **robust ecosystem** with **demonstrated success stories** is needed

Policies and incentives that are catalytic and fit-for-purpose need to be more clearly defined, addressing the regions' unique challenges and focusing incentives where we can deliver impact



02

Investable Ideas

Investing where it counts in 2024

Sweet spot

SEA needs to **identify** these opportunities and **act now**

Impactful

Potential to **reduce carbon emissions above 100 MtCO2e/year** at steady state for entire value chain

Addressable

Technically **feasible and market ready** with **immediate emissions returns** possible within the next 12 months

While long-term impact is critical, SEA should prioritize investment today that can deliver meaningful near-term impact and immediate emissions reductions

What is an investable idea?

1. **Technological innovation** that can be implemented
2. Solution that brings **about concrete emissions reduction**

How do we define a short-term catalytic idea?

1. Technically feasible; has been **tested or implemented** in the market
2. **Immediate emissions returns** within the next 12 months
3. Brings **desirable abatement potential** of more than 100 MtCO2e, which accounts for 3% of SEA emissions

How can we interpret the short list of prioritized ideas?

1. Offer a comprehensive view on **attractive ideas that can be invested today**
2. **Encompass various sectors** with no specific ranking amongst top 13 investable ideas

Note: Regulatory and finance mechanisms are excluded and covered in accelerator section

We assessed ~100 decarbonization investable ideas for SEA by abatement impact and deployability

6 decarbonization opportunities

94 investable ideas

13 priority ideas

Step 1:
Identify and prioritize decarbonization opportunities for SEA

Improved farming practices | Nature-based solutions | Green fuel source | Process optimization | Greener transport | Energy efficient buildings

Step 2:
Create long list of investable ideas within the 6 prioritized opportunity areas and populate 94 ideas

Step 3:
Assess and quantify abatement potential and deployability

Step 4:
Prioritize high-impact and high-deployability ideas

Example (non-exhaustive)

Nature and Agriculture: Improved farming practices; livestock management; nature-based solutions

Nature and Agriculture: Improved farming practices

Alternate wetting and drying (AWD) for rice cultivation
Bamboo production
Organic soil restoration
Precision agriculture practice
Regenerative agriculture practice
Scale green (low-carbon) fertilizer production
Vertical farming
…

AWD for rice cultivation
Precision agriculture practice
Regenerative agriculture practice
…

Source: Project Drawdown

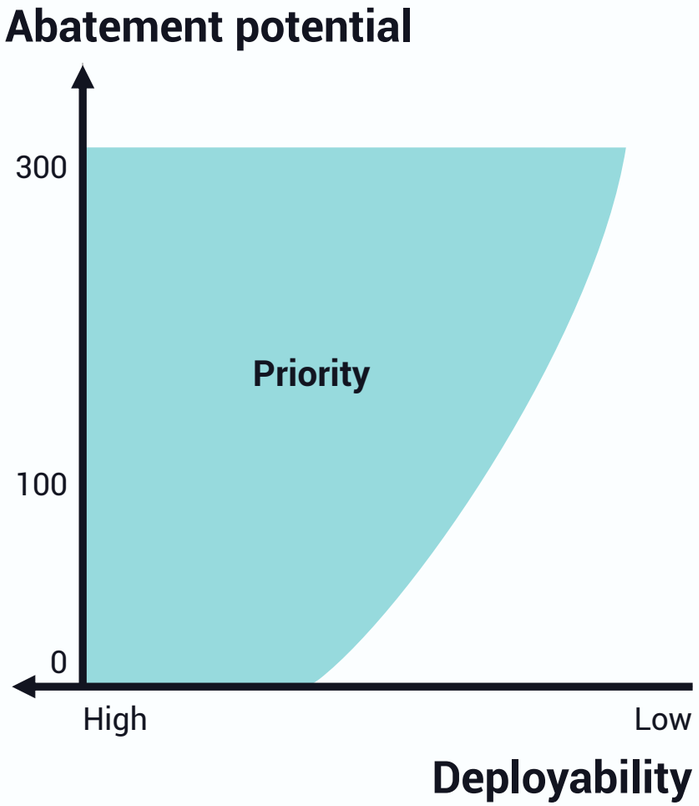
The investment attractiveness was assessed on abatement potential and deployability

Abatement impact

Current emissions scope (tCO2e)

×

Emissions reduction potential (%)



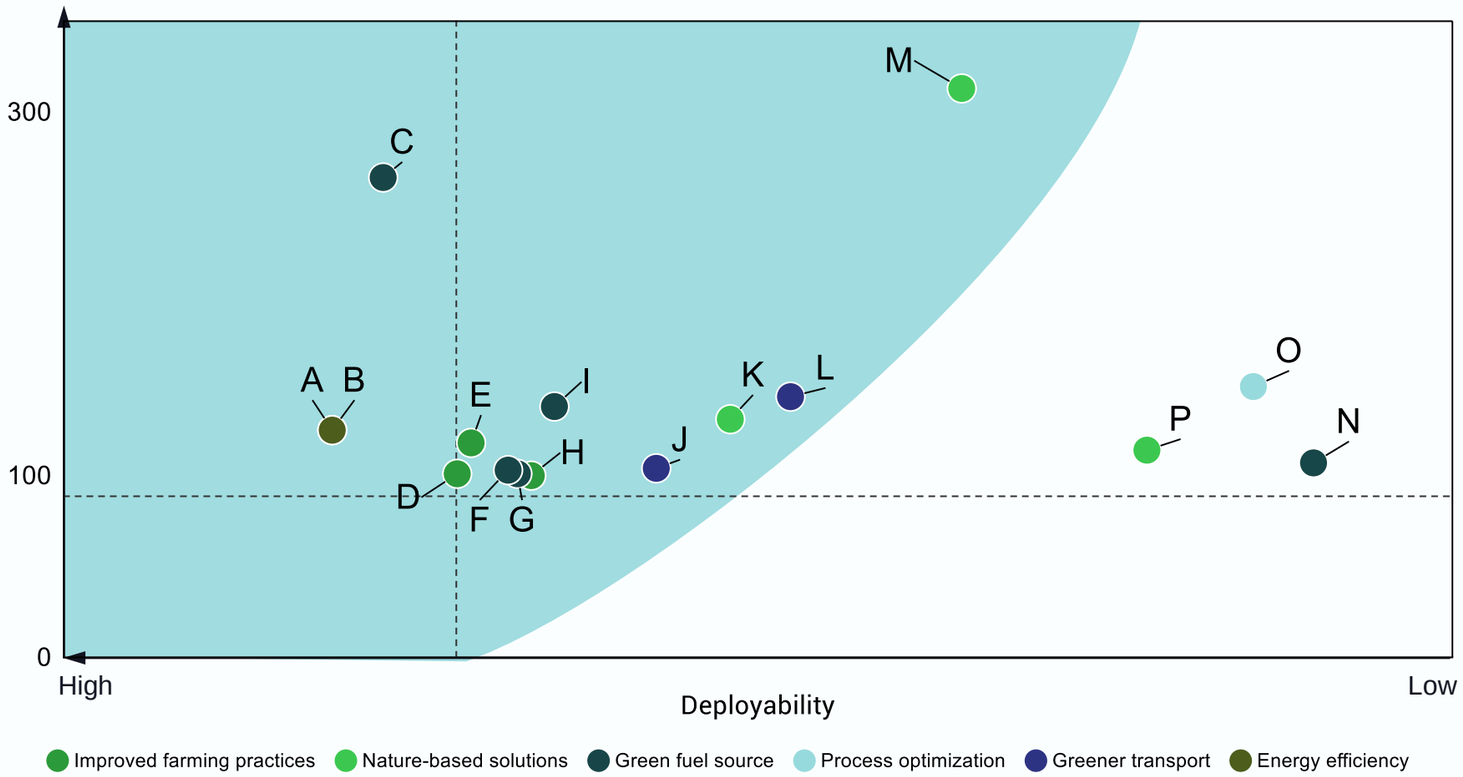
Deployability

Expected net financial benefit to reduce a unit of emission

×

Ability to address deliver impact today vs. tomorrow—time value of carbon

Prioritization: ~100 investable ideas assessed based on abatement potential and deployability, leading to short list of 16 with top 13 investable ideas prioritized

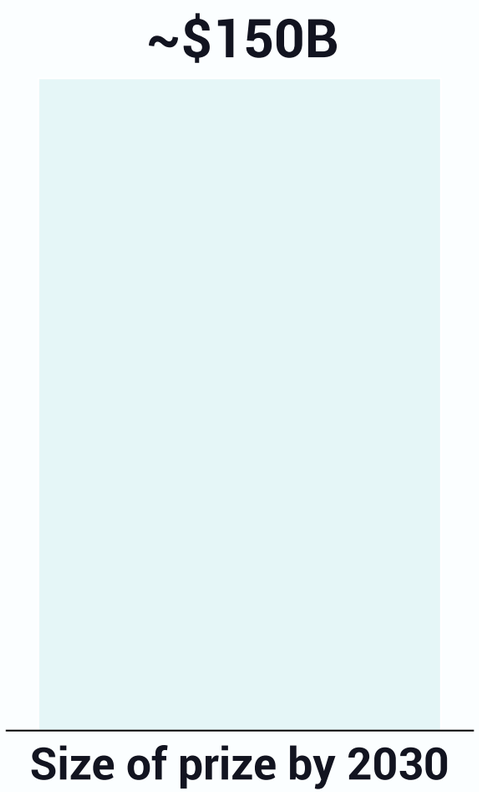


Short list of ideas

- **A** Energy efficiency improvements for data centers
- **B** Energy efficiency improvements for buildings
- **C** Utility-scale solar and wind energy
- **D** Regenerative agriculture practice
- **E** AWD for rice cultivation
- **F** Transmission and distribution (T&D) infrastructure expansion
- **G** Captive solar +[1]
- **H** Precision agriculture practice
- **I** vPPA[2] and bilateral grid interconnections
- **J** Electric passenger vehicles and charging infrastructure
- **K** Forest conservation
- **L** Waste stream for biofuels production
- **M** Peatlands conservation
- **N** Low-carbon transition fuels for maritime
- **O** Optimization of "subcritical" coal plants during transition
- **P** Blue carbon mangrove restoration

Note: 1) Including additional technologies in combination with captive solar; 2) vPPA = virtual power purchase agreement

~$150B size of prize if all 13 investable ideas are implemented in SEA by 2030



Nature and Agriculture

- D — Regenerative agriculture
- E — Alternate wetting and drying
- H — Precision agriculture
- K/M — Forest and peatlands conservation

Power

- C — Utility-scale solar/wind
- F — T&D infrastructure expansion
- G — Captive solar +[1]
- I — vPPAs[2] and bilateral connections

Transport

- J — Electric passenger vehicles and charging infrastructure
- L — Agricultural waste stream for biofuels production

Buildings

- A — Energy efficiency improvements for data centers
- B — Energy efficiency improvements for buildings

Note: 1) Including additional technologies in combination with captive solar; 2) vPPA = virtual power purchase agreement

Nature and Agriculture industry landscape

Ideas context

Ideas could be implemented together as part of a **comprehensive approach to sustainable agriculture and nature conservation**

AWD and **precision agriculture + regenerative agriculture** enhance the ecological resilience of operations and improve crop productivity

Regenerative agriculture + nature conservation within a landscape restoration framework enhance soil health, water resources, and carbon sequestration

D	Regenerative agriculture
E	Alternate wetting and drying
H	Precision agriculture
K/M	Forest/peatlands conservation

Recent developments

Philippines

Philippine Rural Development Project Scale-Up initiative approved by World Bank to scale infrastructure investment in irrigation systems for smallholder farmers

Vietnam

Pilot AWD project in Mekong Delta region was initiated by university researchers in collaboration with local farmers in line with **master plan created by the government in 2022 for the Mekong Delta** to cut greenhouse gas emissions and improve efficiency while diversifying production

Potential accelerators

Partnerships to drive broad-based change:
Provide training and technical assistance to upskill farmers, improve technical know-how, and bring subsequent behavioral change with introduction of smallholder financing solutions

Incentives to unlock financing:
Revenue incentive mechanisms through carbon credits generation as hedge against higher up-front costs and less-certain long-term upside

Standards to scale adoption:
Promote policies and guidelines to incentivize sustainable agriculture practices and conservation

Potential wild cards to consider

Climate variability:
Climate change has led to shifting seasons and erratic weather patterns, which can affect land viable for agricultural use, reduce productivity, and further deforestation

Market dynamics:
Shift in consumers' demand or economic fluctuations can influence farmers' decision to switch and adopt sustainable practices

Regenerative agriculture practice

Improved farming practices

Range of farming techniques like **cover crops, crop rotation, nutrient management, and no or reduced tillage**

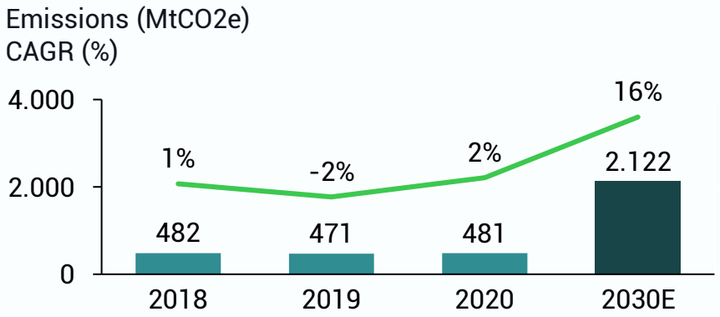
Aim to **improve soil health, sequester carbon in soil, decrease fertilizer use, and reduce cropland burning**

Size of prize ($B)[1] ~6.4

Current state of play

~481 MtCO2e

~14% of total SEA emissions
Represents SEA's agriculture emissions



Emissions reduction potential—midterm ~20%

Assumes improved soil health and fertility would **lower synthetic fertilizer usage**

Potential ways to invest

Project developers with solutions or technology to increase uptake/lower the cost for farmers adopting regenerative agriculture techniques (e.g., project aggregators, end-to-end solutions)

Micro-financing platforms/start-ups to support loans to smallholder farmers

Non-governmental organizations (NGOs) or societal institutions to educate and support farmers on regenerative agriculture techniques

Levers to improve capital flows

Transition barriers to be addressed

Financial: Undesirable unit economics, yielding highly limited investor returns; limited credit availability for farmers to transition/ manage risk

Social: Lack of awareness and skepticism of efficacy among smallholder farmers

Case study: Sustainable coffee production

Context: Vietnamese coffee industrial partners **invested $625,000 in a project** to enhance access to regenerative agriculture for sustainable coffee

Results: Aim to support ~10,000 households and influence industry shifts toward sustainable practices within the coffee sector

Why it works: **Strategic partnership** fosters acceptance of sustainable practices

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Alternate wetting and drying for rice cultivation

Improved farming practices

Water management technique with scheduled draining practices that allows soil to dry between irrigation cycles

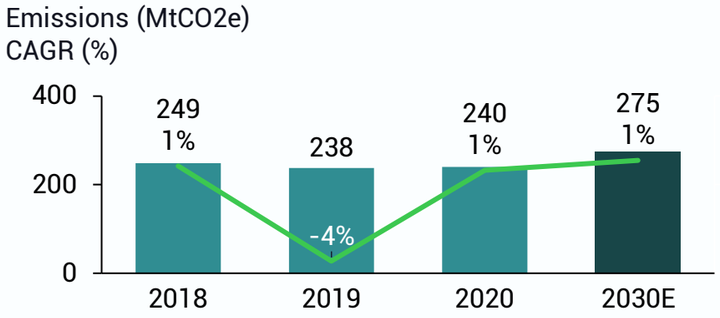
Reduces the amount of time the field is flooded to mitigate **methane**-producing microbial activity and **emissions**

Size of prize ($B)[1] ~6.4

Current state of play

240 MtCO2e

~7% of total SEA emissions
Represents SEA's rice cultivation emissions



Emissions reduction potential—midterm ~40%

Assumes **only half the progressive farmers** would adopt AWD practices in the midterm

Potential ways to invest

Carbon market development with established additionality standards to stimulate local demand, leverage international demand, and increase offtake prices for sustainable rice

Measurement, reporting, and verification (MRV) systems and education/ technical assistance to strengthen farmers' ability to generate value from carbon credits

Trials/pilots with rice corporations directly or via NGOs[2] to build the evidence base for AWD and demonstrate to farmers the limited risks of this technique

Levers to improve capital flows

Transition barriers to be addressed

Financial: Limited economic incentives to adopt AWD practices

Social: Lack of awareness of AWD; inability to independently incentivize adoption without involving all stakeholders across rice value chain

Case study: Rize.Farm decarbonized rice cultivation

Context: Rice is a staple crop, but production forms the bulk of SEA's methane emissions, which is 28 times more potent than carbon dioxide

Results: Rize.Farm is an agritech start-up building platform that can **identify and implement best practices** for reducing GHG emissions in rice cultivation while offering farmers **economic incentives** to adopt such techniques

Why it works: By optimizing strategies based on local farming practices and providing **tailored incentives across value chain** for all stakeholders, it improves yield and soil health

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030; (2) nonprofit organizations
Source: FAOSTAT

Precision agriculture practice

Improved farming practices

SEA's average **nutrient use efficiency of 57% lags the world's average of 70%** and can be improved through adoption of **advanced technology** to optimize farming practices

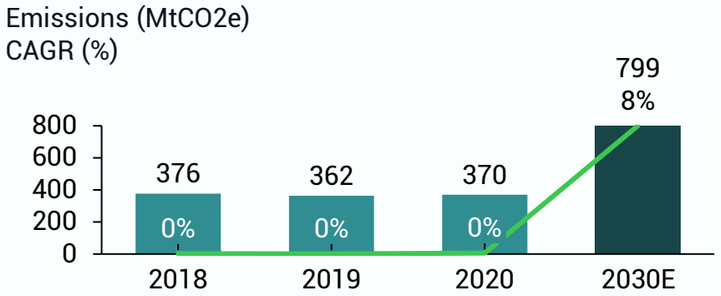
Technologies include **data collecting devices** and **data analytics** on soil composition, pH, nutrients, fertility, etc.

Size of prize ($B)[1] ~6.4

Current state of play

~370 MtCO2e

~11% of total SEA emissions
Represents SEA's cropland management, fertilizer usage, and irrigation practices[2]



Emissions reduction potential—midterm ~20%

Assumes optimization **lowers agricultural inputs**, such as fertilizers, pesticides, and seeds

Potential ways to invest

Mechanization platforms that own and lease machinery to smallholder farmers to allow the cost of equipment to be amortized across many individual farms

Pilots directly or via NGOs[3] to build the evidence base for precision agriculture practice and demonstrate to farmers that it can generate additional income for the farm

Levers to improve capital flows

Transition barriers to be addressed

Financial: High up-front costs that do not guarantee an income for farmers

Social: Varied tech savviness of operators; lack of awareness and skepticism of efficacy among smallholder farmers

Case study: Ricult Thailand

Context: A multiservice platform **raised $3.5 million** during fundraising from elea Foundation, a Swiss impact investment firm and Sojitz, a Japanese conglomerate, to support **development of agritech** in weather analysis, satellite technology, and crop yield modeling

Results: Ricult has **over 400,000 Thai farmers** on its platform and is recognized for **improving farming productivity** by at least 20%

Why it works: **Real-time agronomic advice** to support queries from farmers; assistance with **loan applications with preferential rates** through partnerships with institutions

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030; 2) Encompass emissions related to crop residues, manure applied to soils, manure left on pasture, manure management, rice cultivation and synthetic fertilizers; 3) Nongovernmental organizations
Source: FAOSTAT

DEEP DIVE

K/M

Forest and peatlands conservation

Nature-based solutions

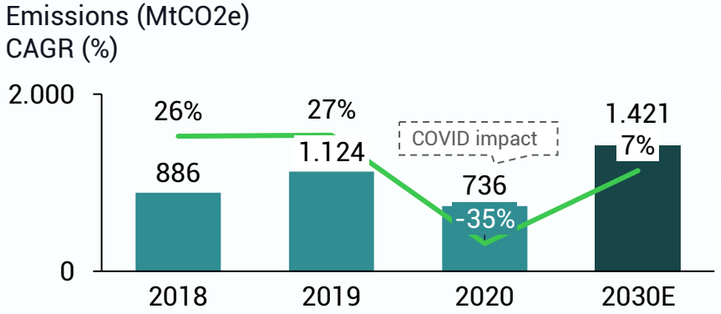
Conservation of **1) tropical forests,** which are the most biodiverse area globally and largest form of ecosystem in SEA; **2) peatland (wetland) ecosystem,** which is a crucial carbon sink and plays a vital role in mitigating floods

Size of prize ($B)[1] ~20.0

Current state of play

~736 MtCO2e

~22% of total SEA emissions
Represents SEA's land-use change and forestry emissions



Emissions reduction potential—midterm ~60%

Assumes **conserving peatlands** holds ~42% potential while **forest conservation** contributes ~18% potential

Potential ways to invest

Regional developers to build capabilities and scale high-quality project development through direct investments or long-term offtake agreements

Nature-based solutions (NBS) tech start-ups to improve understanding of practices and benefits of NBS, such as agroforestry and land restoration

Incubators to help build the capabilities of local stakeholders/ Indigenous groups to design and execute repeated nature projects

Levers to improve capital flows

Transition barriers to be addressed

Financial: Nascent carbon markets result in long lead time to revenue generation

Markets: Development of high integrity regional carbon markets at scale

Technical: Shortage of high-quality developers with a track record

Case study: SCeNe[2] Coalition

Context: Coalition with nonprofits in SEA to accelerate high-quality NBS with **$1 million grant from Google's philanthropic arm** to develop the NBS tool

Results: Aim to map key geographies with high-impact NBS opportunities in an open platform

Why it works: **Collective action** across regional stakeholders who bring shared expertise and resources to **direct climate finance** and meet current demand for carbon solutions

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030; 2) Southeast Asia Climate and Nature-Based Solutions Coalition
Source: Landscape Approaches Report

Renewable energy industry landscape

Ideas context

Renewable power is proven and is transforming grids in much of the world today, but penetration is limited in SEA

Discrete opportunities exist even though scale adoption of solar and wind is limited by structural facts that will take time to resolve

- **C** Utility-scale solar/ wind
- **F** T&D infrastructure expansion
- **G** Captive solar +
- **I** vPPAs and bilateral connections

Recent developments

Philippines

In 2023, amended its Renewable Energy Act to **allow full foreign ownership of renewable energy (RE) projects**

Also established "Green Lanes" to **expedite processes to obtain licenses and permits**

Vietnam

$165 million acquisition of Super Energy's **solar business**

CME Solar secures **$20 million** from responsAbility climate fund in support of **commercial and industrial solar projects**

New long-term strategy for environmental protection **emphasizes renewables**

Accelerators to consider

New regulatory frameworks to ensure predictable investment environment: Facilitate coordinated efforts through credible and transparent power sector planning to ensure an attractive environment for investors

Transition finance to support power reform: Develop a climate framework to recognize the positive contribution of banks in taking on and transitioning brown assets to secure greater capital flow into power projects

Clusters to create progress/ optionality: Foster a cohesive internal marketplace that gives renewable players the option to sell energy generated to corporations within industrial cluster

Potential wild cards to consider

Climate variability: RE sources like wind and solar depend on favorable weather conditions, which can be unpredictable and can affect energy reliability, unlike traditional sources

Oil market dynamics: A major drop in oil prices by major suppliers could disrupt the current cost parity dynamics favoring RE advancement

Geopolitical influence: Balancing challenges related to potential protectionism and disruptions to energy trade, which can impact energy stability and trade dynamics for interdependent neighboring states, is key

Utility-scale solar and wind energy

Green fuel sources

Utility large-scale generation of renewables is **proven globally and has seen falling cost over the years**

However, **roadblocks remain** (e.g., grid congestion, slow permitting) and hinder SEA's ability to scale

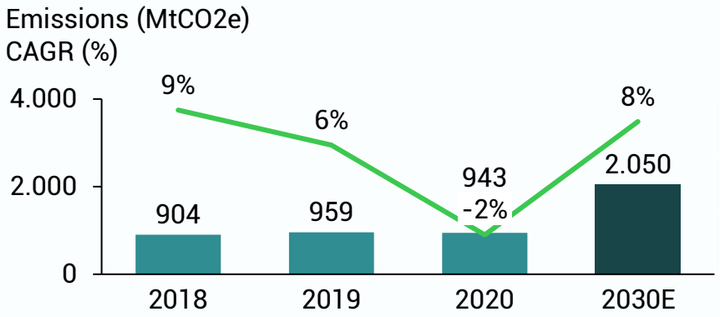
Progress in SEA has only been observed for selective projects; many stalled because of multiple factors

Size of prize ($B)[1] ~18.1

Current state of play

~943 MtCO2e

~28% of total SEA emissions
Represents SEA's power emissions



Emissions reduction potential—midterm ~15%

Assumes switch from fossil to renewables brings **~75% reduction potential**, with actual potential **switch-out to solar/wind in SEA at ~20%**

Potential ways to invest

Utility-scale solar and wind investments hold substantial potential to generate electricity at a large scale and can be achieved through multiple stakeholders' support

Rooftop solar infrastructure generation via a combination of equity investment by developers and project financing by banks will allow businesses flexibility in their access to RE

Direct corporate purchase of RE from generators will provide a predictable revenue stream for project developers and drive growth in RE consumption

Levers to improve capital flows

Transition barriers to be addressed

Political: Weak support for private market participation constrains investment opportunities

Infrastructure: Slow approval for grid upgrade projects leads to severe curtailment issues

Business: Limited incentives to transition from fossil plants create stranded costs for investors

Case study: Meralco Powergen (MGen) acquisition of SP New Energy (SPNEC), Philippines

Context: MGen acquired SPNEC through a **$285 million investment** to fund construction of 3.5 GW solar energy farm and 4.5 GWh battery project

Results: Acquisition aims to align with MGen's RE goals to be coal-free before 2050

Why it works: **Joint venture** with SPNEC **enhances market credibility to scale** with shared resources, funds, and co-sharing of risk, further supporting expansion of RE projects that align with **Renewable Portfolio Standards mandate** for utility players to acquire specific percentage of supply from RE

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Transmission and distribution infrastructure expansion

Green fuel sources

Expansion of energy T&D networks **through alternate partnership model** is crucial to enhance the **efficiency and reliability** of the power grid, which currently causes severe curtailment issues

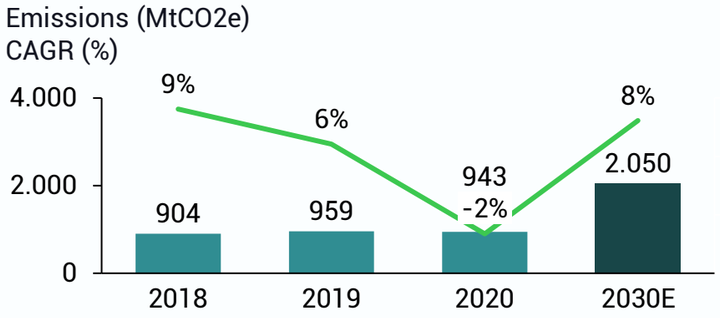
"No regrets" move to find development and financing models with private sector while market reform is considered

Size of prize ($B)[1] ~11.2

Current state of play

~943 MtCO2e

~28% of total SEA emissions
Represents SEA's power emissions



Emissions reduction potential—midterm

~5%

Assumes grid upgrade could increase **power capacity investment by up to 30%**

Assumes switch brings **~75% reduction potential**, with only **~20% potential to solar/wind** in SEA

Potential ways to invest

Private participation via Build, Own, Operate, Transfer (BOOT) model for a specific duration before transferring back to the government to bridge financing gap with private capital and scale investment in grids

Private participation via long-term concession model to manage and operate existing transmission assets and oversee grid expansion in area of operation brings potential to attract more private investment

Levers to improve capital flows

Transition barriers to be addressed

Political: Most grid infrastructure is state-owned leading to limited interest from private developers to invest in grid upgrade projects

Infrastructure: Slow approval for grid upgrade projects leads to severe curtailment issues

Business: Continued fossil fuel subsidy leads to artificial prices that hinder RE's competitiveness

Case study: Quang Trach-Pho Noi Transmission Line Project, Vietnam

Context: National Power Transmission Corp. has received a **$675 million loan** for construction of a 500 kV transmission line to address grid congestion from rapid RE development in recent years

Results: Aim to **strengthen North-Central** transmission grid capacity

Why it works: **Supportive government oversight** to push project progress through investment and permitting approval

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Captive solar +

Green fuel sources

Captive self-generation of solar with storage has **worked in high renewables penetration markets globally**

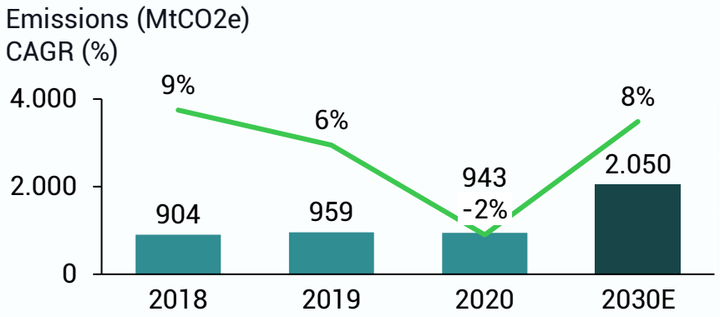
The main potential in SEA is confined to only countries that require **backfill of curtailment**, **backup power for data centers**, and markets with **emerging demand**

Size of prize ($B)[1] ~4.3

Current state of play

~943 MtCO2e

~28% of total SEA emissions
Represents SEA's power emissions



Emissions reduction potential—midterm ~8%

Assumes potential for **~6% additional RE usage** with decentralized system and **~2% additional from use of stored RE**

Potential ways to invest

Priority investments around microgrids with storage systems in industrial parks to support localized, self-sufficient energy solution to enhance reliability; needs new policy frame

Hybrid solar projects with storage system allow flexibility for optimization of energy usage and contribute to bankability of the project

Reuse of solar panels that are meant to be disposed of to extend life span and reduce cost of installation in developing markets

Levers to improve capital flows

Transition barriers to be addressed

Political: Lack of net metering and other solutions to resell self-generated power back to grid undermine viability business case

Case study: Banpu acquisition of Durapower

Context: Banpu NEXT expanded its RE generation capacity and **acquired Durapower for $70 million** to scale its battery-based clean energy opportunities

Results: Implement 1 MWh BESS at a captive solar-powered mining site in Indonesia

Why it works: Extension of storage offerings to **commercial and industrial operators** improves business competitiveness and supports growth

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Virtual power agreements and interconnections

Green fuel sources

Corporate vPPA is a financial contract that allows trading of RE across borders **without physical delivery**; buyers typically receive **Renewable Energy Certificates** which allow them to make claims

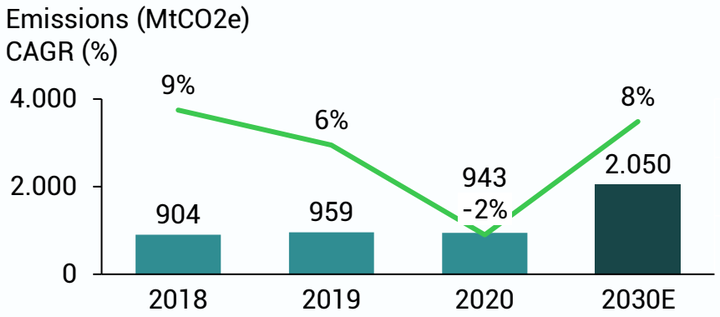
Connecting developers and offtakers in countries with limited RE capacity can bring **stable new revenue stream**

Size of prize ($B)[1] ~18.1

Current state of play

~943 MtCO2e

~28% of total SEA emissions
Represents SEA's power emissions



Emissions reduction potential—midterm ~6%

Assumes vPPA could increase **power capacity investment by up to 40%**

Assumes switch brings **~75% reduction potential**, with only **~20% potential to solar/wind** in SEA

Potential ways to invest

Energy companies' participation in regional electricity trade to create demand, facilitate sale and purchase of electricity, and enhance power grid connectivity in different regions

Public infrastructure development to enhance the capacity and reliability of the power grid for smooth transmission flow between regions

Levers to improve capital flows

Transition barriers to be addressed

Political: Inadequate government-to-government support and protectionist stance of countries will limit the opportunity to inject additional capital that can be crucial for RE expansion

Regulatory: Corporates who have signed up to RE100 initiatives can only accept cross border VPPAs from within the same market boundary

Case study: Singapore-Malaysia cross-border arrangement

Context: With the launch of a National Energy Transition Roadmap and **lift of Malaysia's RE export ban**, it provides opportunity to provide additional revenue above existing market rates with neighboring countries like Singapore; **Memorandum of Understanding signed** between the two countries to explore **infrastructure development** of a second interconnector

Results: Potential to boost investment and for **Sarawak to export ~1 GW of hydropower**

Why it works: Allows market-driven development with **regional funding sources**; green-lit self-contained RE systems enable **private participation**

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Transport industry landscape

Ideas context

J Electric passenger vehicles (EVs) and charging infrastructure

L Agricultural waste stream for biofuels production

Recent developments

Thailand

In 2022, Thailand initiated a **subsidy program for EVs**, ranging from $2,000 to $4,000 per unit and provided **tax incentives** for EVs

In 2022, **BYD invested $500 million** to set up a new facility in Thailand for passenger car production

EV registration has increased 380% in 2023 compared to 2022

Indonesia

In 2023, Indonesia Investment Authority initiated a **special EV Ecosystem Fund** with Chinese battery supplier Contemporary Amperex Technology, with >$15 billion in deals signed since 2020 to support the battery and EV industry

Singapore

In 2023, SIA, CAAS[1], and GenZero completed a 20-month pilot that tested the potential of SAF credits

Accelerators to consider

Subsidy to stimulate financing:
Funding from government to prioritize purchase and installation of EV/biofuel production infrastructure in accordance with commitments to encourage regional investments

Standards through gradual bans to support transition:
Strengthen business case to attract more capital flow into power and charging infrastructure development to alleviate range concerns and promote widespread EV adoption

Potential wild cards to consider

Global market dynamic:
Rapid growth in Chinese EV and biofuels industry and its relevant export strategies increases competition, which can impact profitability and potentially strain production capacity utilization

Minerals supply chain security:
Accelerated electrification of vehicles means demand for lithium and other metals is growing at a fast pace to support battery production, heightened supply chain risk given that production of critical minerals is dominated by a select number of countries

Notes: 1) Civil Aviation Authority of Singapore

Electric passenger vehicles and charging infrastructure

Greener transport mode

Electrification of vehicles, especially **two- and three-wheelers**, which are the most common form of personal transport in SEA and require much **less involved charging** (e.g., largely in private homes)

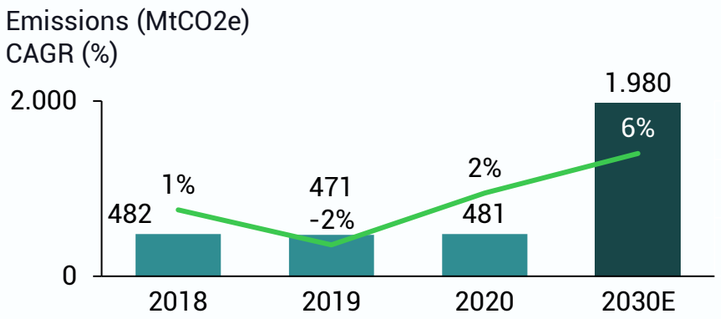
Potential charging solutions like **network of fast charging stations and battery swapping network**

Size of prize ($B)[1] ~30.3

Current state of play

~358 MtCO2e

~10% of total SEA emissions
Represents SEA's transportation emissions for light-duty vehicles



Emissions reduction potential—midterm ~66%

Assumes switch from internal combustion engine vehicles to **avoid fossil fuel usage**

Potential ways to invest

Pursue advancements in battery technologies to improve vehicle performance, increase energy efficiency, and reduce costs to lower barriers for switching to EV

Expand charging network and battery swapping system to support widespread adoption of EV and address consumers' range anxiety

Localize production facilities to develop EV manufacturing capability in the region and reduce cost to purchase an EV locally

Levers to improve capital flows

Transition barriers to be addressed

Business model: High up-front costs to switch

Infrastructure: Slow installation of charging infrastructure and transmission capacity

Customer: Concerns and resistance from operational change and power price volatility

Case study: VinFast Group, Vietnam

Context: >90% of personal use vehicles in Vietnam are two-wheelers, and EVs are at purchase price parity with ICE vehicles. VinFast, the largest EV manufacturer in Vietnam, **invested $213 million (Q4 2023, CapEx) to develop new EV models and charging stations** to scale infrastructure development at speed

Why it works: Government **reduced excise tax for EVs** to 2%–3% (from current 15%) and issued an **exemption on EV registration fees** in 2022, bringing **certainty to consumers** with preferential financing schemes to **support EV growth**

Note: 1) Investment potential is calculated based on additional revenue potential by 2030

Agricultural waste stream for biofuels production

Greener transport mode

Use and convert agricultural waste streams into **second generation (2G) biofuels** for use as **sustainable aviation fuels (SAF)** and **low-carbon transition fuels in maritime**

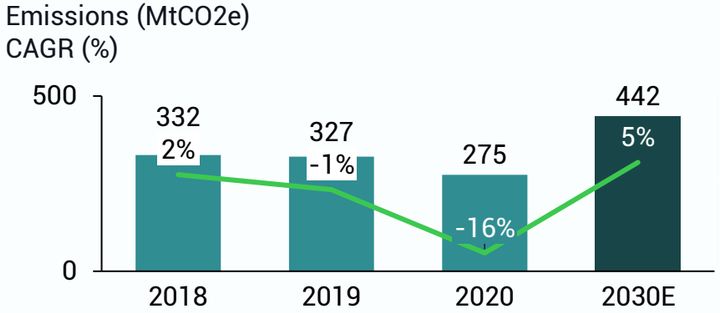
SEA has an **abundance of feedstock** from agricultural waste streams

Size of prize ($B)[1] ~42.0

Current state of play

~275 MtCO2e

~8% of total SEA emissions
Represents SEA's air transportation and bunker fuels emissions



Emissions reduction potential—midterm ~80%

Assumes 2G biofuels offer **emissions reduction typically 70%–90%** compared to 35%–50% for 1G

Potential ways to invest

Rethink agricultural waste collection infrastructure as agricultural waste is collected at mill level (with huge expansion potential in Malaysian and Indonesian agriculture market) to be reprocessed into biofuels for transport industry

Aggregate medium and small-sized mills via a joint venture or merger and acquisition to gain scale in the current fragmented market and accelerate scaling potential of agricultural waste processing

Levers to improve capital flows

Transition barriers to be addressed

Physical: Feedstocks not available at scale

Business: Difficulty accessing substantial funding to build out system across geographies

Infrastructure: Absence of global framework for book-and-claim system makes funding risky

Case study: Singapore Airlines (SIA) SAF pilot

Context: Nov. 2023 SIA, CAAS[2], and GenZero completed a 20-month pilot that tested the potential of SAF credits

Results: SIA **generated 1,000 book-and-claim SAF credits** for sale to corporations and air cargo companies, providing a successful use case in a voluntary market that is still nascent

Why it works: Partnership **reduces market risk and cost premiums**; collaboration with global RSB[3] Book & Claim System **tested the potential of SAF credit market** in SEA

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030; 2) Civil Aviation Authority of Singapore; 3) Roundtable on Sustainable Biomaterials

Buildings industry landscape

Ideas context

A Energy efficiency improvements for data centers

B Energy efficiency improvements for buildings

Recent developments

Singapore

~$400 million investment by Singtel in **PT TeknologiData Infrastruktur**

Authority **raised minimum energy performance requirements,** requiring new buildings to be 50% more energy efficient than 2005 level

Malaysia

$270 million investment by GDS and four mandated lead arrangers in Nusajaya Tech Park **data center**

$250 million investment by YTL Power International, etc. in Kulai data center

Energy Efficiency and Conservation Act mandates audits and energy-saving measures for companies consuming over 21,600 GJ

Accelerators to consider

Standards to drive upgrades: Enforce green building codes with mandatory efficiency guidelines to promote best practices

Partnership through integrated parks to unlock capital flow: Collaboration with major industry players can stimulate demand, promote adoption of scalable technological solutions, and facilitate financing flow by establishing clear and long-term purchase agreements

Potential wild cards to consider

Data localization potential: Regulatory shifts that mandate storage and processing of data within national borders can impact the location, design, and operational landscape of data centers

Disruptive new technologies: The readiness of existing buildings to seamlessly integrate new technologies becomes crucial as the industry evolves with new advancements, such as immersion cooling and server densification

Energy efficiency improvements for data centers (DCs)

Energy efficient buildings

DCs are one of the **fastest-growing sources of emissions** and forecasted to grow ~11% CAGR in Asia-Pacific

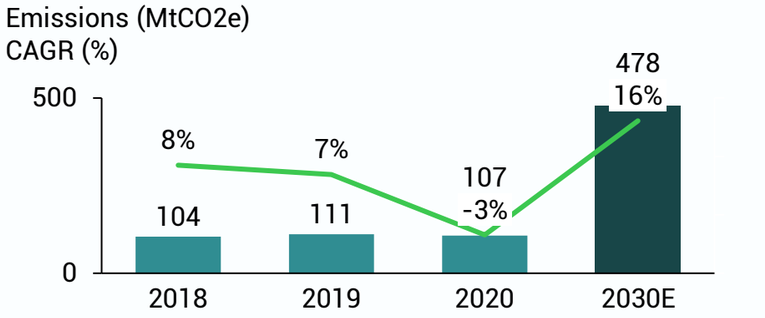
Implement energy-efficient technology and measures like **efficient cooling** and **building automation** systems to **reduce energy usage** while concurrently increasing clean energy power mix

Size of prize ($B)[1] ~5.8

Current state of play

~107 MtCO2e

~3% of total SEA emissions
Represents a portion of SEA's building and electricity/heat emissions



Emissions reduction potential—midterm

~15%

Assumes **latest technology** for efficient building design (e.g., insulation, air tightness, and solar shading) brings an average 15% energy savings

Potential ways to invest

Invest in DC above Tier 3 certification to ensure compliance with standards to increase reliability, uptime, and energy optimization, directly promoting improved energy efficiency

Infrastructure ownership to fund construction of new DC capacity and encourage adoption of energy-efficient technologies within operations

Leverage project financing for hybrid DC development with developers and operators to facilitate cost sharing, resource pooling, and expertise exchange to optimize energy consumption through collaboration

Levers to improve capital flows

Transition barriers to be addressed

Business model: Substantial cost required to retrofit

Technology: Limited clear green data center guidelines can hinder new technology adoption

Customer: Lack of confidence in technology's benefit given limited proof points

Case study: Nusajaya Tech Park Data Center

Context: Chinese developer and operator GDS raised **$270 million green loan** in Malaysia with four mandated lead arrangers, including Standard Chartered as Joint Green Loan Coordinator to develop a ~70 MW DC that adopts liquid-cooling technology to improve overall energy efficiency

Results: Aim to complete Phase 1 of project within 14-month time frame

Why it works: **Strategic position** of DCs within the SIJORI region (Singapore, Johor, and Riau Islands in Indonesia) to match digitalization demand; **green design attestation** with GDS receiving LEED Gold Certification for several of its overseas DCs; **industrial community** of MNCs[3] and enterprises within park

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030

Energy efficiency improvements for buildings

Energy efficient buildings

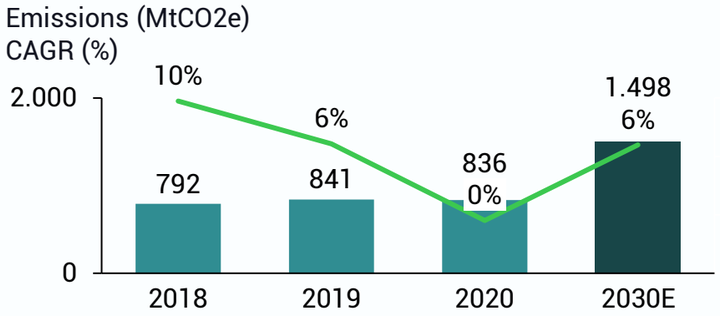
Implement energy-efficient technology and measures like **efficient cooling** and **building automation** systems to **reduce energy usage**

Size of prize ($B)[1] ~13.4

Current state of play

~836 MtCO2e

~24% of total SEA emissions
Represents SEA's building and electricity/heat emissions



Emissions reduction potential—midterm ~15%

Assumes **latest technology** for efficient building design (e.g., insulation, air tightness, and solar shading) brings an average 15% energy savings

Potential ways to invest

Invest in buildings above industry energy efficiency standards to ensure compliance with standards to increase reliability, availability, and energy optimization, directly promoting improved energy efficiency

Encourage real estate ownership to support construction of new buildings and integration of energy-efficient technologies and practices

Leverage project financing for collaborative developments with developers and operators to facilitate cost sharing, resource pooling, and expertise exchange to optimize energy consumption through collaboration

Levers to improve capital flows

Transition barriers to be addressed

Business model: Limited incentives for developers to implement energy-efficient building operations

Infrastructure: Divergent energy-efficient technologies in the industry

Customer: Lack of confidence in technology's benefit given limited proof points

Case study: CapitaLand Malaysia Trust's (CLMT) sustainability-linked loan

Context: CLMT acquired Queensbay Mall in Penang for **~$148 million through a sustainability-linked loan** with interest rate rebates based on **predetermined sustainability performance targets**, including green building certification and targeted reduction in energy consumption

Results: Align with CLMT's goal to integrate ESG[2] framework into financing strategies

Why it works: **Bank rebates incentivize** energy-efficient technology deployment; use of **third-party verifications** bring added credibility to loan

Notes: 1) Investment potential is calculated based on additional revenue potential by 2030; 2) Environmental, social, and governance

Artificial Intelligence: Companies have been looking to leverage AI solutions for green investments for years; rapid rise of generative AI could accelerate deployment in selected areas

	Nature and Agriculture	Power	Transport	Buildings
Traditional AI	**Precision agriculture** Data-driven predictive analytics to optimize farming practices **Crop management** Use aerial imagery to optimize crop health and yield **Smart irrigation system** AI to adjust irrigation run times based on external conditions **Yield forecast** Model and predict crop yields and harvests to optimize resource use	**Smart grid** Use smart meters to optimize and manage real-time energy needs **Predictive maintenance** Early identification of issues to reduce unplanned downtime **Demand prediction** Forecast energy requirement to manage peak load demand **Energy trading** Analyze and sieve market data for trading decisions	**Route optimization** Analyze traffic data to reduce fuel consumption **Inventory management** Optimize inventory levels to reduce wastage **Autonomous vehicles** Process data from sensors to safely navigate in real time **Smart EV chargers** Optimize availability of charging stations to meet users' demand	**Control system** Monitor HVAC system to optimize real-time energy consumption **Smart lighting** Automate lighting levels to enhance efficiency and comfort **Setpoint automation** Analyze occupancy rates to enable microzoning for each area **Occupancy analytics** Analyze data to bring efficient space utilization
Generative AI	**Reduced data infrastructure requirement:** Able to learn from fewer datasets, which aligns with prevalent smallholder farms in SEA with limited data networks	**Improved optimization of different power sources:** Able to integrate data from multiple power sources (e.g., distributed renewables, electric vehicles, energy storage, virtual power plants) to ensure resilience, and affordable power access	**Vision technology:** Able to use computer vision and machine learning to improve object detection during development of autonomous vehicles	**Rapid learning and adaptability:** Able to respond effectively to dynamic building conditions and optimize energy consumption in real time

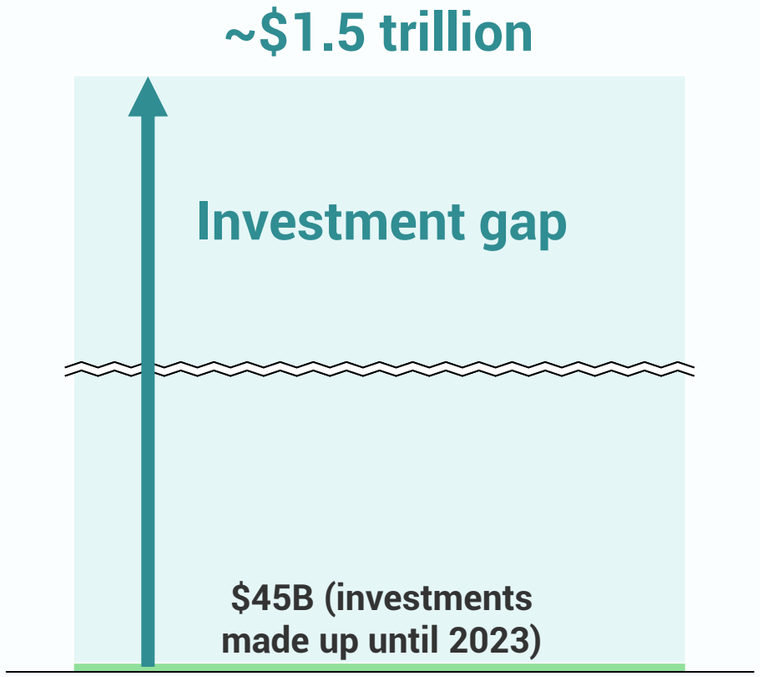
Notes: It is acknowledged that adoption of AI brings energy and carbon implications

03 Accelerators

Scaling capital flows into the green economy constrained by multiple factors

Large gap exists to fund the transition

Required investment
in Southeast Asia until 2030



Investability hindered by project investment & country risks

Project investment risks

- Lower risk-weighted returns vs. investor expectations

*"When considering green investments, **the expected returns and level of risk often do not align** with what private investors expect and are willing to accept."*

Investment Specialist, MDB[1]

Emerging market risks

- Political stability and governance
- Currency and exchange rate volatility
- Depth and maturity of capital markets
- Robustness of the project pipeline
- ...

*"**The regulatory landscape** in Southeast Asia is **rapidly evolving** and **instability in foreign exchange rate** increasing cost of borrowing for a lot of countries."*

Head of Sustainability Group, Japanese Bank

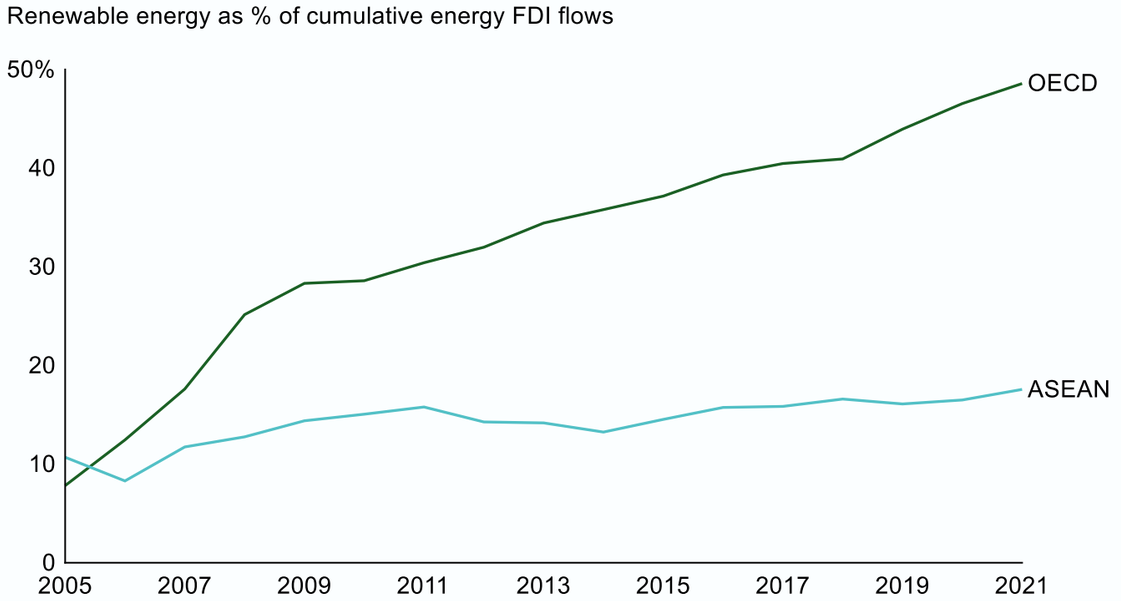
*"**Market structure is not fully liberalized** and remains **relatively closed to foreign investments**, complicating investment analysis when considering purely commercial terms."*

Asset Manager, Global Investment Management Firm

Notes: 1) Multilateral development banks
Sources: Expert interview; Lit. search; Bain analysis

ASEAN investment in renewables continues to underperform vs. global trends; change is needed to unlock the green potential in power sector

Renewables FDI flows into the region have underperformed relative to OECD countries …



"From 2016–2020, for every dollar invested in RE power capacity in SEA, ***another dollar was invested in unabated fossil fuels****, compared with US$0.5 in Sub-Saharan Africa, US$0.3 in China and US$0.2 in Latin America."*

Southeast Asia Energy Outlook 2022, IEA[1]

… driven by market and regulatory conditions as well as costs of capital impacting returns

Project investment risks

Higher costs of capital

The cost of capital for RE investments remains relatively high in many SEA countries like 10%–12% in Vietnam, and the **financial value proposition for private sector investment in renewables remains unclear** vs. advanced economies

Higher perceived risks lower project bankability

Private capital has accounted for only 60% of renewable power investment in Southeast Asia, compared to about 90% in advanced economies, due to **ongoing perceived currency fluctuation and regulatory risks**

Emerging market risks

Higher offtake risk

In many SEA countries, electricity is heavily regulated, often subsidized to the consumers and requires a **state-owned utility enterprise to be the sole offtaker;** uncertainty about ability and timing of grid upgrades to support

Lack of policy continuity

Supportive policy incentives in SEA countries like Vietnam have spurred a significant solar and wind buildout, especially over the past 5 years, but the **process has been characterized by constant changes to deployment and grid regulations,** and uncertainty about tariff structure to support

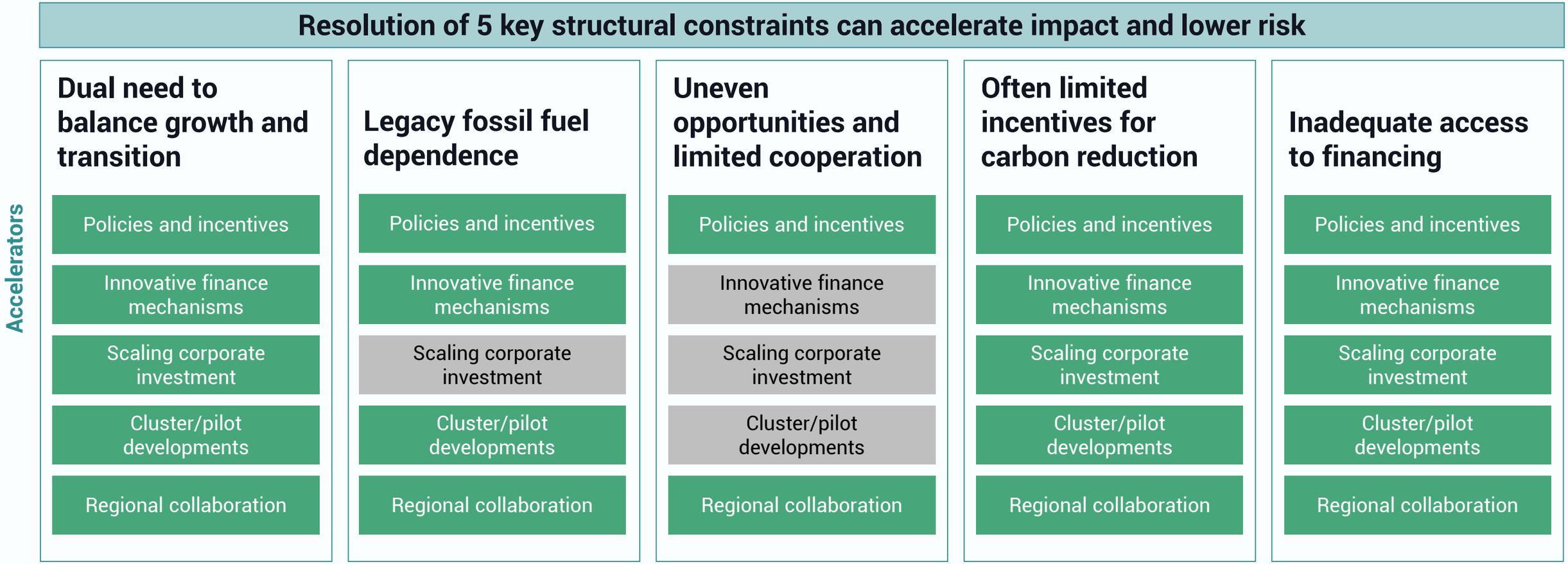
Notes: 1) International Energy Agency
Sources: IEA 2022 Energy Outlook; ASEAN Renewables: Opportunities and Challenges (IEA)

More needs to be done to accelerate investments

Accelerators required to unlock full potential

1. **Policies and incentives** to further push transition and green investments
2. **Innovative finance mechanisms** to facilitate more capital flow
3. **Scaling corporate investment** to establish future-ready businesses
4. **Cluster/pilot developments** to scale technological development
5. **Regional collaboration** to drive coordinated SEA strategy

SEA's structural constraints could be addressed by the five accelerators



Note: 1) Coal plants under 20 years
Source: Expert interview; Lit. search; Bain analysis

Five accelerators can help build ecosystems near-term and bring investment to scale

1. **Policies and incentives**
2. Innovative finance mechanisms
3. Scaling private corporate investment
4. Cluster/pilot developments
5. Regional collaboration

Structural challenges: Government action to support green economy needs to contend with fundamental economic and societal challenges as well as inherent trade-offs

Social
Attend to basic human needs vs. establish sectorial just transition

GDP
Majority countries in SEA are considered emerging markets

$6K GDP per capita in 2023 (vs. $63K in North America)

Energy
Access and fuel mix are prominent concerns

Energy demand expected to double

~75% With SEA's current fossil fuels mix[1]

~30M People continue to live without electricity[1]

Food and healthcare
Challenges with limited access

~3% in extreme poverty[2]

~1% Infant mortality rate

Economic
Remain cost competitive vs. adopt fiscal approach

Manufacturing dependent
Primary contributor to GDP

~21% average GDP from manufacturing (vs. 11% in North America)

Export dependent
Mainly export-driven economies

~74% average exports-to-GDP ratio in 2022

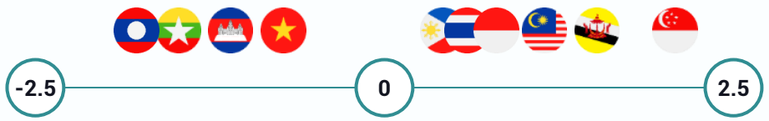
Workforce
Challenges with workforce transition and income losses

~22% of employment in manuf. sector

~100K Approx. Vietnam workers affected by CPO[3]

Political
Balance stakeholder interest vs. develop forward-looking policy

Bureaucratic efficiency
Policy implementation faces challenges



~0.1 Average SEA regulatory quality score[1,4]

Political stability
Commitment to long-term policies, independent of political pressures

~0.3 Average SEA government effectiveness score[1,4]

Notes:1) Represent latest available data across SEA countries; 2) Represent 7 countries with extreme poverty data below International Poverty Line of $2.15 per day; 3) Coal phase-out; 4) Country scores are provided in units of a standard normal distribution, ranging from -2.5 (weak performance) to 2.5 (strong performance) | Sources: World Bank; Our World in Data; IEA; Trading Economics; Bain analysis

Comprehensive policies that promote disclosure, provide incentives, and establish carbon pricing mechanisms are pivotal accelerators of progress

Disclosure and Standards

*"… top priority for buildings will be to introduce new builds with higher standards that fulfil **green loan principles.** It is important for SEA to catchup with current building standards in developed countries"*

Former COO, International Bank

*"… while building codes currently exist, it is key **to ensure that the codes are updated in tandem with innovation**"*

Strategy & Development, Investor

Incentives

*"… governments **need to enable the ecosystem through supporting green subsidies to trigger initial market movement**, before eventual market mechanisms start to work, and subsidies can then be reduced"*

Partner, Investor

*"… SEA has a challenge of lower than ideal setpoint temperatures due to inefficient cooling designs, which calls for **incentives like innovation grants to encourage investment in energy optimization technologies while maintaining indoor comfort level** and reducing energy consumption"*

Sustainability Director, Real Estate

Carbon Pricing

*"… there should **be involvement in carbon markets to facilitate economic neutrality** where players get remunerated by transiting away from fossil fuels"*

CEO, Renewables Company

*"… we need to see carbon pricing developed and connected across the region. It is **top priority for SEA to start introduction of carbon prices**"*

Head of Carbon Markets, International Bank

Current situation: SEA is making progress on more comprehensive policies for the green economy yet more work needed on investment incentives and carbon pricing infrastructure

Disclosure and Standards

6/10 **countries** have implemented **mandatory corporate disclosure**

4/10 **countries have set** legal mandates for **renewable energy portfolio mix**

6/10 **countries** participating in **ASEAN Taxonomy**

6/10 **countries have set minimum energy performance standards** (MEPS)
but most require update (established with ~4 years lag[1])

Incentives

6/10 **Countries have financial incentives** for renewable energy, electric vehicles, and green buildings

0/10 **Countries have large scale climate incentive programs** through a mix of tax incentives, grants, and loan guarantees targeting specific sectors, like US Inflation Reduction Act (IRA)

5/10 **Countries continue to provide fossil fuels subsidies** for end-use electricity, petroleum, coal and natural gas

Carbon Pricing

2/10 **Only Singapore and Indonesia** have adopted **carbon tax or emissions trading scheme** (ETS) while another 3 countries are still developing their policies

5/10 **Countries are** developing domestic **carbon market infrastructure**, registries

Note: 1) Average number of years since standard was adopted or revised in comparison to 2023
Sources: Lit. search; Bain analysis

Disclosure and standards: SEA has made progress to lay a regulatory foundation and provide clarity for corporates and investors on the landscape ahead

Why it is important

- Disclosure **guides investment decisions** towards corporates that engage in sustainable practices
- Standards like taxonomy framework offer **clear structure that provides assurance and instills confidence** in adopting new technologies that promote sustainable practices

SEA has made good progress to date on (non-exhaustive)

Disclosure

3/10 Countries with **no corporates** that have **set Science-Based Targets Initiative (STBi) targets**

8/10 Countries with corporates that **submitted responses to CDP**

Standards

6/10 Countries participating in **ASEAN Taxonomy**

4/10 Countries have set legal mandates for **renewable energy portfolio mix**

6/10 Countries have set **minimum energy performance standards**

Further opportunity (non-exhaustive)

Increase corporate adoption of

- **Accounting principles** like International Sustainability Standards Board (ISSB)
- **Increase corporate adoption** of science-aligned net-zero targets

Increase government adoption of

- **Gradual phase-outs** of legacy technology (e.g., internal combustion engine, coal plants)
- **Low carbon** performance standards
- Sustainable aviation fuel **blend mandate**

Sources: Lit. search; Bain analysis

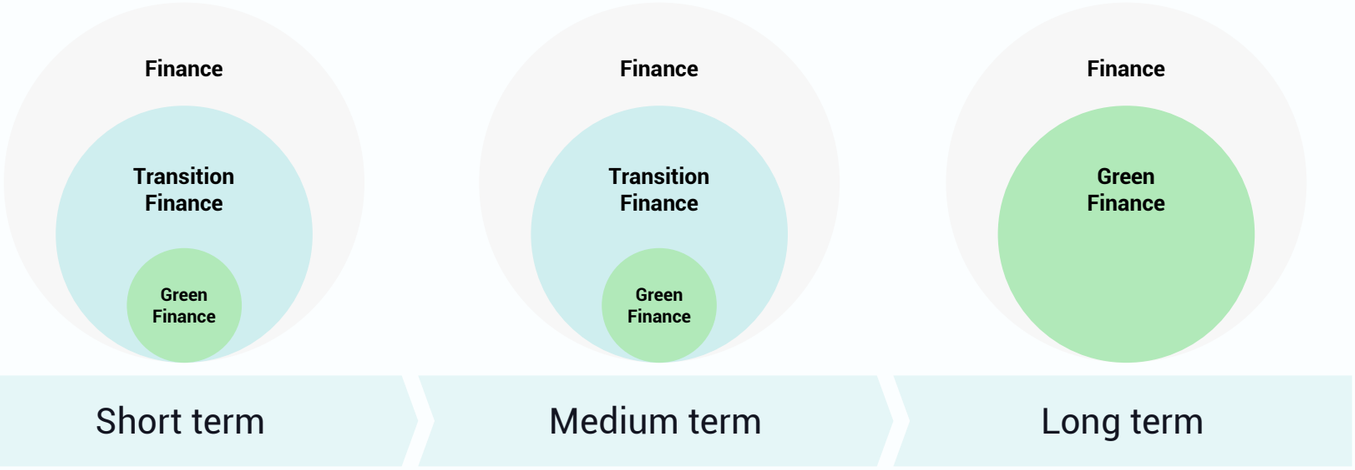
Case study: The EU's taxonomy offers lessons for SEA; highlights imperative for an integrated approach to transition & green finance

EU Taxonomy

- Ensure **EU sustainable finance** framework support private funding into **both green and transition projects**
- Necessitate **investments in transitional activities**, where green technologies are not yet available

Evolution

Relationship between green and transition finance today and over time



- Introduced in 2020 with **definition covering only green finance**
- Updated in 2023 to now **define sustainable finance** as financing **both** what is environment-friendly today **(green finance) and** transition to environment-friendly performance levels over time **(transition finance)**

Lesson for ASEAN

Evolve from green finance approach to integration with transition finance to **catalyze transformation at scale**

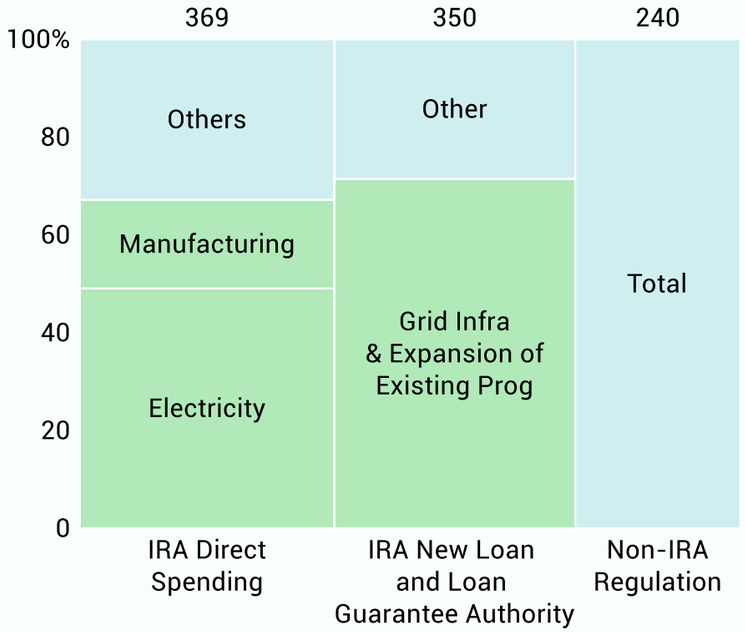
Encourage an inclusive definition of sustainable initiatives to **avoid limiting range of viable investments**
(e.g., ASEAN and Singapore-Asia Taxonomy both have a traffic light classification system)

Facilitate access to capital through a clear, **transparent governance framework**

Incentives: US IRA (Inflation Reduction Act, effective as of 2022) has successfully accelerated green investment, including for global players

IRA and other stimulus: >$1T in clean energy and manufacturing

Announced US public investment split by source ($B)



IRA policy is favoring investments in the US; for SEA companies too

$282B of investment across **280 clean energy projects** in 44 US states was announced in first year of IRA

Recent SEA momentum (non-exhaustive)

VinFast — Building an $4B EV plant in North Carolina

Maxeon — Planning to build $1B 3GW solar facility in New Mexico, pending loan approval

Indorama Ventures — Assessing plans to build lithium-ion battery solvents plant in Gulf Coast

Incentives can help to make nascent solutions like green hydrogen more viable

2022 levelized cost, H2, USD/kg

	2022 (global)	Post IRA (US gulf coast)[1]
Grey H2 (Fossil-based)	**$1-3.5**	
Blue H2 (with CCUS)	**$2-3.5**	**~$0.5-1**
Green H2 (Renewable energy-based)	**$3-6**	**~$0.5-3.5**

Notes: 1) Cost of blue after 45Q or 45V tax credit. Cost of green after renewable energy PTC and PTC combined with 45V tax credits | Sources: Kaya; GSA; Bain global H2 cost model

Incentives: SEA's fiscal incentives continue to remain limited and incongruent

Example: Energy incentives in SEA

$26B (2022)
$30B (2021)

SEA renewable energy investment[1]

VS

$117B (2022)
$48B (2021)

SEA fossil subsidies

- SEA continues to **incentivize fossil-based energy consumption**
  - Example; Indonesia, Vietnam, and Malaysia **provide subsidies for electricity and petroleum leading to below-market prices** that distort returns for renewable
  - Example: Indonesia has a **price cap on coal** supplied to keep electricity costs to consumers low

Example: Agriculture incentives in SEA

$378B (2022)

SEA Agriculture's GDP contribution

VS

$16B (2022)

SEA total support estimate

- **Financial support** for agriculture is **limited compared** to SEA **agriculture's GDP contribution**
- Support provided often goes into **non-sustainable practices** despite original intent to support economic development and fertilizer industry
  - Example: encourage **excess fertilizer usage** and **expand agricultural area into forests**

Notes: 1) Investment in solar, wind, geothermal, hydro, nuclear, biopower
Sources: GlobalData; OECD; World Bank; ADB; Bain analysis

Incentives: Given limited financial resources, SEA governments should focus where strategic impact and acceleration is greatest to define their own fit-for-purpose IRA

SEA has limited funds and many competing economic needs

Stage of economic development

- **GDP per capita is low** at $6K in 2023 (vs. $63K in N. America)
- **Emerging middle-class economies**, which means rapid growth in resources and energy demand
- **SEA will see a ~40% increase in power demand** this decade to be met while going green
- **Just transition for all stakeholders** poses challenges

SEA should prioritize action based on its advantages and define what is the region's answer to scale incentives that drives green investments

1 Accelerate critical industries

Implement measures to support **decarbonization pathway** of strategic industries

2 Support growing green exports

Strategically align and focus on emerging green industries (e.g., sustainable minerals mining) and ensure strategic competitiveness (e.g., electric vehicles)

3 Promote nature conservation

Support projects and practices that enable **sustainable land use and value nature**

4 Catalyze grid infrastructure

Allocate resources to **enhance grid infrastructure** and support transition to green energy sources

5 Ensure a just transition

Incorporate programs to ensure **access to clean and affordable energy** and equip workforce with skills needed for new green jobs to **minimize job losses**

6 Drive agriculture transition

Encourage the adoption of regenerative practices by small farmers at a reasonable scale

Sources: Expert interview; Lit. search; Bain analysis

Carbon pricing: Global experience offers a roadmap for SEA to draw upon

Carbon tax

- **National governments** impose **fixed-price per ton** of carbon emitted

Coverage of global emissions

- **Implemented** in Singapore, Japan, Sweden, etc.

- **Predictable carbon cost**
- **Easy to enforce** into tax system

Emissions trading scheme (ETS)

- **National governments** issue a **fixed number of tradeable permits** to limit emissions

Coverage of global emissions

- **Implemented** in Indonesia, European Union, China, etc.

- **Capped emissions** offers certainty in **exact emissions reduction**

Article 6 of Paris Agreement (Bilateral Agreements)

- **National governments** are **piloting Article 6** collaboration with other nations

81 Bilateral agreements implemented as of 2023

- **Signed** by Switzerland, Thailand, Ghana, Singapore, Japan, South Korea, etc.

- **Foster global cooperation** and indicate firm demand
- **Enhance transparency** for emissions reduction projects

Voluntary carbon market

- **Corporates purchase tradeable carbon credits to** voluntarily offset emissions
- Operates separately from national reduction targets
- Requires integrity to ensure the quality of carbon credit

- **Support new innovative** development/capital flows
- **Facilitate global financing** for new carbon projects

Sources: UNEP-CCC; Lit. search; Bain analysis

Carbon pricing: SEA is making steady progress on carbon pricing related policies

Stages	Pre-design	Carbon pricing design in-development	Carbon pricing enforced	Bilateral Agreements[1] signed
	Philippines, Laos PDR, Myanmar, Brunei, Cambodia			Singapore — Carbon tax
		Vietnam, Thailand	Indonesia	ETS
		Malaysia — Undecided		

Note: 1) Under Article 6 of the Paris Agreement
Sources: Lit. search; Bain analysis

Carbon pricing: Many countries are considering how to implement carbon pricing and markets

Country	System	Coverage	Country's journey	Results
Singapore	Carbon tax	Covers **~80% of GHG emissions**	• 2015 to 2019: Develop carbon pricing **strategy** • 2019: Introduce **carbon tax** on large emitters • 2024: Allow 5% of emissions to be **offset with international carbon credits** to facilitate international alignment	Aim to support Singapore's net-zero target by 2050
Indonesia	ETS	Covers **~36% of GHG emissions**	• 2018: Publish **MRV[1] guideline** for power after emissions profile and cost study; examine instrument options and conduct **stakeholder consultations** • 2021: Issue **national framework** for carbon pricing • 2023: Launch **mandatory ETS** for power sector	Expect reduction of 500,000 $tCO2e^2$ in power sector in 2023
Thailand	ETS	**In development** with initial target on GHG-intensive industrial sectors	• 2013: Develop **pilot MRV[1]** system with industrial sectors • 2018: Establish **mandate to design** pricing instruments • 2022: Conduct **capacity building** activities • 2023: Authorized and **transferred the world's first ITMOs** from a bus electrification project with Switzerland.	Aim to support commitment to reduce emissions by 20.8% by 2030
Vietnam	ETS	**In development** with initial target on steel, cement, thermal power	• 2021: Establish **mandate** to design national crediting mechanism (NCM) and a domestic ETS • 2022: Outline **implementation roadmap** for sectors • 2023: Plan to **establish ETS** in 2028; signed **Article 6.2 agreements** with Japan, Singapore, and South Korea	Not applicable
Malaysia	Undecided	**Under discussion** to design framework	• 2021: Engage state governments and corporate sector with aim to **align policies** and regulation • 2023: Conduct study to **develop design** framework	Not applicable

Notes: 1) Monitoring, reporting, and verification; 2) Metric ton of carbon dioxide equivalent
Sources: International Carbon Action Partnership; World Bank Group; IMF; Lit. search; Bain analysis

Case study: Singapore has achieved growth in manufacturing sector and attracted global investments while implementing its carbon tax system

Singapore's carbon tax system

Covers **80% of large emitters** above 25,000 tCO2e annually

2019
Implement carbon tax
- Set at S$5/tCO2e

2022
Introduce progressive tax rate and international carbon credits framework
- S$25/tCO2e in 2024, S$45/tCO2e in 2026, SS$50–80/tCO2e by 2030;
- Potential to offset up to 5% of taxable emission

2023
Implementation agreement via Article 6 of Paris Agreement
- First agreement signed with Papua New Guinea

Results and learning points

Presence of a robust carbon ecosystem is favoring investments

4%	Average year-on-year manufacturing growth (2019–23)
EDP Renewables	Invest ~S$10B to establish APAC headquarters in Singapore due to "ecosystem of clean energy"
Sylvera	Set up Singapore office for APAC expansion in partnership with the Singapore government

- **Gradual and firm** carbon tax pricing helps **manage international competitiveness**
- **Focus on large emitters** reduces burden on SMEs[1]
- **Collaborative** nature with frequent public consultations brings **trust and transparency**

Note: 1) Small and medium enterprises; Sources: SingStat; Lit. search; Bain analysis

Voluntary carbon markets: SEA countries seek development of national carbon markets and related infrastructure as a priority to attract investment

Carbon registry and carbon market status

Country	Carbon credit projects	Standards	Exchange mechanism	Voluntary vs. mandatory	Progress to date	Expected potential
Malaysia	Host country for **technology-based** and **nature-based** carbon credits	Adopt **Verified Carbon Standard** from Verra, and other standards	**Domestic** Shariah-compliant Bursa Carbon Exchange (BCX)	**Voluntary registry** Malaysian National Carbon Credit Registry (MYNCCR)	Transacted ~17K Verra-registered carbon credits	Expect ~100K credits annually from forestland carbon stock
Vietnam	• **In process** of establishing voluntary domestic ASEAN Carbon Credit Exchange (CCTPA) with pilot in 2025 and expected to be operational by 2028 • Currently trades on global carbon markets				-	Expect ~10M credits annually
Thailand	Host country for **renewable energy** certificates and **nature-based** carbon credits	Adopt **local carbon standards** verified by Thailand Voluntary Emission Reduction, and other standards	**Domestic** Federation of Thai Industries Carbon Credit Exchange (FTIX)	Voluntary registry T-VER	Transacted ~ 1M carbon credits	Expect ~4M credits annually from alternative energy sources
Indonesia	Host country for **technology-based** and **nature-based** carbon credits	Potentially developing and adopting **local carbon standards** verified by Sistem Registri Nasional	**Domestic** Indonesia Carbon Exchange (IDX)	**Mandatory national registry** SRN	Transacted ~500K carbon credits from energy sector	Expect ~7M credits annually from forestland carbon stock
Singapore	**Buyer of carbon credit projects** from other host countries	Accept credits **verified by global standards** such as Verra and Gold Standard	**Several global exchanges** (e.g., Climate Impact X (CIX))	**In process** of establishing a mandatory national registry	Transacted ~1M nature-based carbon credits	Allow 5% of emissions to be offset with international carbon credits

Sources: Lit. search; Bain analysis

Carbon markets and pricing: SEA should prioritize work on domestic carbon markets in 2024

1 Accelerate setup of domestic carbon market

- Complete work on **national registries, standards, and markets for voluntary trade**
- **Incentivize carbon market** adoption with focus on **transparent and uniform standards**
  - ICVCM[1] Core Carbon Principles sets guidelines for quality assurance

2 Establish global/regional carbon market connectivity

- Implement market measures to allow **export of carbon credits to international offtakers**
- **Fungibility of investment and capabilities**

3 Harmonize carbon data

- Connect **data from separate registries** to avoid double counting, build trust in markets
  - Climate Action Data Trust (CAD Trust), launched in 2022 in collaboration with the Singapore government, integrates data from separate registries to improve transparency in carbon credits

4 Diversify emissions products for carbon market

- Expand scope of emissions product beyond nature to include **broader range of emissions reduction and removal approaches**
  - Transition credits support the shift to renewable energy, adoption of low-carbon technologies, and sustainable practices across different sectors

5 Policy implications on carbon pricing from CBAM[2]

- Monitor and consider policy tools like **carbon pricing** to cushion potential **impact on exports** of carbon intensive products, trade levels, GDP, and economic growth
  - CBAM equalized the price of carbon for domestic products and imports

6 Strengthen green capabilities

- Institute **capability-building initiatives to upskill** community and bring specific expertise
  - Under the Singapore Green Plan, development of carbon services ecosystem can create more than 50,000 related new jobs by 2030
  - Workforce Singapore launched career conversion programme to support reskilling of 200 workers to green roles

Notes: 1) Integrity Council for the Voluntary Carbon Market; 2) Carbon Border Adjustment Mechanism is designed to place a carbon price on imports of certain goods from outside the EU with current transitional phase lasting between 2023 and 2026 and initially apply to imports of cement, iron and steel, aluminum, fertilizers, electricity and hydrogen; Sources: Expert interview; Lit. search; Bain analysis

Recommendations: Governments need to push further on comprehensive foundational policies

Five accelerators

1. **Policies and incentives**
2. Innovative finance mechanism
3. Scaling private corporate investment
4. Cluster/pilot developments
5. Regional collaboration

Immediate recommendations

Disclosure and standards

- SEA governments are taking actions—but a more **integrated approach** is needed considering **transition and green investments** that acknowledges local challenges
- **Continued adoption of disclosure and standards** is needed to recognize companies that are leading and pressure laggards to act

Incentives

- Given limited set of funds and competing constraints, government should prioritize and focus **green incentives** on advantages and immediate needs
- **Prioritizing six actions is essential to accelerate progress**
  - Accelerate critical industry; Support growing green exports; Promote nature conservation; Catalyze grid infrastructure; Ensure a just transition; Drive agriculture transition

Carbon pricing

- Government are making progress on **carbon pricing** and building **national carbon markets**
- **Prioritizing six actions is essential to accelerate progress**
  - Set up carbon markets; Align global/regional connectivity; Harmonize carbon data; Diversify emissions products; Assess implications from CBAM[1]; Strengthen green capabilities

Note: 1) Carbon Border Adjustment Mechanism
Sources: Expert interview; Bain analysis

Five accelerators can help build ecosystems near-term and bring investment to scale

1 Policies and incentives

2 **Innovative finance mechanisms**

3 Scaling private corporate investment

4 Cluster/pilot developments

5 Regional collaboration

Voice of investors: Innovations and scaling of catalytic financing are needed to address emerging market risks, higher cost of capital, and optimize green economics

Catalytic capital needed to catalyze investment

Finance experts in the market emphasize that blended finance will be the key accelerator for decarbonization in the region in the short term

*"Scaling concessional fund is not the piece to solve… **Blended finance is the only short-term solution for the next 2-3 years to build ecosystem and track record, acting as catalyzer**"*

Asset Manager, Global Investment Management Firm

*"In the Philippines, **blended finance is definitely needed due to a clear gap which cannot be filled** by existing market sources"*

CEO, Sustainable Infrastructure Financing Platform

*"Although it is still nascent, there is a great potential in blended finance as **key stakeholders from public and private sectors all have a lot of interest**"*

Member of GFANZ

*"**Blended finance is essential as public funds serve as a catalyst to mobilize private fund**, resulting in an overall increase in capital for projects …"*

Former Operations & Strategy Officer, MDB

Other innovations like transition credits

Interest in new ideas like transition credits, particularly in Singapore, to drive transition

*"There are ongoing works on energy transition, **especially focusing on transition financing and credits**"*

Head of Carbon Markets, Standard Chartered Bank

*"New methodologies for **transition credits require the region to develop new renewables capacity** to manage coal phase-out"*

Chief of Staff, GenZero

Sources: Expert interview; Lit. search; Bain analysis

Solutions: SEA funds and banks are starting to address financing challenges via innovative mechanisms like blended finance and carbon credits

Challenges today

High perceived or real risk
- Creditworthiness of PPA offtakers
- Permitting and grid connection
- Long-term stability of green policies

Emerging market risks
- Currency and exchange rate volatility
- Depth and maturity of capital markets
- Political stability and governance

Underlying financial system
- Requires capital markets or domestic financial institution to participate

Innovative finance mechanisms addressing challenges today

Blended finance
Approach leveraging different catalytic sources to attract private capital

Catalytic capital[1]	Guarantee	Additional assistance
Funding with favorable terms for projects/funds	Assurance for stakeholders on outcomes/obligations	Assistance enhancing project performance
Subordinated debt	Credit guarantee	Technical assistance
Below market-rate debt		
Junior equity	Risk guarantee—e.g., PPA	Project preparation grant
Capped return equity		
Concessional fund		

Carbon credits
Tradeable units issued based on CO_2 emissions removed, serving as a financing tool for transition projects

Transition credits
Other carbon credits

Note: 1) Types of catalytic capital are not limited to ones listed but encompass more granularity
Sources: Convergence; IFC; WFP; OECD; Bridgespan; Expert interview; Lit. search; Bain analysis

Blended finance is not the silver bullet but a catalytic first step to unlocking capital for transition

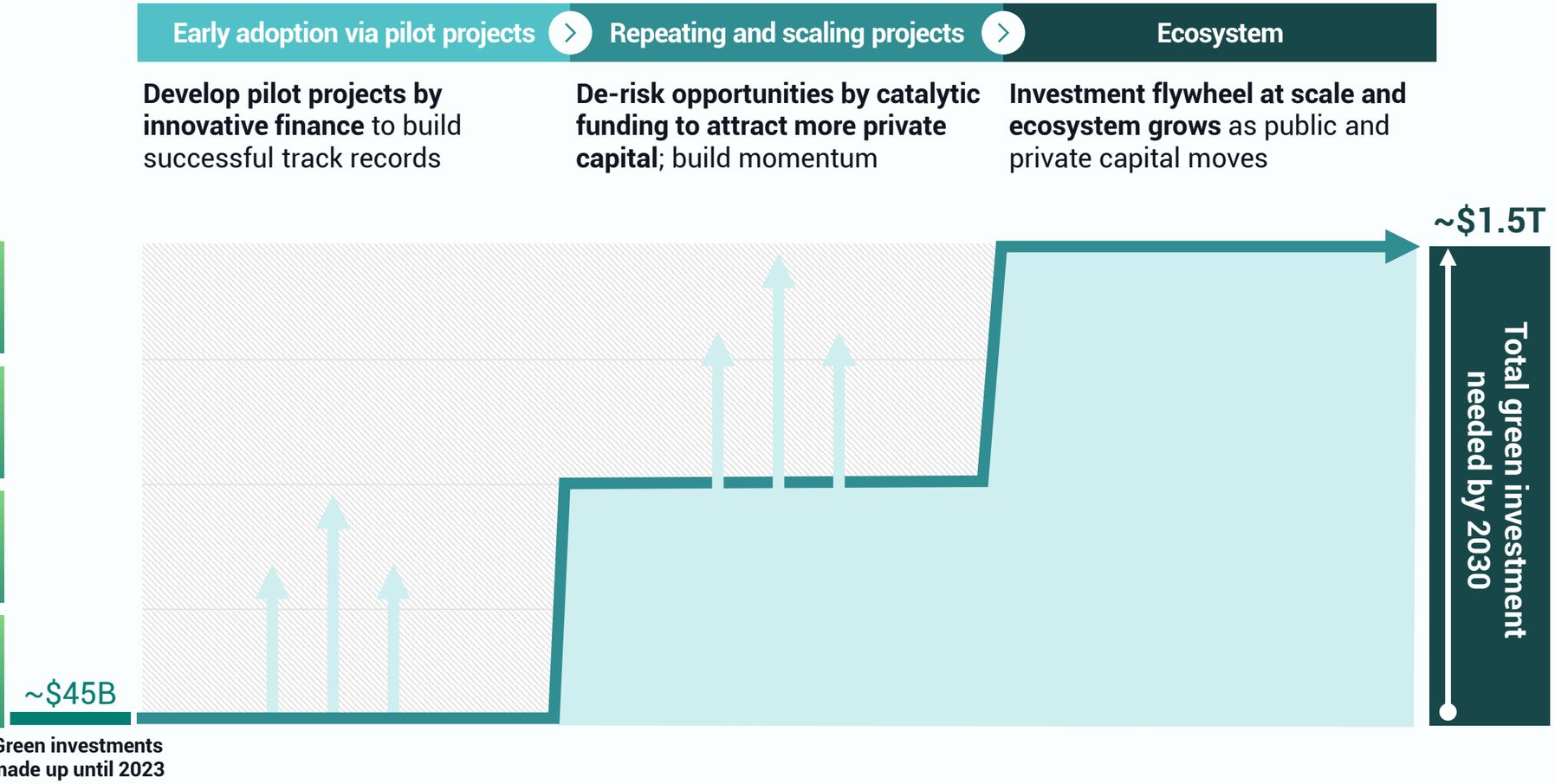
What do we need to do to accelerate blended finance?

Policy
Unlocking policies on financial incentives and regulatory frameworks

Public-private partnership
Collaborating at regional level and through industrial clusters

Talent
Having pool of talents with expertise on innovative finance and the region

Projects
Creating sufficient projects to build track records with proven results



Sources: Expert interview; Lit. search; Bain analysis

Innovative finance structures can vary depending on the fund or project, with different catalytic funds tailored to specific needs

Catalytic capital

Subordinated debt
Debt with lower priority in liquidation or bankruptcy proceedings

Below-market-rate debt
Loan with interest rates lower than the market rate

Junior equity
Equity positioning at bottom of the repayment hierarchy and is the first in, last out

Capped return equity
Equity investment with a predetermined maximum profit

Concessional fund

Guarantee

Credit guarantee
Reduce lenders' and investors' risk or access to funding by absorbing a share of potential losses and improving creditworthiness, typically in exchange for payment

Volume guarantee
Ensure specific amount of future revenue through volume (e.g., PPAs[1])

Additional assistance

Technical assistance (TA)
Talent or capability support assisting feasibility testing for early-stage projects and structuring during funding stage

Project preparation grant
Fund provided with no expectation of returns to support technical assistance if meeting other set KPIs

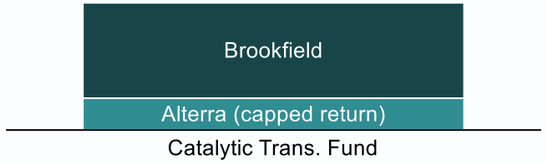
High-quality carbon credits

Transition credits
Carbon credits generated from replacing high-emission assets, like CFPPs[2], with clean energy sources

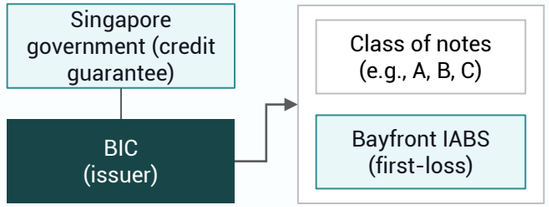
Other carbon credits
Carbon credits generated from other activities and projects

Exemplary structures

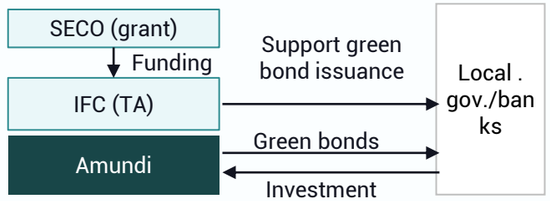
Capped return equity: Alterra is investing with capped return, enabling others to receive excess returns



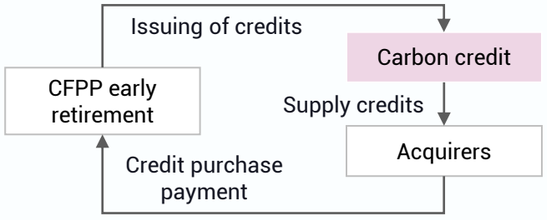
Credit guarantee: Securities with Singapore gov. guarantees & Bayfront investing in the first-loss tranche



Technical assistance: IFC[3], with grant funded by SECO[4], has supported local financial institutions to issue green bonds in EMs[5]



Transition credits: For coal phase-out, providing extra source of revenue making project more fundable



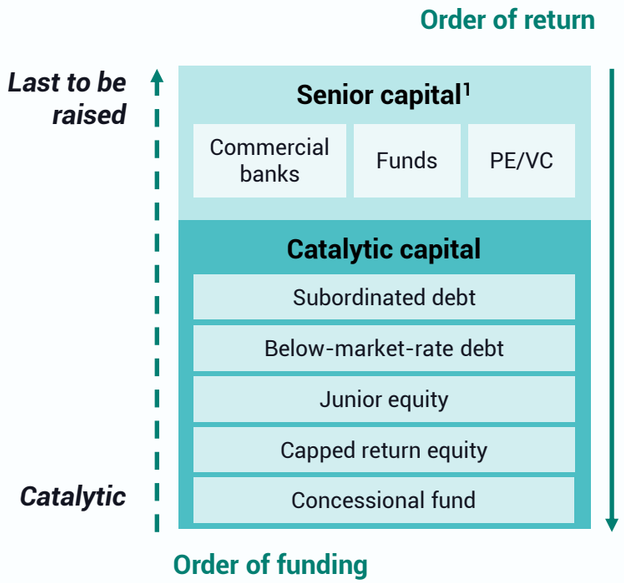
Notes: 1) Power Purchase Agreements; 2) Coal-fired power plants; 3) International Finance Corporation; 4) Swiss Secretariat for Economic Affairs; 5) Emerging markets
Sources: Convergence; IFC; WFP; OECD; Bridgespan; Expert interview; Lit. search; Bain analysis

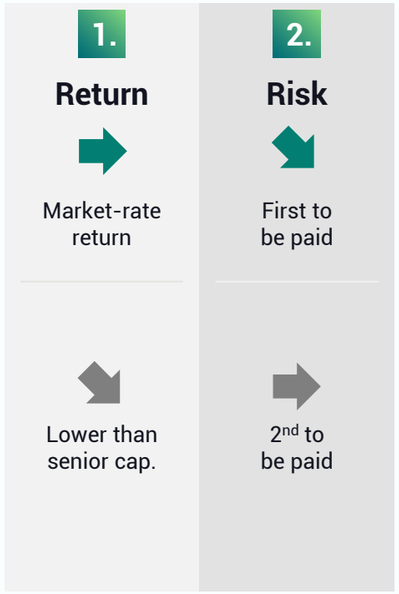
What is blended finance? One of the solutions to unlock the full potential of green investments through attracting more commercial capital

Definition: Blended finance

Blended finance is an **approach that combines multiple financial structures** by **leveraging catalytic sources to attract more private capital**
- Catalytic sources include but are not limited to catalytic capital, guarantee, additional assistance, and high-quality carbon credits

Example structure of blended finance





1. Lower cost of capital

- Catalytic capital is deployed at **a different risk-return profile**
- **Lower interest for developers to pay**; leads to **reduced cost of capital**

2. Lower risks

- Capital structure leads to **lower risks for private investors**
- Public-private joint structure **helps de-risk** certain risks

Benefits of blended finance

Increase in fundable projects by reducing **cost of capital** through below-market catalytic capital

Boost in private green investments by **de-risking the overall project** via catalytic capital

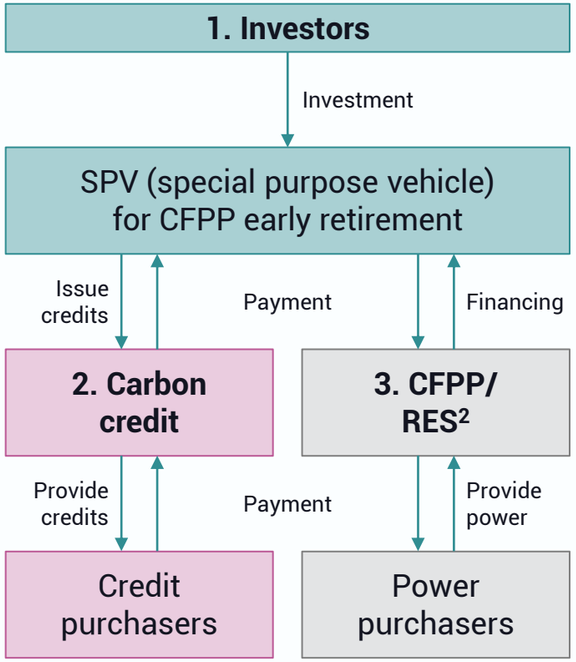
Unlock the potential of different decarbonization ideas to achieve net-zero targets set by 2050

Note: 1) Capital refers to either equity or debt
Sources: Convergence; Expert interview; Lit. search; Bain analysis

How can it be enhanced? Harnessing carbon markets to enable greater capital flow to accelerate decarbonization/transition opportunities

Definition: Carbon credit

Transition credit is a type of carbon credit to **bridge the financing gap** for early retirement of CFPPs. High-integrity carbon credits can be issued to generate a **new revenue source** to facilitate the transition process.



1. Financing & developing project

- Identify funding gap and investors, and develop a project for early retirement of CFPPs

2. Issuing carbon credits

- Register projects under carbon credit programs and issue carbon credits
- Estimate the price of carbon credits and negotiate with potential buyers

3. Replacing coal-generated power

- Select RES developer and sign MOUs[3] with potential clean energy purchaser to replace coal-generated energy

Benefits of carbon credits

High integrity carbon credits can guarantee **new revenue source** through issuing and selling carbon credits

High integrity carbon credits can be an added toolkit to bridge the financing gap between the required capital globally (e.g., $20/tCO2e) to retire CFPP and replace them with renewables

However, high integrity carbon credit may not fill all the necessary financial gap required for CCFP retirement and will not fully address the energy reliability consideration

Notes: 1) Coal-fired power plants; 2) Renewable energy source; 3) Memorandum of Understanding
Sources: Monetary Authority of Singapore; GRANZ; IFC; Expert interview; Lit. search

Southeast Asia has seen several projects/funds in recent years that offer new approaches to address green investment challenges through catalytic ideas

Case study overview

				Key characteristics			
1.	**ADB Laos Wind Project (2023)**		Laos PDR	$692M **loan financing** for onshore wind project, led by ADB[1]	Catalytic capital	Guarantee	Additional assistance	Carbon credit
2.	**Pentagreen Capital PH Solar Project (2023)**		Philippines	$100M **mezzanine construction green loan facility** for solar project formed by Pentagreen Capital and Citicore Renewable Energy	Catalytic capital	Guarantee	Additional assistance	Carbon credit
3.	**Southeast Asia Clean Energy Fund II (2024)**		SEA	$127M fund for **equity acquisition** of early-stage climate infrastructure projects	Catalytic capital	Guarantee	Additional assistance	Carbon credit
4.	**Bayfront IABS (2021~[2])**		Asia	Structured and issued 3 **projects and infrastructure debt securitization transactions** with major banks worth **~$400M each** for eligible green and social asset	Catalytic capital	Guarantee	Additional assistance	Carbon credit
5.	**Emerging Green One Fund (2018~[2])**		Emerging markets	$1.4B **fund investing in green bonds** issued by local financial institutions, launched by Amundi and IFC[3]	Catalytic capital	Guarantee	Additional assistance	Carbon credit
6.	**ACEN Early Retirement of CFPP[4] (2022)**		Philippines	$310M investment in **debt and equity** being first successful market-based ETM[5] project, and has been selected as pilot project for **transition credits**	Catalytic capital	Guarantee	Additional assistance	Carbon credit

Notes: 1) Asian Development Bank; 2) Repeatedly formed since the presented year; 3) International Finance Corporation; 4) coal-fired power plants; 5) Energy Transition Mechanism
Sources: Expert interview; Lit. search; Bain analysis

Case study #1: ADB Laos Wind Project

Case study highlight

Catalytic capital and guarantee of future revenue via PPA[1] played major roles in de-risking the investment and attracting private investors

Project overview

In March 2023, ADB[2] led financing structuring and packaging **$692M loan financing for 600 MW Monsoon onshore wind project in Laos**

$60M size of catalytic capital initially raised to mobilize the investment

Catalytic capital from JICA[3] ($20M), CFPS[4] ($30M), and ADB ($10M)

Plans to finish construction and begin operation of wind farm in year 2025

PPA signed with Vietnam Electricity

Project shareholder

Lender			Developer
CFPS	JICA	ADB	BCPG
Kasi-korn	SMBC[5]	SCB[6]	IES[7]
			Mitsubishi Corp.

Challenge & enabler

Challenge

Hard to attract investors due to low return nature

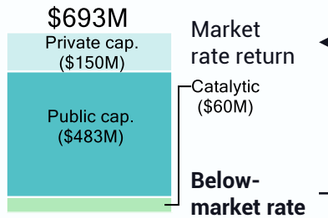
Longer time to realize return prevents green deals from investments

Due to the characteristic of infrastructure investment that has long duration for return

How it was addressed

1. Catalytic capital | 2. Guarantee | Additional assistance | Carbon credit

1 Below-market rate loan and grant lowered capital costs



Make project bankable for investors through catalytic capital, including loan and grant

2 Future volume guarantee provided

Signed 25-years-long PPA with Vietnam Electricity

Provide investors **assurance as future revenue is guaranteed, thus providing certainty on expected returns**

Notes: 1) Power Purchase Agreement; 2) Asian Development Bank; 3) Japan International Cooperation Agency; 4) Canadian Climate Fund for the Private Sector; 5) Sumitomo Mitsui Banking Corporation; 6) Siam Commercial Bank; 7) Impact Electrons Siam Limited; Sources: Expert interview; Lit. search; Bain analysis

Case study #2: Pentagreen Capital Philippines solar project

Case study highlight

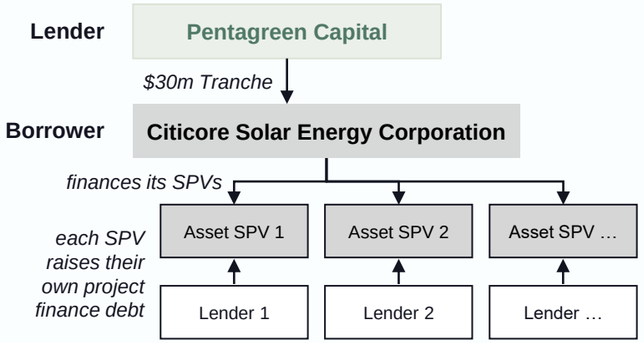
Pentagreen Capital provided mezzanine debt to Citicore Solar Energy Corporation ("CSEC") at its HoldCo level to finance greenfield assets held at its SPV[1] level

Project overview

In September 2023, Pentagreen Capital structured a $100 million Mezzanine Construction Green Loan Facility and **committed an initial tranche of $30 million with CSEC**

CSEC is a holding company which owns interest in dedicated Asset SPVs which in turn shall raise project finance debt from a mix of local banks and international project finance lenders—**Pentagreen's loan is structurally subordinated to the senior secured project finance debt at the Asset SPV level**

The debt will **finance a portfolio of six solar power projects with gross capacity of 490 MWs** with option to increase the committed amount to $100 million to fund additional greenfield solar projects



Challenge & enabler

Challenge

- **Bankability constraint in early construction phase infrastructure projects**
  - Subordinated debt is too high risk for commercial banks
  - Too "greenfield" (assets in construction) for private credit

How it was addressed

1. Catalytic capital | Guarantee | Additional assistance | Carbon credit

1 Improved the bankability of the situation

Pentagreen is a non-bank financial institution with a balance sheet that is able to take and price subordinated risk appropriately; it also has the know-how around construction risk mitigation

Despite improved bankability, it is only with further blended finance can such deals be sufficiently de-risk for banks/institutional investors and be funded repeatedly to fill infrastructure investment gaps

Note: 1) Special purpose vehicle
Sources: Expert interview; Lit. search; Bain analysis

Case study #3: Southeast Asia Clean Energy Fund II

Case study highlight

The risk in early-stage projects is mitigated by track record of catalytic capital investment

Project overview

In January 2024, Southeast Asia Clean Energy Fund II (SEACEF II) **raised $127M to invest in early-stage climate infrastructure**, six times bigger than the previous fund

The fund's first close includes **both junior equity**, primarily philanthropic and government-supported organizations, **and senior equity investors**

Focuses on proven countries and technologies (e.g., E-mobility, grid infrastructure), **and aiming to make 25-30 investments** in the coming years

Project shareholder	
Equity	
Junior	Senior
ACP[1]	BII[4]
ADI[2]	FMO[5]
GEAPP[3]	IFC[6]
...	...

Challenge & enabler

Challenge

Hard to attract diverse investors in **early-stage infrastructure projects due to high risks**

- Volatility of regulations increases the country risks

How it was addressed

1. Catalytic capital | Guarantee | Additional assistance | Carbon credit

1 Attracted senior equity by proving the viability with catalytic capital

Notes: 1) Allied Climate Partners; 2) Australian Development Investments; 3) Global Energy Alliance for People and Planet; 4) British International Investment; 5) Dutch Entrepreneurial Development Bank; 6) International Finance Corporation
Sources: SEACEF; Expert interview; Lit. search; Bain analysis

Case study #4: Bayfront IABS

Case study highlight

Has attracted private capital through issuing Asia infrastructure asset-backed securities (IABS) with Bayfront investing in first-loss tranche and guarantees from the Singapore government

Project overview

Bayfront has been established in 2019 **based on successful issuance of Asia's first infrastructure debt securitization transaction** in 2018

- Bayfront shareholders are Clifford Capital (70%) and AIIB[2] (30%)

Has **structured and issued three additional transactions to date**

- Size of ~$400M for each issuance, consisting of 4–5 tranches of rated notes

Bayfront investing in majority of first-loss tranche, acting as the risk mitigator for private investors

Challenge & enabler

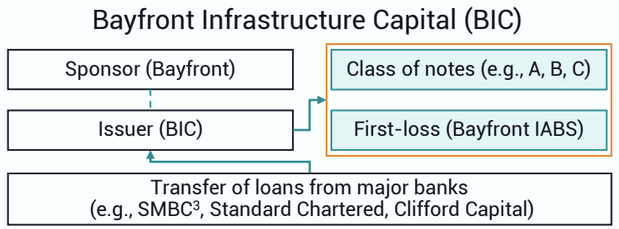
Challenge

Hesitations exist among investors due to the risks and barriers to entry (e.g., sub-investment grade ratings, illiquidity, etc.) associated with committing capital to infrastructure projects situated within the Asian region

How it was addressed

1. Catalytic capital | **2. Guarantee** | Additional assistance | Carbon credit

1 Bayfront invested in first-loss tranche and providing various classes of notes



2 Credibility and access to funding enhanced by the government guarantee

- **Singapore government provides a $2B guarantee** for debt instruments, loans, or other credits issued by Bayfront
  - Bond issued by Bayfront is rated high investment grade of AAA by S&P, resulting in attracting private investors

Notes: 1) Bayfront Infrastructure Capital; 2) Asian Infrastructure Investment Bank; 3) Sumitomo Mitsui Banking Corporation; Sources: Bayfront Capital; Lit. search; Bain analysis

Case study #5: Emerging Green One Fund

Case study highlight

Success has been driven by the involvement of public and MDBs investment in junior class shares and the technical assistance from IFC

Project overview

In 2018, IFC[1] and Amundi announced launch of **$1.4B green fund** focused on investing in **green bonds issued by financial institutions in emerging markets**

As of 2022, the fund has expanded to include 34 green bonds in 14 emerging markets

Challenge & enabler

Challenge

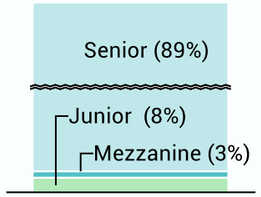
Difficult to attract investors due to high risks in investing in emerging markets

Challenging to issue green bonds due to insufficient experience and expertise in the emerging markets

How it was addressed

1. Catalytic capital | Guarantee | 3. Additional assistance | Carbon credit

1 Risk cushion provided through junior and mezzanine class shares



- ~8% of the fund structured with junior class shares backed by public investors and DFI/MDBs[2]
- $256M commitment from IFC as first-loss position

3 IFC-managed comprehensive technical assistance program

- Has supported local financial institutions to **issue green bonds in emerging markets**
- Has offered **educational programs for banks** to improve their expertise in green investment

Notes: 1) International Finance Corporation; 2) Development Finance Institutions/Multilateral Development Banks; Sources: Expert interview; Lit. search; Bain analysis

Case study #6: ACEN early retirement of coal-fired power plant

Case study highlight

Enabling early retirement of coal-fired power plant (CFPP) by generating new revenue source through investment in renewable energy and issuance of transition credits

Project overview

In 2022, ACEN successfully launched first market-based Energy Transition Mechanism (ETM), reducing SLTEC[1] **246 MW CFPP** lifetime by **half from 50 years to 25 years**

Market-based ETM has involved total **investment value of $310M** from both private and public sectors

- ~$243M debt financing from commercial banks, ~$67M equity share from GSIS[2], InLife, ETM, and ~$128M to reinvest in renewable energy

ACEN, CCCI[3], and MAS[4] plan to pilot **SLTEC for transition credits to further accelerate CFPP retirement**

Challenge & enabler

Challenge

Challenging to generate a reasonable risk-reward profile for early retirement of CFPPs
Conflicting incentives for corporates and there are countries with dependency on fossil fuel such as coal

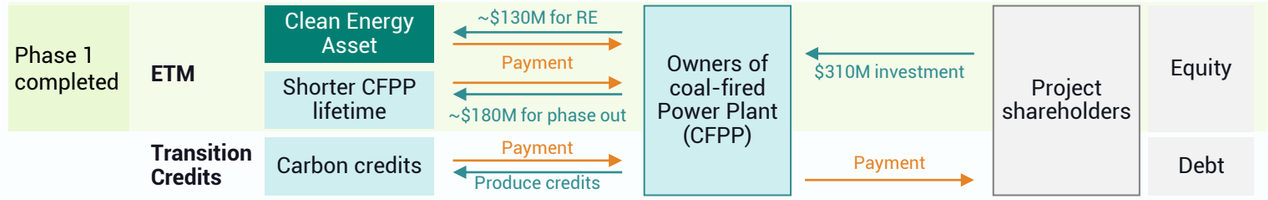
Lack of coal optimization efforts due to low-return nature of MPO[5]

How it was addressed

Catalytic capital | Guarantee | Additional assistance | **4. Carbon credit**

4 **Replace coal phase-out** with reinvestment on **renewable energy**

4 **New revenue source is provided** by producing and supplying **carbon credits**



Notes: 1) South Luzon Thermal Energy Corporation; 2) Government Service Insurance System; 3) Coal to Clean Credit Initiative; 4); The Monetary Authority of Singapore 5) managed phase-out
Sources: Expert interview; Lit. search; Bain analysis

Lessons from recent projects: Higher risks and lower return nature of green projects can be overcome by integrated approach stacking different interventions

Key learnings from early SEA pilots

Catalytic capital

- **Each pilot project utilized varied methods around catalytic capital** to unlock additional capital, tailored for specific situations (e.g., securitization of green loans by Bayfront; equity acquisition of early-stage projects by SEACEF[1] II)

Guarantee

- **Guarantees reduced cost of capital by de-risking real or perceived risks**, even though no funding is provided directly (e.g., government guarantee for Bayfront IABS[2])
- **Volume guarantee (e.g., Power Purchase Agreements) provides certainty on the expected return**, drawing more private investors

Additional assistance

- Beyond providing funds, **assistance includes broader capacity building** around design of enabling policies, get project pipeline development going, facilitate green bond issuance (e.g., project bundling by Pentagreen; training programs for bankers by IFC[3])

Carbon credits

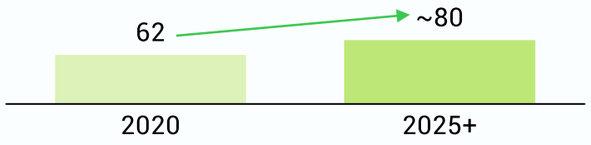
- **High integrity carbon credits** can unlock greater capital to global south including SEA and enhance economics in favor of green/transition opportunities

Notes: 1) Southeast Asia Clean Energy Fund; 2) Infrastructure asset-backed securities; 3) International Finance Corporation; Sources: Expert interview; Lit.search; Bain analysis

Potential size: By growing available concessional funds and more effectively utilizing for blended finance, the potential blended finance pool could be increased 8-10x to up to $20B annually

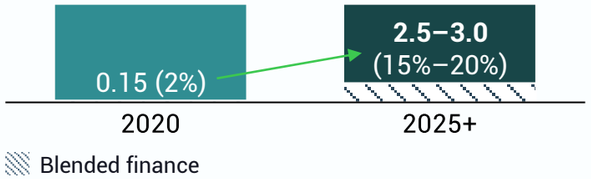
Headroom to increase scale of SEA concessional funds used for blended finance

Global concessional fund (USD, B)



SEA share of global concessional fund (USD B, %)

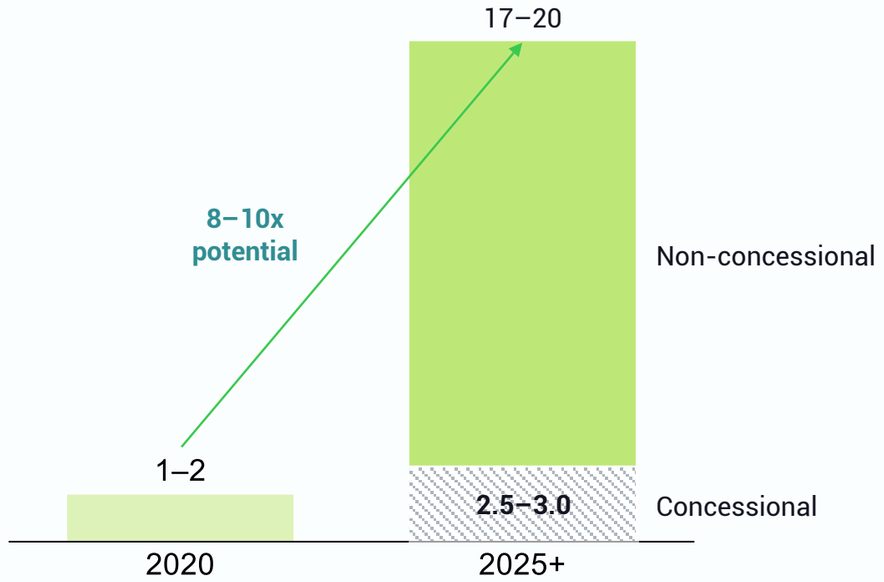
SEA concessional fund used for blended finance (USD B, %)



2020	2025+
$62B Global concessional fund (2020)	~$80B Potential global concessional fund *(assuming historical pre-COVID growth)*
X	X
14% SEA share of global concessional fund (2020)	~20% SEA share of global concessional funds with increasing momentum and headroom *(e.g., SEA region captures up to 20% of global FDI inflows annually)*
X	X
2% Concessional fund used in blended finance (2020)	~15%–20% of SEA concessional fund as seed for blended finance vs. historical 5-year average ~5%
=	=
$0.15B	**~$2.5–$3.0B**

Which could imply a $17B–$20B blended finance pool

Blended finance in SEA (USD, B)



Concessional fund typically forms 10%–20% of blended finance

Sources: Lit. search; Bain analysis

Recommendations: Scaling blended finance needs more project "proof points" in the next 2–3 years, a larger project funnel, capability building, and a strategic focus on where capital matters most

Five accelerators

1 Policies and incentives

2 **Innovative finance mechanism**

3 Scaling private corporate investment

4 Cluster/pilot developments

5 Regional collaboration

Immediate recommendations

Set up supportive policies

- **Align interests for policy establishment:** coordinate stakeholders to implement carbon pricing and financial incentives that encourage more private participation, focus

Build proven repeatable models

- **Develop repeatable playbooks for catalytic capital usage:** track record-based guide is needed to identify the right innovative finance mechanisms for each situation, enabling their repetition and eventual scalable platforms across the region widely
  - Aim is for financial institutions to become comfortable with risks in new green energy projects and transition projects like coal phase out and carbon intensive hard-to-abate sectors even in absence of catalytic capital
- **Strategically invest in priority projects:** allocate funds selectively and strategically in priority projects, given the limited blended finance pool available to the region
  - To enable this, governments should establish investment criteria focused on a priority climate-related theme, instead of exhaustive criteria covering all ESG initiatives (today)

Secure regional talent pool

- **Invest in talent pool:** secure grants to set up green finance hubs to foster capacity building (lack of talent is a constraint today in private sector, companies, and governments)
  - e.g., MAS[1] has launched sustainable finance hub, SSFA[2], and announced loan/bond grant scheme that encourages sustainable advisory service in 2024 Singapore Budget announcement
- **Set up dedicated teams for green finance:** organize dedicated green investment expert units with specific roles, KPIs, and training programs
  - e.g., Sustainable finance team in Standard Chartered; Japanese banks' rotational program[3]

Facilitate public-private cooperation

- **Bridge the knowledge gap between public and private sectors:** MDB/FIs[4] should foster cross-sector communication to mitigate lack of trust between different sectors arising from different backgrounds and interests

Notes: 1) The Monetary Authority of Singapore; 2) Singapore Sustainable Finance Association; 3) Rotational programs to provide managers to work with regional managers to enhance expertise; 4) Multilateral development banks and financial institutions; Sources: OECD; Expert interview; Lit. search; Bain analysis

Five accelerators can help build ecosystems near-term and bring investment to scale

1 Policies and incentives

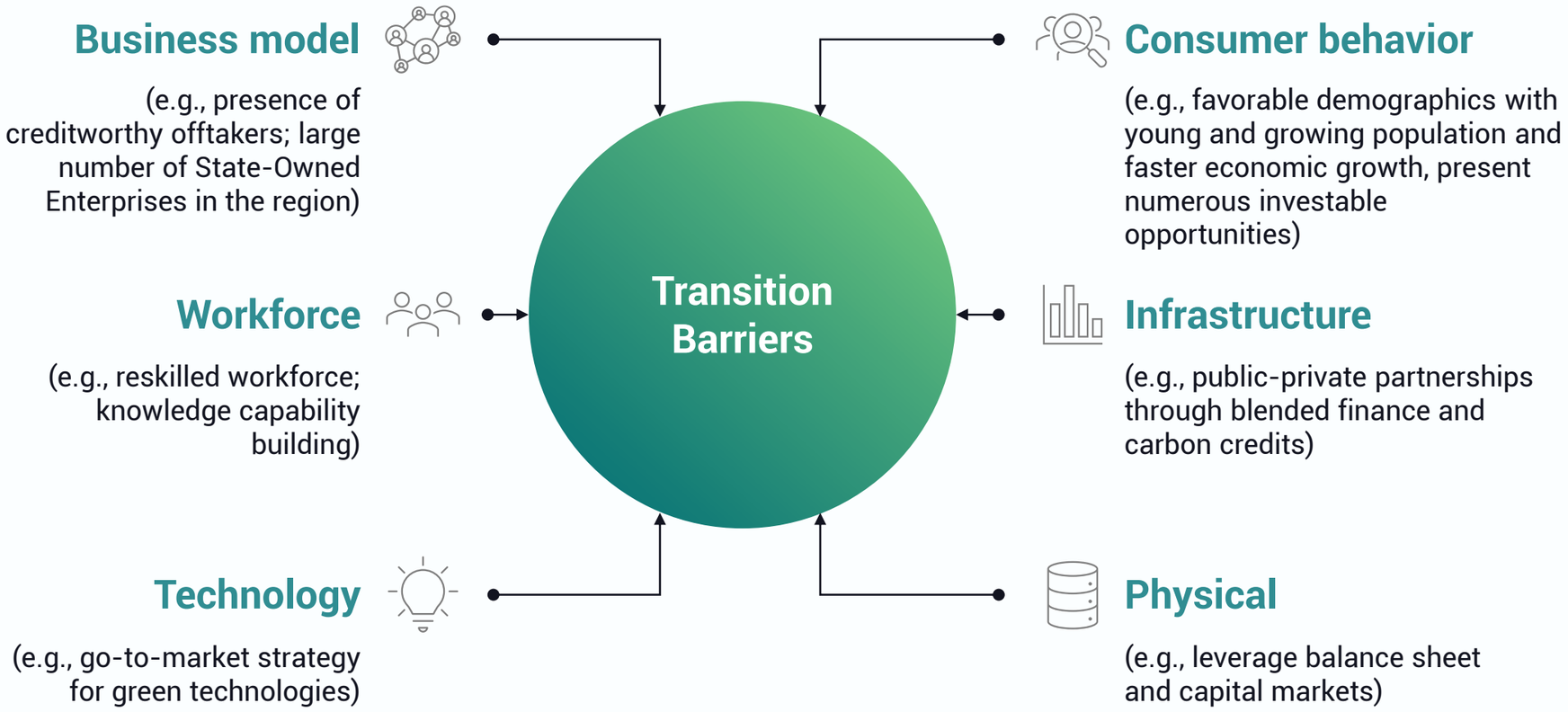
2 Innovative finance mechanisms

3 **Scaling private corporate investment**

4 Cluster/pilot developments

5 Regional collaboration

Corporates will need to play a leading role in driving investments given regional realities

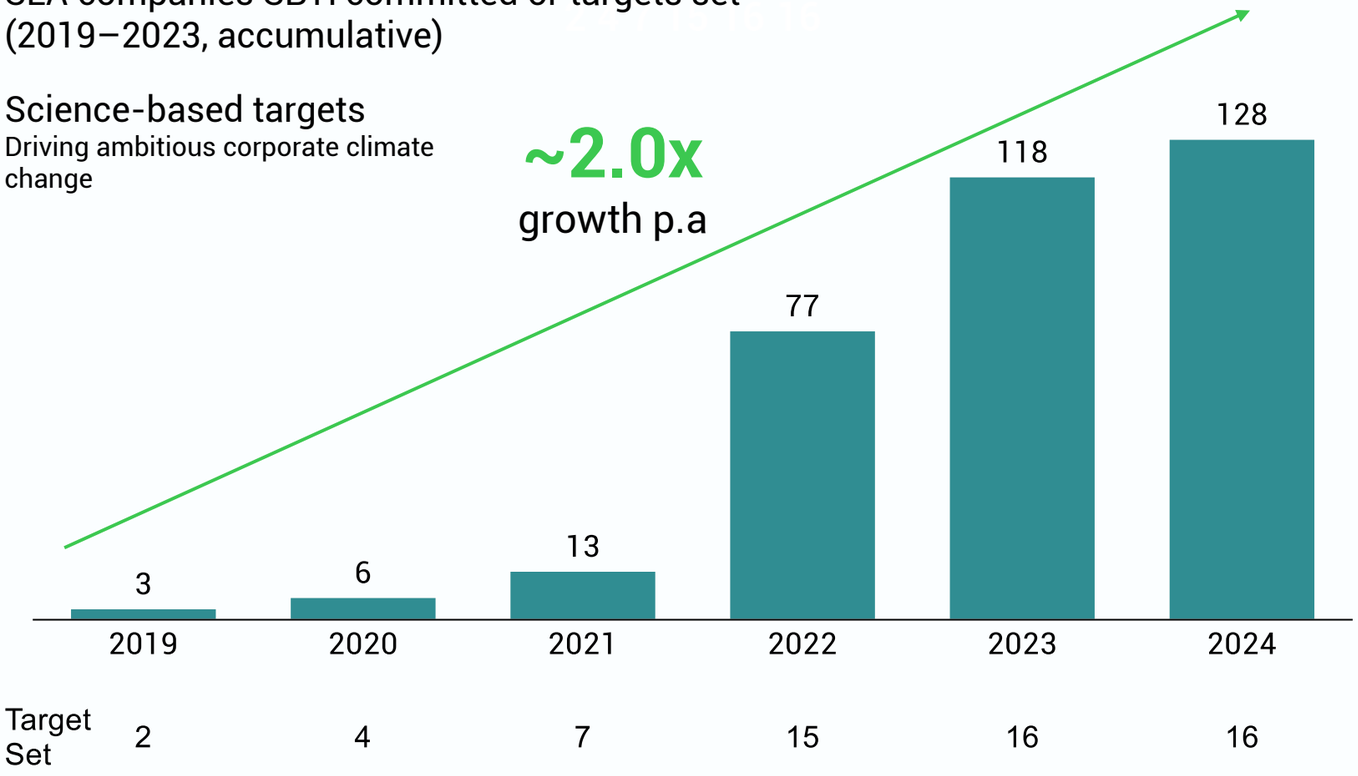


Corporate challenge: More SEA corporates committing to decarbonization; struggling how to deliver

More companies in SEA are setting or committing to SBTi targets

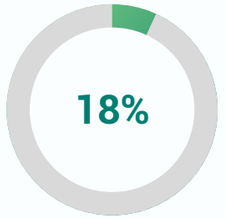
SEA companies SBTi committed or targets set[1]
(2019–2023, accumulative)

Science-based targets
Driving ambitious corporate climate change



Note: 1) Active or Target Set
Source: Science Based Targets (31st December 2023)

Yet many plans are losing SBTi validation



Out of 49 companies dropped from SBTi commitment list in Asia, 9 were in SEA

Unless continuous efforts are made, SBTi validation could be gone/rejected

To keep SBTi's framework robust, SBTi has put in place a policy to reassess firms that do not have commitments and targets that can withstand scrutiny

Asian companies are struggling more than others to build plans and targets for net zero

Asian companies have challenges to set realistic plans and targets for reasons like limited understanding of scope, ability to fund transition projects, etc.

Corporate challenge in SEA: Unique characteristics of SEA today limit incentives for many corporates to accelerate green investments near term

Policy volatility, limited stakeholder pressure, and high business risks result in few SEA corporate commitments

Macro and regulatory environment

Governments offer limited ESG financial support

- Fewer tax exemptions and subsidies for decarbonization compared to other regions
  - E.g., ~$700B US IRA[1] direct spending, loan, and guarantee in clean industrials and infrastructure

Unclear direction in ESG policy and mandates

ESG policies tend to be unstable due to a high dependency on political change

Shift expected with the upcoming elections in the region

- ID presidential election and SG prime minister election will take place in 2024 and 2025 respectively

Low pressure from investors

Family-owned businesses dominate local corporates

Over 75% of corporates in SEA are family businesses, which may face lower ESG pressure by investors

Decarbonization is still not a priority of investors

*"Return is still the most important criteria of investors … The way to solve trillion-dollar gap is **large-scale investments at returns that match the investors' expected outcome**."*

Asset Manager of a global investment management firm

Weak business case

Lower return

SEA

Europe

Consumers considering ESG factors when purchasing are less in SEA compared to others

Higher risk

- Political stability and governance
- Currency and exchange rate volatility
- Depth and maturity of capital markets

Notes: 1) Inflation Reduction Act
Sources: Expert interview; Lit. search; Bain analysis

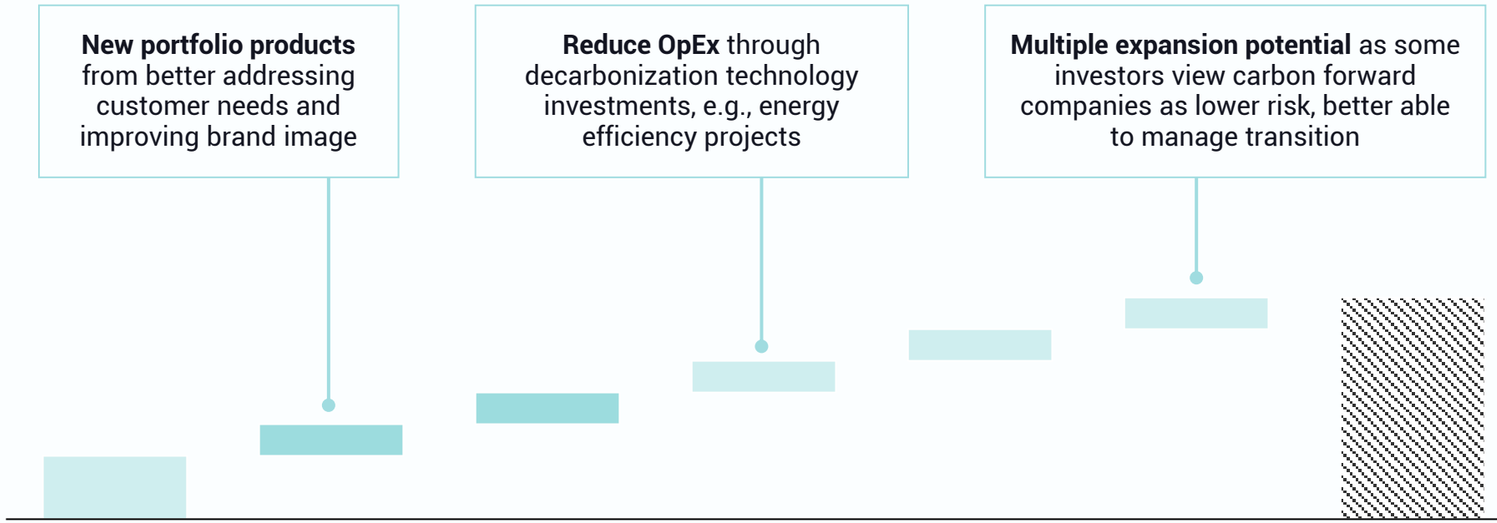
Leading corporates globally are investing across green themes for rationale reasons

Economic ESG Value Creation

New portfolio products from better addressing customer needs and improving brand image

Reduce OpEx through decarbonization technology investments, e.g., energy efficiency projects

Multiple expansion potential as some investors view carbon forward companies as lower risk, better able to manage transition



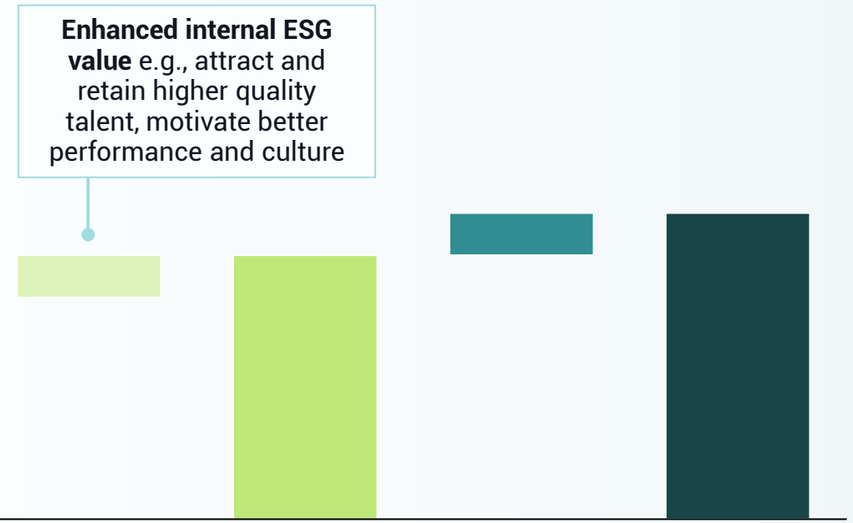
Revenue growth from improved brand image gaining market share and premiumizing current offering

Reduce CapEx Future proofing ahead of regulatory changes to minimize future costs

Cost of capital: Improved access to preferred capital markets and finance terms for LBO e.g., better ESG performance can result bps reduction in cost of debt and lower cost of capital

Non-Financial ESG Benefits

Enhanced internal ESG value e.g., attract and retain higher quality talent, motivate better performance and culture



Enhanced external ESG value e.g., lower environmental footprint due to reduced carbon emissions

Source: IPCC, DHL, EV Council, SCLAA, Brambles, AFR, Amazon, MSCI, Refinitiv, Bain analysis

Case Study: Many SEA companies unlocking value from going green

Revenue Growth: Consumers value sustainably farmed brands

Verti Veggies' capture of new revenue opportunity

Customer green ambition

Urban farming has gained popularity in Singapore as more consumers demand **healthier and sustainably grown food** with lower water use and carbon footprint

Singaporeans are showing increased interest in **food security and self-sufficiency** in a country with >90% imports

Business case

Indoor farming market in Singapore is expected to grow by **22% CAGR 2024–2027**

Cost of Capital: Actively seek alternative finance to cut the capital cost

Sustainability-linked trade facility for Wilmar

Secured **sustainability-linked trade finance facility** of ~$200M in 2023

- Margin ratchet on this facility will be linked to annual performance against predefined internal key performance indicators and external benchmarking standards

Funded by Standard Chartered **to support businesses' transition to low-carbon ecosystem**

- Part of Standard Chartered's $300B sustainable finance mobilization commitment

New Portfolio Product: New revenue opportunity through shift in portfolio

ACEN's 'business building' towards renewables

Ayala group has **expanded renewables portfolio since 2019 and continues** expansion up to date

2019 Ayala acquires ACEN, listed renewable energy platform

2021 Ayala makes commitments towards net zero by 2050

2022 ACEN first early retirement of coal plant by market based ETM[3]

2023 ACEN newly secures ~$360M 10-year term loan for renewables

Sources: Expert interview; Lit. search; Bain analysis

Corporate investment recommendations: Corporates should assess new revenue opportunities and make their businesses future-ready through green investments

Five accelerators

1 Policies and incentives

2 Innovative finance mechanism

3 **Scaling private corporate investment**

4 Cluster/pilot developments

5 Regional collaboration

Immediate recommendations

Revenue Growth

- Identify pockets of opportunity where consumers value green services and/or where corporates can become enablers of decarbonization, secure a premium
- Build future-proof go-to-market portfolio of leading green products and assess new revenue opportunity with creditworthy offtakers to enable financing
- Shift mindset from compliance focus to value creation in decarbonization

Green investment

- Continue to invest in areas with momentum and business case (e.g., building efficiency, shipping, EVs, power distribution)
- Look for green finance opportunities by leveraging balance sheet and capital markets to scale technology deployment
- Tap on private-public partnership opportunities to drive value creation and lower cost of capital (e.g., blended finance, carbon credits)

Resource and capability

- Cultivate talent pool that can drive ESG efforts and identify business case opportunities
- Liaise with MDB and government to continue to receive guidance on regulations and create plans that are aligned with national agenda

Sources: Expert interview; Lit. search; Bain analysis

Five accelerators can help build ecosystems near-term and bring investment to scale

1 Policies and incentives

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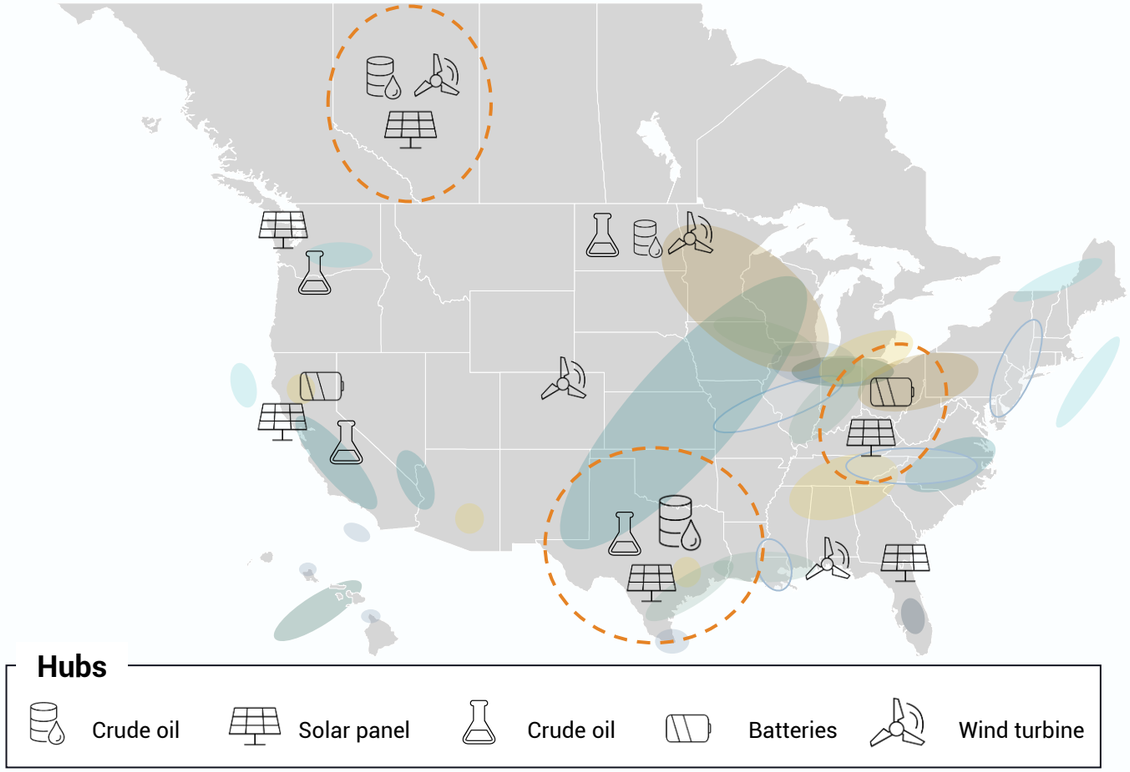
Transition and adaptation spending will not be uniform; investments and financing requirements will vary widely by location, sector, and client segment

Investment will not be uniform by sector or geography…

North America example: Manufacturing hubs are evolving

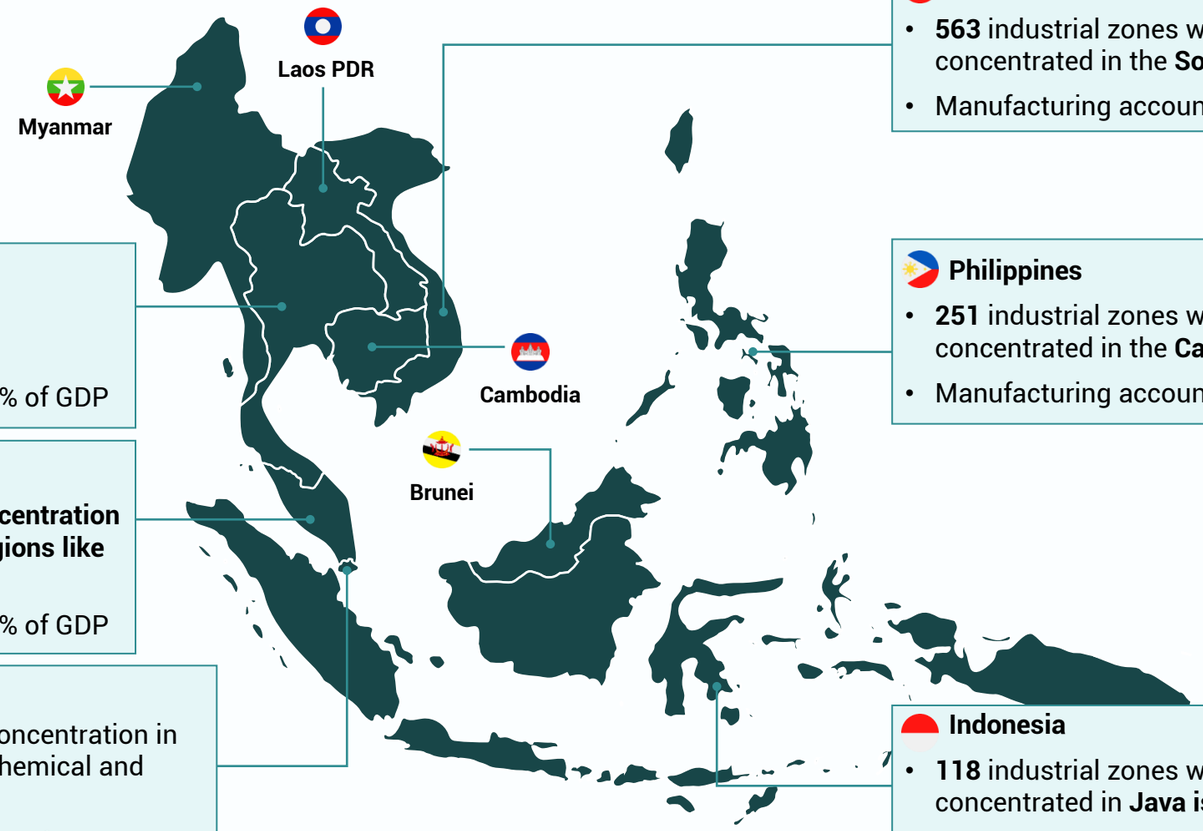


…and financing needs will differ by client segment

Cluster name	Incentives	Results
Alberta, Canada	• $2B+ invested to develop **low-carbon infrastructure**	**~34MTPA** Carbon sequestration infrastructure capacity **~$1.2B** Investment into Alberta Carbon Trunk Line project
US Battery Belt cluster	• **$30B** Wind, Solar, and Battery Manufacturing Production Tax Credit from US IRA[1]	**~$90B** Battery technology investment (2023)
US regional hydrogen hubs	• **$13B** Clean Hydrogen Tax Credit from US IRA, **$7B** funding from Bipartisan Infrastructure Law	**~25MTPA** Carbon sequestration infrastructure capacity[4] **~$40B** Attract private investment[4]

Note: 1) Inflation Reduction Act | Sources: Lit. search; Bain analysis

Economic demographics of SEA suggest targeting industrial clusters for green investment could accelerate impact and work around structural constraints



Thailand
- **67** industrial zones with **~80%** concentrated in **East region**
- Manufacturing accounts for ~27% of GDP

Malaysia
- **247** industrial zones, **limited concentration ~20%** in **Johor** and **the rest in regions like Sarawak**, etc.
- Manufacturing accounts for ~26% of GDP

Singapore
- **6** industrial zones with highest concentration in **Jurong Island** with >100 global chemical and energy companies
- Manufacturing accounts for ~21% of GDP

Vietnam
- **563** industrial zones with **~40%** concentrated in the **South region**
- Manufacturing accounts for ~23% of GDP

Philippines
- **251** industrial zones with **~40%** concentrated in the **Calabarzon region**
- Manufacturing accounts for ~18% of GDP

Indonesia
- **118** industrial zones with **~60%** concentrated in **Java island**
- Manufacturing accounts for ~21% of GDP

Tailwinds support targeted focus

Rationale for entry:
Concentrated global industrial business with net-zero commitments enables collaboration potential to co-develop

Setup for success:
Bankable opportunities and supportive government allowing access to private capital enable integrated circular services

Sources: Expert interview; Lit. search; Bain analysis

This is not a new idea; SEA is already building green clusters but could do far more

	Indonesia	Thailand	Malaysia
	Jababeka Net-Zero Industrial Cluster	**EV Hub potential via Next-Generation Automotive Banpho**	**Samalaju Industrial Park in Bintulu**
Context	• **Largest industrial estate in** SEA with more than 2,000 companies from 30 countries, in Java	• Initiative in the East region as part of **Eastern Economic Corridor (ECC)**	• Part of **Sarawak Corridor of Renewable Energy** that is **mainly hydro powered**
Focus	• Cluster formation with partners includes **energy player and global MNCs** focus on **system efficiency and electrification**	• Focus on development of next-generation **technologies in automotive sector**	• Focus on **energy-intensive industries** like aluminum that contribute greatly to economy
Results[1]	**~709KtCO2e** Current cluster emissions **~1.7M** Jobs protected	**~80MtCO2e** Current Thailand's transport emissions **~200K** Jobs will be created by ECC **~$5B** Total foreign investment in automotive[1]	**~800KtCO2e** Target emissions reduction in Sarawak by 2030 **~14K** Jobs created in Sarawak region **~$24B** Total investment attracted[1]
Why cluster worked	✓ **Location**: Co-located global companies with rich expertise ✓ **Government**: Implemented carbon pricing encouraging low-carbon solutions development ✓ **Business**: Attract tenants with net-zero targets	✓ **Location**: Target industries in designated zones and clusters ✓ **Government**: Provision of incentives like corporate tax and import duty exemptions ✓ **Business**: Existing automotive industry covering entire production process	✓ **Location**: Co-located energy-intensive industry players ✓ **Government**: Investment-friendly policies to attract foreign and local investors ✓ **Business**: Attract players who see a hydropower as an important differentiator

Note: 1) Based on latest information available
Sources: Euromonitor; Lit. search; Bain analysis

A wider strategic focus on ring-fenced green investment targeting such zones offers pathways forward while respecting constraints; helping green industrial policy and competitiveness

Five accelerators

1 Policies and incentives

2 Innovative finance mechanism

3 Scaling private corporate investment

4 **Cluster/pilot developments**

5 Regional collaboration

Immediate recommendations

Government

- **Assess clusters for incentives and potential carve-out** for public—private investment into renewable power, use of PPAs, and other enablers
- **Align/**integrate new industrial clusters with **national net-zero roadmap**
- **Shape green incentives schemes** to encourage industry to adopt green tech

Business

- **Propose private investment to support clusters** from setup to operations
- **Develop and propose integrated plans for renewable deployment within** clusters to develop new markets for solar/wind and other services
- **Identify area with concentrated activities** to support modular approach and focus efforts on existing infrastructure and expertise-sharing
- **Form incubator programs** to encourage greenfield decentralized municipal setup away from government-led clusters to enhance agility and efficiency

Sources: Expert interview; Bain analysis

Five accelerators can help build ecosystems near-term and bring investment to scale

1 Policies and incentives

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5 **Regional collaboration**

What to do: Three areas warrant action aligning with individual and collective interests

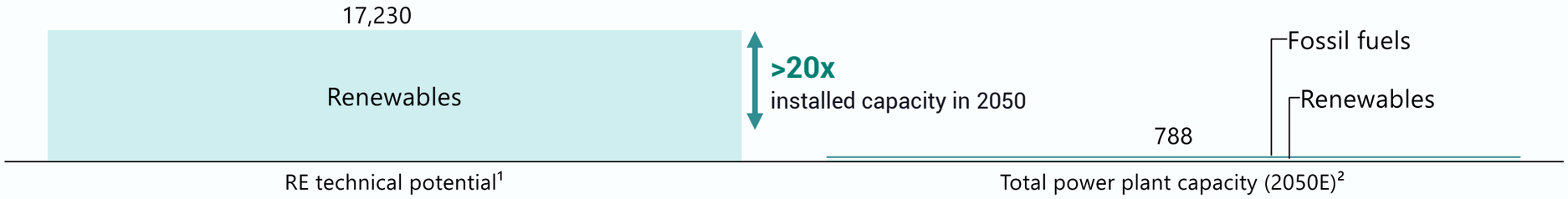
	Advance regional cross-border grid	Grow high-integrity VCM[1]	Expand ASEAN Taxonomy
Why it is important today	• **Unlock renewable energy potential** with increased integration • **Cheaper energy access** for the region • **Increase energy security as a region** with effective utilization and resource sharing	• **Unlock and scale supply of NBS[2]** through cross-border carbon market funding • **Boost investor confidence and corporate demand** by capturing full value of credits • **Drive economic growth** with revenue generated from credits	• **Improve investor confidence** to adopt a harmonized high integrity taxonomy • **Increase green capital inflows** into energy transition relative to fossil fuels • **Accelerate decarbonization journey** with greater bankability to drive transition
Potential actions for corporates and investors	• Create **domestic and bilateral** grid connections to promote grid flexibility • Mobilize resources to plan and build **interconnection projects** where relevant	• Promote demand via **purchase of credits** • Leverage **innovative finance** to support NBS project development	• Leverage private **financing/MDB partnerships** • Introduce **financial incentives** such as feed-in tariffs, auction pricing, tax rebates
SEA progress			

Notes: 1) Voluntary carbon market; 2) Nature-based solutions
Sources: Expert interview; Bain analysis

Regional cross-border grid: A regional grid can unlock even greater renewables potential while helping reduce intermittency risks in any renewables transition

SEA has abundant renewable energy resources

SEA RE technical potential[1] vs. expected total power plant capacity (GW)



SEA challenges

- **Slow deployment of grid infrastructure** to integrate RE
- **Fossil fuel dependency** despite high environment costs
- **Mismatch of RE demand and supply** due to geog. dispersion

Case study

Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP)

- ASEAN laid out **priority bilateral interconnection projects** and is piloting first multilateral trade pilot projects
- **Leveraging grid interconnections** from the LTMS-PIP project, **Singapore imports up to 100 MW renewable energy,** equivalent to 1.5% of SG's peak electricity demand, from Laos since 2022

Next steps to accelerate

Legal regulatory framework:
Reflection of support in country policies like the roadmap will build endorsement and confidence

Private sector engagement:
Potential to involve private financial investors will enhance bankability of grid projects

Standards:
Leverage existing GMS[3] grid code to develop ASEAN-wide interoperability standards

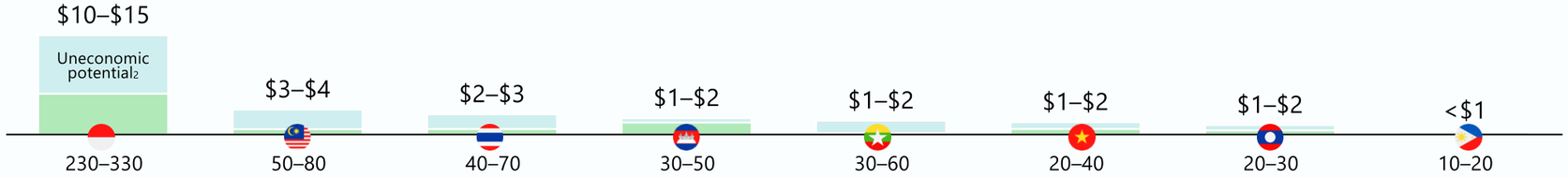
Notes: 1) Renewable energy technical potential factors in geographical information, generation patterns and hourly profiles, and system and topographic constraints but does not include economic (e.g., cost competitiveness, grid connectivity) and market factors (e.g., investor interest); solar and wind potential excludes settlements and urban areas to consider wind parks and utility-scale PV systems (does not assess rooftop solar potential); 2) 41% RE mix in AMS Target Scenario from ACE–assuming SEA countries meet their most recently announced targets; 3) Greater Mekong Subregion | Sources: Expert interview; Lit. search; Bain analysis

Scale regional carbon markets: Building connectivity across national carbon markets will create greater demand, investment flows, and overall impact

SEA has massive opportunity to be a carbon issuer through forest protection

Investable carbon potential in SEA ecosystems estimated at 0.4–0.7 GtCO2e/year, representing a $20B–$30B annual forest protection opportunity

Potential investable opportunity from financially viable forest protection projects[1] ($B/year)



SEA challenges

- **Weak enforcement of forest conservation policies**
- **Absence of solutions to price nature effectively**
- **Limited knowledge to develop/ monitor NBS projects**
- **Ongoing growth in energy demand which needs to be met affordably and reliably**

Case study

Emissions reduction-linked bond

- World Bank issued a $50M emissions reduction-linked bond in Vietnam to **mobilize private capital** and **increase upfront support** by providing investor returns linked to **verified carbon units**

Next steps to accelerate

Legal regulatory framework:
Reflect role of NBS in national plans for education initiatives to generate awareness

Private sector engagement:
Leverage innovative financing like carbon credits to improve bankability of projects

Standards:
Implement best practice standards regarding MRV to ensure high-quality carbon offsets

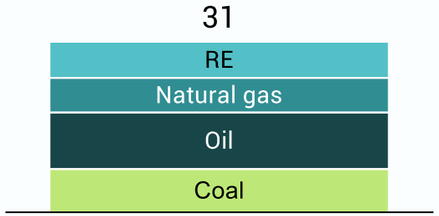
Notes: 1) Net present value for financially viable forest carbon, with the following assumptions: a) Constant carbon price of $5.8/tCO2 for the first 5 years, followed by a 5% price appreciation for subsequent years over 30-year project time frame; b) $25/ha for initial project establishment costs, and $10/ha for subsequent years for project maintenance; c) Incorporates Verified Carbon Standard criteria (e.g., requirement to set aside buffer credits); d) Risk-adjusted discount rate of 10%; | Sources: Expert interview; Lit. search; Bain analysis

Taxonomy: Aligning approaches on transition and green finance will further help to build the financing ecosystem and drive returns for all stakeholders

SEA has heavy reliance on fossil fuels

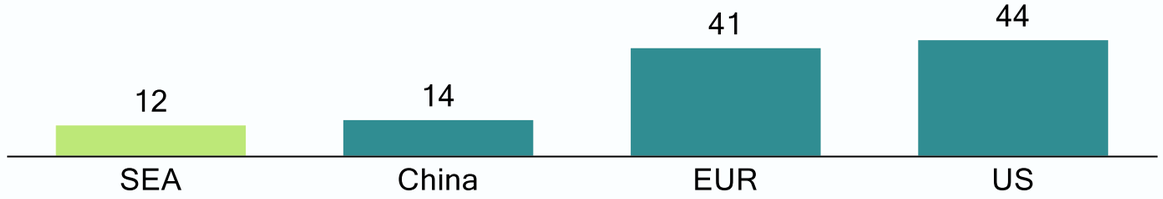
Coal generates 25% of SEA energy

SEA energy supply by fuel (EJ, 2019)



Relatively new coal plants that are yet to naturally retire

Average age of CFPPs[1] (# of years, 2023)



SEA challenges

- **Higher perceived risks** lower project bankability
- **Lack of policy continuity** dissuades investment
- **Higher offtake risk** given heavily regulated power market

Case study

Singapore-Asia Taxonomy

- Monetary Authority of Singapore has launched the Singapore-Asia Taxonomy for Sustainable Finance, which sets out thresholds and criteria for **defining green and transition activities across eight focus sectors**

Next steps to accelerate

Legal regulatory framework:
Adopt carbon pricing, like carbon tax or emissions trading scheme, to accelerate decarbonization

Private sector engagement:
Leverage MDB partnerships and private sector involvement to unlock more capital

Standards:
Provide transaction technical assistance to support analysis of project's fundamentals

Note: 1) Coal-fired Power Plants | Sources: Expert interview; Lit. search; Bain analysis

Regional collaboration recommendations: Individual SEA countries should seek out regional collaboration opportunities

Five accelerators

1 Policies and incentives

2 Innovative finance mechanism

3 Scaling private corporate investment

4 Cluster/pilot developments

5 **Regional collaboration**

Immediate recommendations

Government

- Accelerate opportunities for **cross-border renewables** investments and define government-to-government **ground rules/protocols** to progress forward
- Develop **internationally aligned domestic carbon markets** for market fungibility
- Introduce **incentives** and common approaches for green and transition projects

Corporates

- Promote opportunities for **public-private investment in grid** infrastructure
- Selectively invest in **proven high-impact carbon projects**
- **Adaptation of global standards** in reporting and assessing risk

Investors

- **Align with governments on investing criteria** for high-capex infra projects
- Partner with corporates/developers to pilot **novel financing models**
- Focus **near-term investments** on proven renewables, energy efficiency, and nature-based projects

Sources: Expert interview; Bain analysis

04

Conclusion

SEA region made a step forward but still has long way to go

SEA countries have raised commitments on carbon …

5 out of 10 SEA countries have improved national roadmap at sector level linked to COP28[1]

2x increase in SBTi commitments from SEA corporates from 2022 to 2023

… and momentum is moving forward in the region …

~$6.3B green capital flow into the SEA region in 2023

~200% annual growth in EV[2] (4W[3] passenger car) sales from 2019 to 2022

… yet still faces difficulties to reduce emissions and reach net-zero targets

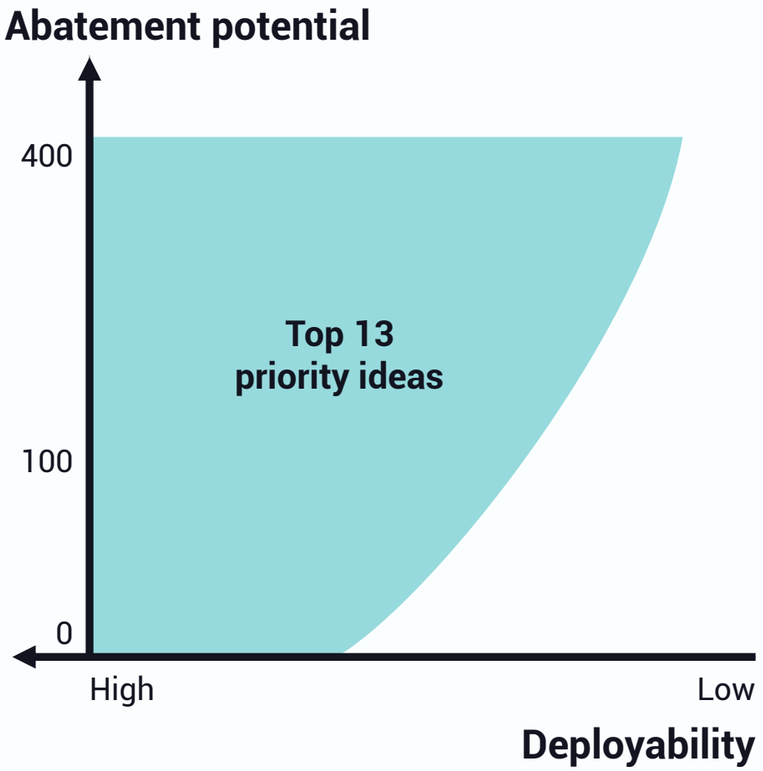
~$1.5T investment gap with only $45B investments made as of 2023

~42% projected energy demand increase from 2020 to 2030

Notes: 1) COP 28 stands for the 28th meeting of the Conference of the Parties (COP) to the UNFCCC; 2) Electric vehicles; 3) 4-wheelers
Sources: Expert interview; Lit. search; Bain analysis

Translating ambition to action and results will take time; yet we know there are investable ideas and accelerators to leverage and speed up SEA's progress

We know where to invest
in top 13 investable ideas



How to accelerate
with 5 main accelerators

- Policies and incentives
- Innovative finance mechanisms
- Scaling corporate investment
- Cluster/pilot developments
- Regional collaboration

SEA needs to move faster
with cooperation of all stakeholders

- Governments
- Corporates
- Investors

Sources: Expert interview; Lit. search; Bain analysis

All stakeholders need to take actions to be on track for 2030 targets

Governments

- Prioritize and focus green incentives
- Continue accelerating progress on carbon pricing and national carbon markets
- Develop policy framework that encourages regional collaboration
- Adopt integrated approach that considers transition and green investments in a just and inclusive way

Corporates

- Identify revenue growth opportunity and invest in proven ideas
- Decarbonize and invest in green opportunities that increase long-term resiliency and future-proofing
- Invest in resource and capability building
- Establish corporate-level roadmaps aligned with national plans/targets

Investors

- Identify opportunities to partner with corporates and public sector on pipeline development and optimizing risk/return
- Invest in talent pool and set up teams for green finance
- Facilitate public-private knowledge sharing
- Continue to pilot catalytic capital usage and the platform for novel financing

Collective actions across stakeholders and countries so SEA can accelerate action

Sources: Expert interview; Lit. search; Bain analysis

Government: Calls for action

1 Prioritize and focus green incentives

Accelerate critical industries' decarbonization pathway

Catalyze grid infrastructure enhancement to gradually support energy transition away from fossil fuel subsidies

Drive agriculture transition to encourage sustainable practices

2 Continue progress on high-integrity carbon pricing and carbon markets

Align global/regional connectivity and implement market measures **to allow export of carbon credits to international offtakers**

Incentivize carbon market setup with focus **on transparent and uniform standards**

Strengthen green capabilities (upskill community and specific expertise)

3 Facilitate regional collaboration with policy framework

Clarify full system costs borne by government budget and **streamline permitting processes**

Create internationally aligned domestic carbon project standards

Tailor policies to leverage the unique geographic and economic advantages of each country

4 Integrate approach with transition and green investments

Foster clarity on green and transition projects definition to improve financing certainty and to increase projects that meet scalability requirements

Guide investment decisions with disclosure and standards to recognize leading companies and pressure laggards

Meet new demand with green and **develop clear transition roadmap for carbon-intensive assets** that considers energy security and affordability

Sources: Expert interview; Lit. search; Bain analysis

Corporates: Calls for action

1 Identify revenue growth opportunity and proven ideas

Identify pockets of opportunity where consumers value green services and/or where corporates can become enablers of decarbonization

Build future-proof go-to-market portfolio of leading green products and assess new revenue opportunity **with creditworthy offtakers**

2 Look for opportunities to optimize risk-return and resiliency

Look for green finance opportunities by leveraging balance sheet and capital markets to scale technology deployment

Continue to invest in areas with momentum and business case (e.g., building efficiency, shipping, EV, power distribution)

3 Invest in resource and capability building

Cultivate talent pool that can drive ESG[1] efforts and **identify business case opportunities**

Stay front-footed on evolving regulation and policy, including by liaising with/informing MDB[2] and governments

4 Establish corporate roadmaps aligned with national plans

Create target, implementation plan, and milestone that is aligned with national agenda; corporates can take the lead if national agenda is lagging

Form strategic cluster/private-public partnerships to drive value creation and develop on corporate targets

Notes: 1) Environmental, Social, and Governance; 2) Multilateral Development Bank | Sources: Expert interview; Lit. search; Bain analysis

Investors: Calls for action

1 Cooperate with stakeholders to optimize risk-return

Closely work with various stakeholders such as government, corporates, and development banks **to improve financing mechanisms and scale investable opportunities**

Build risk-return profile that would **fulfill appetite of various stakeholders and boost investment for green transition opportunities**

2 Invest in talent pool and dedicated team for green finance

Foster green capability building to capture green areas and transition opportunities

Set up dedicated team for green finance to work closely with government and/or development banks

3 Proactively facilitate public-private knowledge sharing

Have regular cadence to focus near-term investments on proven 13 investable ideas with high impact and deployability

Further unlock new opportunities through cross-sector communication to support introduction of enabling conditions and policies

4 Continue to pilot catalytic capital usage for scale

Work with other stakeholders to develop repeatable playbooks for catalytic capital usage in innovative finance models like blended finance or transition credit

Create a structure that can move innovative finance mechanism **pilots to repeatable project approaches**

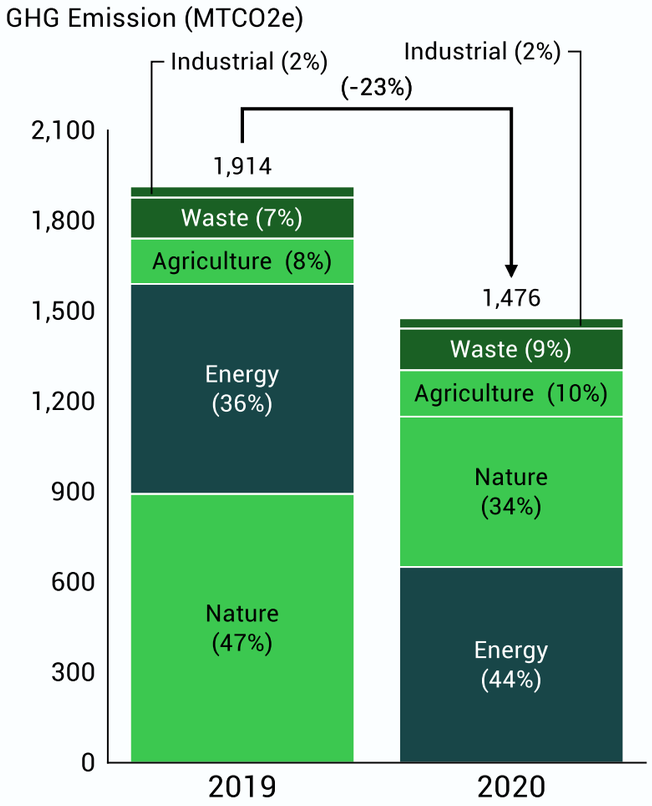
Sources: Expert interview; Lit. search; Bain analysis

05

Country Insights

Indonesia: Country Snapshot

GHG Emissions Profile



2024 Indonesia Progress Overview

Government commitments under NDC aim for **32% emissions reduction** compared to 2030's BAU

- **34% renewable energy contribution** by 2030 (vs. 18% in 2021) and **20% EV of new vehicle sales** by 2025 (vs. 1% in 2022)

Upward trajectory in 2024 Green Index Score, driven by **progress seen in GHG emissions and release of roadmap** under energy sector

- Temporary drop in GHG emissions for nature sector due to COVID-19 and La Niña
- Release of JETP CIPP outlining priorities and financing plans to implement JETP

Steady increase in private green investment in 2023, with 28% increase compared to 2022, increase due to large, one-off deals

- **2023 private green investment of $1,594M**, accounting for ~25% of 2023 SEA total

Major investments seen under fuel substitution and agriculture productivity

- ~$650M acquisition in Abadi gas project by Petronas and Pertamina and $500M investment by IFC in microfinancing for small, medium enterprises

Progress in accelerators seen in implementation of **new carbon pricing framework and establishment of first net-zero industrial cluster** in the region but **limitations are still seen in deployment of blended finance funds**

- 2023 launch of mandatory ETS in power sector
- Jababeka net-zero industrial cluster with over 2,000 companies
- Detailed roadmap has been released for JETP, but roadblocks in implementation still exist

2024 Green Economy Index Score

41/100 (▲ +2)

Decarbonization Ideas

1. **Electric passenger vehicles and charging infrastructure**
2. **Optimization of "subcritical" coal plants during transition**
3. **Forest/peatlands conservation and blue carbon mangrove restoration**

Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Indonesia: Overall Progress Assessment

		Requirements and Assessment	'23	'24	Commentary
Ambition		Target-setting and quality			**Non-legally binding 2060 net-zero target** with 2030 conditional and unconditional emissions targets from BAU[1] levels, 2020 emissions at ~1,476 MtCO2e vs. ~1,953 MtCO2e 2030 unconditional target
		Target cascading			2030 national target cascaded to sectors; **6/10 major emitting corporates like Indocement have set emissions targets, but net-zero target-setting should be encouraged** as none of them has set one
Progress		Current state			**Significant decrease (~23%) in emissions (5.4t per capita)**; 18% RE[2] share for power generation 18%, 1% of battery EV in annual 4W passenger car sales
Roadmap		National sector-level roadmap			**LT-LEDS covers all sectors**; **energy transition roadmap by MEMR/IEA** has detailed milestones for subsectors; **operational roadmap for FOLU** decarbonization has been set by MEF
		Corporate roadmap			With **Indocement's recent announcement of its decarbonization roadmap**, there now exists a corporate with a roadmap in the nation (**1/10 major emitting corporates** with roadmaps)
Accelerators		Regulatory framework			**No mandatory emissions reporting and permitting process for RE electricity** REDD+ framework well implemented and requires **mandatory certificate for oil palm growers (ISPO)**
		Financial prerequisites			**Launch of mandatory ETS for power sector** announced recently (Feb. 2023); incentives for solar and EV in place **~80M carbon credits;** provides subsidies for both organic/chemical fertilizers
		Infrastructure, tech, and human capital			Lacks sufficient grid for energy transition, **planning to develop Super grid by 2025;** ~450 EV charging stations Has **4 registered, 5 under development NBS projects; high level of SRI adoption**
Investment		Corporate investment			Required capital investment of $108B but with only $1.6B private investments made in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

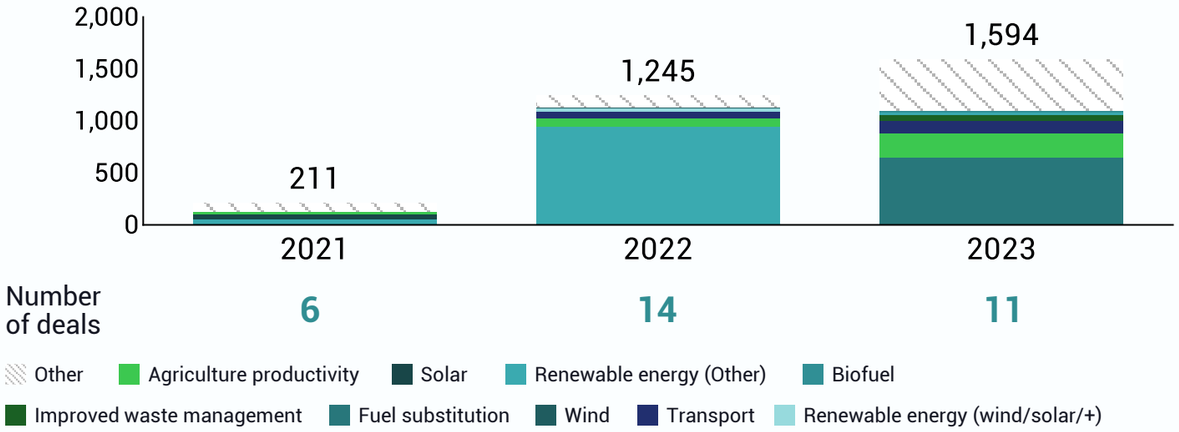
Notes: 1) Business-as-usual; 2) Renewable energy
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Indonesia: Investment Flows and Investment Opportunities

New investments made in Indonesia

(Unit: M USD)

2023 total = $1,594 (~25% of SEA)



Recent deal examples

Fuel substitution: ~$650M acquisition of Shell's 35% stake in Masela production sharing contract, which includes Abadi gas project, by Petronas and Pertamina

Microfinancing: $500M investment by International Finance Corporation (IFC) in Indonesian lender PT Bank BTPN Tbk to support women-led micro, small, medium enterprises and action on climate change

Where further investments can be made

Investable ideas	Rationale
Electric passenger vehicles and charging infrastructure	**Investments in EV adoption seen since 2022 by several auto companies** (e.g., Indika Energy, Ilectra Motor Group) In 2023, Indika Energy established a **new EV battery manufacturing subsidiary** and **invested $191M** Ilectra Motor Group, focusing on **electric two-wheelers**, has **raised $50M** in Series B funding
Optimization of "subcritical" coal plants during transition	Coal accounts for **~60% of Indonesia's electricity** with >50% of the units being 'subcritical' coal plants Despite plans to phase out coal and commitments to discontinue new coal plants, **exemptions are made for plants linked to national initiatives**
Forest/peatlands conservation and blue carbon mangrove restoration	Indonesia peatlands hold SEA's largest carbon stock but are **prone to fire in dry season** Initiate **Reduced Impact Logging** for less forest damage and increase conservation Positive efforts seen through **Mangrove for Coastal Resilience Program**

Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Indonesia: Policy

Gov. commitments under NDC

Emission

- 32% — Unconditional emissions reduction vs. BAU by 2030

Energy

- 34% — RE contribution for power generation by 2030
- 20% — Electric vehicle of new vehicle sales by 2025

Nature

- 12M ha — Degraded land restored by 2030
- 0% — Net forest loss by 2030

Recent developments on regulatory framework

March 2022

FOLU Net Sink 2030 Operation Plan

- Outlines targets and operational plans on **sustainable forest management, environmental governance, and carbon governance**
- Targets to reach minus **140MtCO2 emissions by 2030** and decrease to **304Mt CO2 emissions by 2050**

Feb. 2023

Launched mandatory ETS

In **first phase**, 2023-2024, will cover **coal-fired power plants** with production capacity more than 100 MW

Sept. 2023

Indonesia Carbon Exchange (IDX)

Launched first carbon trading market IDX, offering mechanism to offset companies' emissions and fund carbon projects

Nov. 2023

New and Renewable Energy bill

In the process of drafting to provide regulatory framework that can **support clean and renewable energy**

Comprehensive Investment and Policy Plan

- Has released specific plans to **mobilize $20B JETP public and private financing**
- Six investment focus areas on **grid improvement, early coal-fired power plant retirement**, dispatchable and variable **renewable energy acceleration, renewable energy supply chain enhancement, energy efficiency**, and **electrification**

Sources: CIPP report; FOLU Net Sink: Indonesia's Climate Actions Towards 2030 report; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Indonesia: Accelerator

Finance mechanism

Recent developments

Indonesia JETP

- **Nov 2023:** JETP **Comprehensive Investment and Policy Plan (CIPP) released** but still **faces struggles**
  - UK and US have offered **~$2B of guarantees**, accounting for 20% of IPG's public support
  - More than **55% of public sector IPG funding has already been earmarked** before release of JETP CIPP 2023
  - Has **excluded captive coal-fired power plants** from JETP coals phase-out plan

What is needed

Collaborative effort towards transition finance

- **Policy reform** to initiate private investments
- Developed countries to **deploy funding according to timeline**
- **MDBs to coordinate** between public and private sectors and facilitate crowding in funds

Policy

Carbon pricing

- Issued **national framework** for carbon pricing in 2021
- Launched **mandatory ETS** for power sector in 2023, specifically for coal-fired power plants
  - Expect reduction of 500,000 tCO2e in power sector in 2023

Enhance carbon pricing

- Introduce measures to revise existing long-term PPA[1] to **incorporate clauses that restrain carbon cost passthrough**
- Expand **ETS coverage beyond power** sector and **recognize international carbon certifications**

Partnership

Jababeka industrial cluster

- **First net-zero industrial cluster in the region** with more than 2,000 companies from 30 countries
  - Companies within the cluster include energy players and global MNCs
- Key goals include increasing energy efficiency and transitioning from fossil fuels to solar and renewable sources

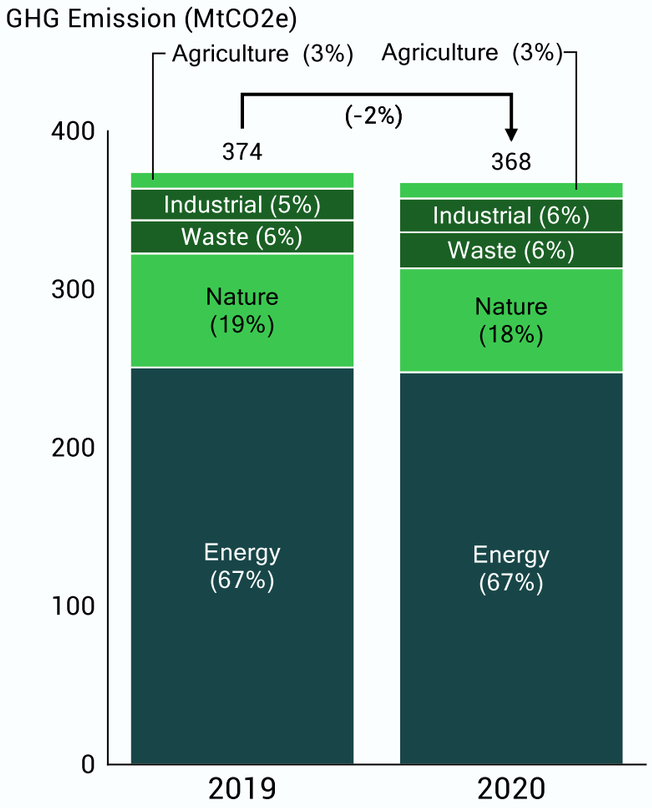
Create competitive environment

- **Focus on growing battery value chain** and leverage Indonesia's **abundance of nickel** minerals to capitalize on increasing demand from EV industry
- Export-oriented industries to **adopt low-carbon practices** to cushion impact of CBAM on imports into EU

Note: 1) Power purchase agreement
Sources: CIPP Indonesia; Lit. search; Bain analysis

Malaysia: Country Snapshot

GHG Emissions Profile



2024 Malaysia Progress Overview

Government commitments NDC aim for **45% emissions reduction** vs. 2005

- **40% renewable energy contribution** by 2035 (vs. 18% in 2021) and **15% EV of new vehicle sales** by 2030 (vs. ~1% in 2022)

Upward trajectory in 2024 Green Index Score, increase in roadmap under energy sector

- Release of National Energy Transition Roadmap, which includes initiatives, transition levers, and enablers to accelerate transition into clean energy

Development in regulatory framework aiming to attract more **investments in renewable energy** and to increase **energy efficiency among corporates**

- Malaysian government has **lifted ban on renewable energy exports**
- Energy Efficiency Conservation Act with mandatory audits and energy-saving measures for corporates with energy consumption over 21,600 gigajoules

326% increase in 2023 private green investment, due to increase in large-scale deals seen specifically under building sector

- **2023 private green investment of $1,030M**, accounting for ~16% of 2023 SEA total

~50% of investments have been made in buildings; steady investments also seen in 2023 for solar

- $280M investment in Nusajaya Tech Park data center, $250M investments in Kulai data center

$430M catalytic fund has been allocated by the government for blended finance and developments in **industrial clusters seen in Sarawak and Johor districts**

2024 Green Economy Index Score

43/100 (▲ +2)

Decarbonization Ideas

1. **Enable vPPA via bilateral grid interconnection**
2. **Invest in energy efficiency improvements for buildings**
3. **Forest conservation**

Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Malaysia: Overall Progress Assessment

		Requirements and Assessment	'23	'24	Commentary
Ambition		Target-setting and quality			**Non-legally binding net-zero target by 2050 earliest** with 2030 unconditional emissions reduction targets; 2020 emissions at ~368 $MtCO_2e$ vs. ~736 $MtCO_2e$ 2030 unconditional target
		Target cascading			Absence of sector-specific emissions targets, but with **presence of net-zero and emissions targets among 7/10 major emitting companies, recently target set by YTL Power Intl.**
Progress		Current state			**Decreased emissions by 2%, but relatively high emissions per capita (11.3t)**; 18% RE share for power generation, ~1% of battery EV in annual 4W passenger car sales
Roadmap		National sector-level roadmap			**Recently announced National Energy Transition roadmap (Aug. 2023),** a detailed, long-term plan for energy transition
		Corporate roadmap			**4/10 major emitting companies** have released roadmap to achieve net zero
Accelerators		Regulatory framework			No mandatory emissions reporting, but **structured permitting process for RE electricity** exists **REDD+ implementation** is in good progress and requires **mandatory certificate for oil palm growers (MSPO)**
		Financial prerequisites			Incentives for EV, solar, and green building exist and **started to develop carbon tax policy in 2023** **~0.5M carbon credits;** has agency providing guarantee to SMEs[1], but no incentives on organic agriculture
		Infrastructure, tech, and human capital			**Grid sufficient for current RE penetration,** grid upgrade plans being implemented; **~1K EV charging stations** 2 registered NBS projects; has low SRI adoption level
Investment		Corporate investment			Required capital investment of $27B but with only $1B private investments made in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

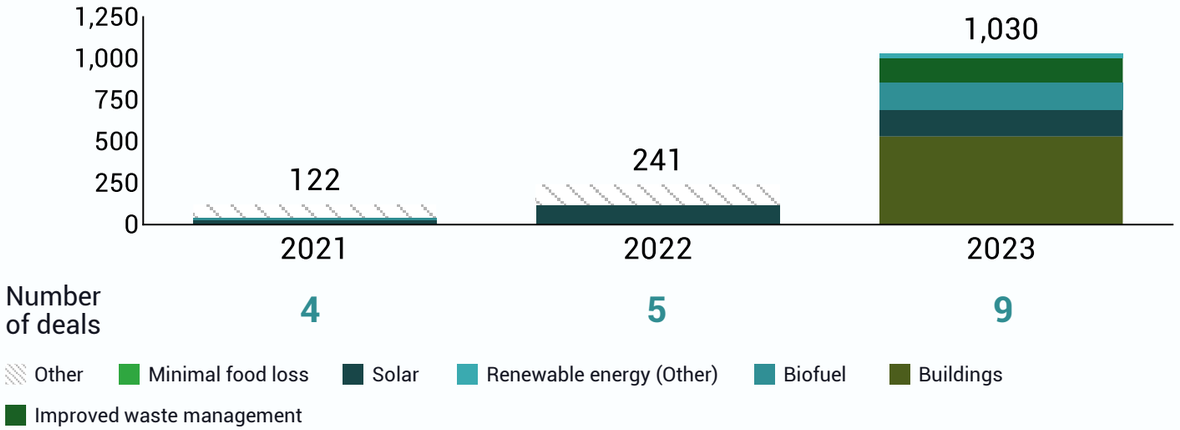
Note: 1) Small and medium-sized enterprises
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Malaysia: Investment Flows and Investment Opportunities

New investments made in Malaysia

(Unit: M USD)

2023 total = $1,030 (~16% of SEA)



Recent deal examples

Buildings: $280M investment by GDS, and four mandated lead arrangers, in Nusajaya Tech Park data center in Malaysia

Buildings: $250M investment by YTL Power International, local banks for Kulai data center project

Where further investments can be made

Investable ideas	Rationale
Enable vPPA[1] via bilateral grid inter-connection	Malaysia sees the **potential for export of renewable energy to fund its energy transition plans** YTL PowerSeraya and TNB Power Generation have teamed up to **export and import 100 MW of electricity to Singapore via a newly upgraded interconnector**
Build system to increase energy efficiency in buildings	Malaysia plans to invest **~$1.47B into increasing energy efficiency in government buildings** according to National Energy Transition Roadmap (NETR) phase two
Forest conservation	While forest covers ~50% of total land area, Malaysia has **experienced 28% decrease in forest coverage since 2000** Developed **REDD+ Finance Framework to** incentivize reforestation activities through Forest Conservation Certificate and Forest Carbon Offset

Note: 1) Virtual power purchase agreement
Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Malaysia: Policy

Gov. commitments under NDC

Emission

- 45% — Unconditional emissions reduction vs. 2005

Energy

- 40% — RE contribution for power generation by 2035
- 15% — Electric vehicle of new vehicle sales by 2030

Nature

- 50% — Forest coverage by 2030
- 0% — Net forest loss by 2030

Recent developments on regulatory framework

May 2023 — Lifted ban on RE exports

To encourage renewable energy investment, Malaysian government lifted ban on renewable energy exports

Jul. 2023 — Green Technology Financing Scheme 4.0

Reinstate **~ RM1 billion of financial support, interest/profit rate subsidies, and government guarantees until Dec. 31, 2025,** to ensure green technology-based projects continue to receive support

Aug. 2023 — National Energy Transition Roadmap (NETR)

- NETR specifically presents **50 initiatives under six energy transition levers and five enablers**
  - 6 levers: energy efficiency, renewable energy, hydrogen, bioenergy, green mobility, CCUS[1]
  - 5 enablers: financing and investments, human capital and capabilities, policy and regulation, technology and infrastructure, governance

Sep. 2023 — Energy Efficiency and Conservation Act

Companies with energy consumption over 21,600 gigajoules need to go through **mandatory audits and energy-saving measures**

Oct. 2023 — Joint Committee on Climate Change (JC3)

- Co-chaired by Bank Negara Malaysia (BNM)
  - Launched **SME ESG Guide** to assist SMEs in their sustainability journey
  - **Climate Change and Principle-based Taxonomy (CCPT) review** to ensure more consistent and credible reporting by financial institutions
  - **Task Force on Climate-Related Financial Disclosures (TCFD) review** to consider ISSB[2]

Nov. 2023 — Carbon trading regulation

Sarawak state was the first to pass bill on generation and sales of voluntary carbon credits with penalty tax for companies that fail to disclose emissions

Notes: 1) Carbon capture utilization and storage ; 2) International Sustainability Standards Board
Sources: Twelfth Malaysia Plan; National Energy Transition Roadmap; National Statement; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Malaysia: Accelerator

Finance mechanism

Policy

Partnership

Recent developments

Blended finance

- Aug. 2023: Malaysia Prime Minister announced allocation of **$430M catalytic fund to enable blended finance** for energy transition
- **Bank Negara Malaysia** established financing facility for SMEs in 2022, which includes utilization of blended finance

Energy exchange

- Malaysia **lifted bans on renewable energy exports in 2023**
- Plans to launch Energy Exchange system soon to **accelerate renewable exports to neighboring countries** and support cross-border energy sales

Industrial parks

- Sarawak **state government's investment-friendly policies** and **presence of hydropower resources** are attracting more collaboration activities
  - Samalaju Industrial Park dedicated to energy-intensive industries like steel, aluminum, etc.
  - BioHub Port at Bintulu given presence of biomass industry
  - H2Biscus ammonia feasibility study at Bintulu

What is needed

Deployment of blended finance

- **Develop and go through feasibility studies on blended finance projects** with support from MDBs and asset managers with rich experience
- **Engage stakeholders with rich technical and operational experience** in executing climate projects

Further developments in renewables regulations

- **Increase renewable target** beyond current 40% to scale energy transition
- Facilitate **first successful cross-border RE sale** to demonstrate feasibility
- Develop a **sector implementation roadmap** to provide clear direction

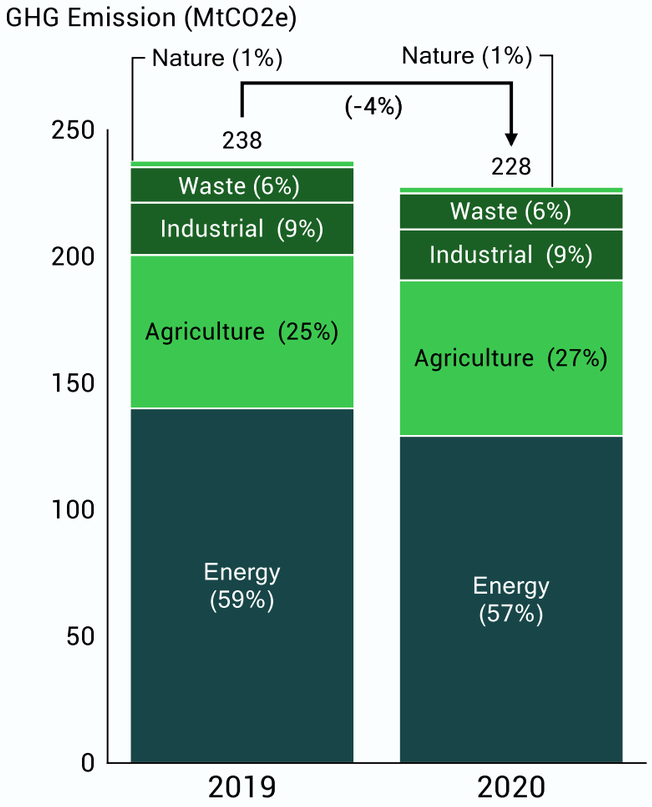
Continue momentum within industrial parks

- State governments, such as Sarawak and Johor, should **continue enabling policies to attract private investors**
- Catalyze **more eco-industrial park formation** by identifying partners with keen interest in decarbonizing

Sources: Convergence; MSCI; UNFCCC; Expert interview; Lit. search; Bain analysis

Philippines: Country Snapshot

GHG Emissions Profile



2024 Philippines Progress Overview

Government commitments under NDC aim to **decrease ~3% emissions by 2030 vs. 2005**

- **35% renewable energy contribution** by 2030 (vs. 22% in 2021) and **100% EV of new vehicle sales** by 2040 (vs. ~1% in 2022)

Upward trajectory in 2024 Green Index Score, driven by progress seen within corporates' ambitions and roadmaps

- Acen newly set ambitions and released roadmap towards net zero

Development in regulatory framework has been made, **allowing more foreign investments in renewables**

- Amended Renewable Energy Act to allow full foreign ownership of renewable energy projects
- Established "Green Lanes" to expedite process of receiving licenses and permits

57% increase in private green investment in 2023 compared to 2022, due to increase in domestic investments in infrastructure

- **2023 private green investment of $1,464M**, accounting for ~23% of 2023 SEA total

Significant increase in waste management investment, while investment momentum continues in solar sector in 2023

- ~$682M investment by Manila Water Company in waste management and ~$285M acquisition of shares by Merlaco under solar sector

Positive efforts have been seen in **blended finance and new regional collaboration effort towards coal phase-out**

- Pentagreen Capital solar project and transition credits pilot projects

2024 Green Economy Index Score

39/100 (▲ +3)

Decarbonization Ideas

1. **Utility-scale solar and wind energy**
2. **Captive solar with incremental energy storage system**
3. **Regenerative agricultural practice**

Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Philippines: Overall Progress Assessment

		Requirements and Assessment		Commentary
		'23	'24	
Ambition	Target-setting and quality			**No net-zero commitments but has 2030 unconditional and conditional targets**; 2020 emissions at ~228 MtCO2e vs. ~351 MtCO2e 2030 unconditional target
	Target cascading			Absence of sector-specific emissions targets but **4/10 major emitting companies set net-zero and emissions targets**
Progress	Current state			**All metrics have improved or maintained their status**; 2.0t of emissions per capita, 22% RE share for power generation, ~0.5% increase in forest land, 1% of battery EV in annual 4W passenger car sales
Roadmap	National sector-level roadmap			**No LT-LEDS** available but additional 2040 Energy Plan and Philippine Master Plan for Climate Resilient Forestry Development exist
	Corporate roadmap			**3/10 major emitting companies** have released roadmap to achieve net zero; **Acen Corp. has newly established roadmap** towards net zero
Accelerators	Regulatory framework			Requires mandatory emissions reporting and **process obtaining permit of RE electricity under development**; REDD+2 strategy in progress; **inadequate forest law enforcement; requires no registry for fertilizers**
	Financial prerequisites			**Carbon tax being explored; complete set of incentives available** for solar, electric vehicles, green bld. ~10K carbon credits; **"Organic Agriculture Act"** supports organic farming through incentives on tax exemption
	Infrastructure, tech, and human capital			In progress of **unifying three grids to improve connectivity**; ~300 EV charging stations in place **One registered, two under development/approval NBS projects**; multiple organizations in support of SRI
Investment	Corporate investment			Required capital investment of $16.6B but only $1.5B private investments made in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

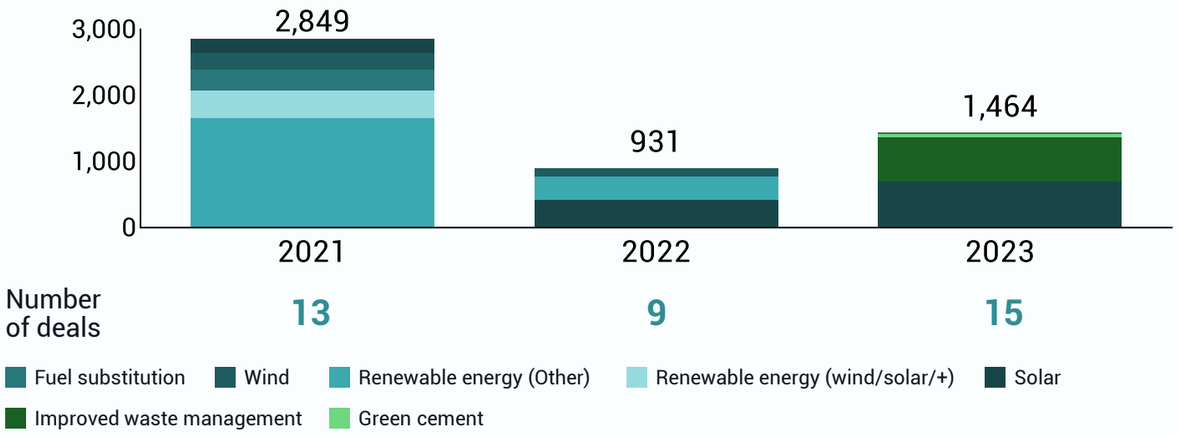
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Philippines: Investment Flows and Investment Opportunities

New investments made in the Philippines

(Unit: M USD)

2023 total = $1,46M (~23% of SEA)



Recent deal examples

Waste management: ~$682M investment by Manila Water Company in Three-River System Wastewater Project, which involves construction of wastewater treatment facilities and sewer network

Solar: ~$285M acquisition 50.5% in SP New Energy by Meralco

Where further investments can be made

Investable ideas	Rationale
Utility-scale solar and wind energy	Philippines is **heavily dependent on coal, which accounts for >50% of power generation** In 2023, Meralco Powergen acquired SP New Energy through a $285M investment to **fund construction of 3.5GW solar energy farm and 4.5GWh battery project**
Captive solar with incremental energy storage system	March 2023: **San Miguel Global Power launched nationwide BESS project**, which will be built across 32 locations with commercial operations of 1,000 MWH
Regenerative agriculture practice	Philippine government **allocated ~$766M under 2023 General Appropriations Act on agriculture** (e.g., National Rice Program, National Corn Program, Organic Agriculture Program)

Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Philippines: Policy

Gov. commitments under NDC

Emission

- 3% — Unconditional emissions reduction by 2030 vs. 2005

Energy

- 35% — RE contribution for power generation by 2030
- 100% — Electric vehicle of new vehicle sales by 2040

Nature

- 0% — Net forest loss by 2030

Recent developments on regulatory framework

Amended Renewable Energy Act (Jan. 2023)

Amended 2008's Renewable Energy Act to allow **full foreign ownership of renewable energy projects**

Established "Green Lanes" (Feb. 2023)

Aimed to **attract more investments by expediting process of obtaining licenses and permits** needed

Provide incentives for use of RE (Oct. 2023)

Introduced **incentives** for companies with **self-financed energy efficiency projects**

Philippine Development Plan (Jan. 2023)

- **Outlines roadmap on nationwide economic and social priorities from 2023-2028**
- Priorities are on job creation and accelerating poverty reduction through high growth
- Includes plans on promoting **renewable energy** sources and **modernizing agriculture**

Public-Private Partnership (PPP) Code (Dec. 2023)

- Established PPP Code, which **provides unified legal framework for all PPP projects in the Philippines**
- PPP Code introduces features such as establishment of Project Development and Monitoring Facility, Risk Management Fund, PPP Governing Board

Sources: Philippine Development Plan; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Philippines: Accelerator

Recent developments

Finance mechanism

Pentagreen Capital solar project

- Pentagreen Capital has provided **$30M subordinate loan** for solar projects implemented by Citicore Philippines, **improving bankability of the deal**
  - The project has bridged funding 490 MW of renewable in the Philippines and targets to expand up to 1 GW
  - Pentagreen Capital aims to increase size of fund up to $100M

Policy

Regulations on renewables

- Has made **regulatory progress in accelerating renewables** in the country
  - Amended Renewable Energy Act
  - Established "Green Lanes"
  - Introduced incentives for use of renewables
  - Established Public-Private Partnership Code

Partnership

Transition credits pilot projects

- Dec. 2023: MAS has announced launch of **two pilot projects for transition credit in the Philippines**
  - South Luzon Thermal Energy Corporation coal plant (first successful market-based ETM) and Mindanao coal plant
- TRACTION[1] will be bringing insights and projects to build concrete solutions for transition credits

What is needed

Successful blended finance cases

- Ensure **successful implementation of solar projects**, both in terms of **green outcomes** and **funding more capital through blended finance**
- Eventually, aim towards **scaling and repeating similar projects** to accelerate green investments in the region

Further development on renewables regulations

- Establish **clear framework to enforce** Renewable Portfolio Standards
- Develop a **comprehensive energy roadmap** to give visibility and predictability to investors

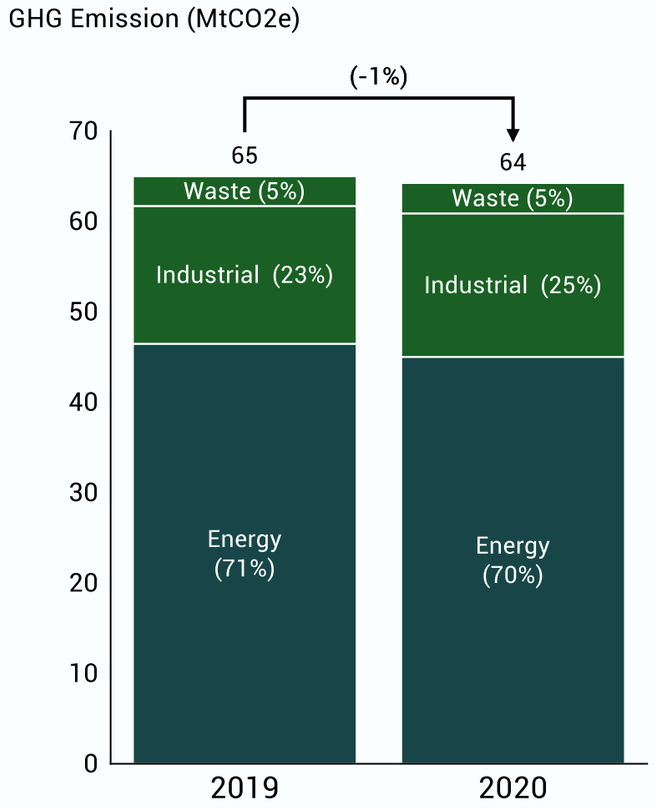
Regional collaboration

- Cooperate with members and partners of TRACTION to **identify roadblocks and build repeatable system**
- **Implement transition credits** through the two pilot projects with support from partners with richer experience

Note: 1) Transition Credits Coalition
Sources: MAS; UNFCCC; Expert interview; Lit. search; Bain analysis

Singapore: Country Snapshot

GHG Emissions Profile



2024 Singapore Progress Overview

Government commitments under NDC target to limit GHG emissions **in 2030 to 60 MtCO2e**

- **3% renewable energy contribution** by 2030 (vs. 4% in 2021) **and 100% EV of new vehicle sales** by 2030 (vs. 12% in 2022)

Singapore continues to lead 2024 Green Index Score, with progress seen among corporates releasing ambitions and roadmaps on net zero

- SBS Transit, Jardine Cycle & Carriage, Wilmar International have set either ambition targets or roadmaps on net zero

21% drop in private green investments in 2023 compared to 2022 due to decrease in size of individual deals

- **2023 total private green investments of $913M**, accounting for ~14% of 2023 SEA total

Despite overall drop in investments, increases were seen in transport and building sectors, while decreasing in solar and waste management vs. 2022

- ~$400M acquisition by Singapore Telecommunications Limited in buildings and $70M investment from BPIN Investment Co in transport

Steps have been made on **transition credits, carbon pricing, and regional collaboration for low-carbon electricity imports**

- Monetary Authority of Singapore has launched TRACTION
- 2024 new carbon pricing schemes are expected to be implemented in Singapore
- EMA[1] has approved low-carbon imports from Cambodia, Indonesia, and Vietnam in 2023

2024 Green Economy Index Score

55/100 (▲ +4)

Decarbonization Ideas

1. **Enable vPPA via bilateral grid interconnection**
2. **Energy efficiency improvements for data centers**
3. **Waste stream for biofuels production and low-carbon transition fuels for maritime**

Note: 1) Energy Market Authority | Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Singapore: Overall Progress Assessment

		Requirements and Assessment		Commentary
		'23	'24	
Ambition	Target-setting and quality			**Non-legally binding 2050 net-zero target with an overall 2030 absolute emissions target of 60 MtCO2e;** 2020 emissions at ~64 MtCO2e vs. ~60 MtCO2e 2030 unconditional target
	Target cascading			Absence of sector-specific emissions targets, but with **presence of net-zero and emissions targets among 6/10 major emitting companies, recently target set by JC&C, SBS Transit**
Progress	Current state			**No significant progress**; 11.3t of emissions per capita, ~4% RE share for power generation, 12% of battery EV in annual 4W passenger car sales
Roadmap	National sector-level roadmap			**LT-LEDS and Green Plan** released in 2021 provides targets but lacks implementation details; no new roadmap was released
	Corporate roadmap			**3/10 major emitting companies** have released roadmap to achieve net zero; **SBS Transit and Wilmar International newly released** roadmaps on net zero
Accelerators	Regulatory framework			**Mandatory emissions reporting for industrial facilities** emitting >2K tCO2e/year **Connection point of global carbon registries:** carbon credits can offset 5% of carbon taxes from 2024
	Financial prerequisites			**Plans to increase carbon tax** from S$5/ton of emissions to S$25/ton of emissions by 2025 No carbon credits issued in 2023 due to limited land area; **presence of green loans for SMEs**
	Infrastructure, tech, and human capital			**~4K EV charging stations** in place; **more grid infra with AI/ML planned to support DER[1] and energy imports** Limited land resources for forestry projects and agricultural areas to implement SRI
Investment	Corporate investment			Required capital investment of $5B but only $0.9B private investments made in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

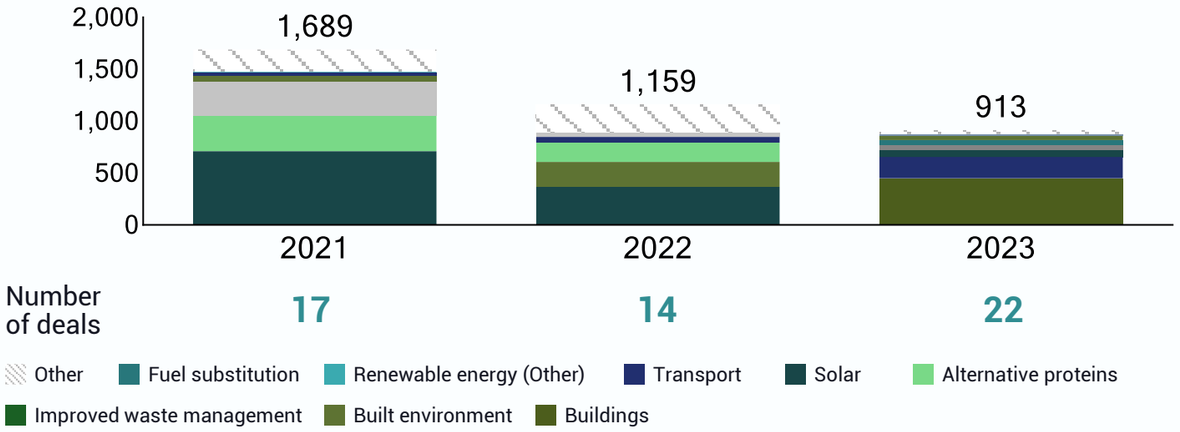
Note: 1) Distributed Energy Resource
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Singapore: Investment Flows and Investment Opportunities

New investments made in Singapore

(Unit: M USD)

2023 total = $913M (~14% of SEA)



Recent deal examples

Transport: $70M investment from BPIN Investment Co. increasing share in Durapower Holdings from ~48% to ~65%

Solar: $42M funding in Maxeon Solar Technologies by Zhonghuan Singapore Investment and Development Pte. Ltd.

Where further investments can be made

Investable ideas	Rationale
Enable vPPA via bilateral grid interconnection	At present, Singapore **imports almost all its energy** needs and is exploring strategies to diversify its energy sources November 2023, Singapore has approved fourth cross-border electricity contract, **import of low-carbon electricity by Sembcorp from Vietnam**
Build system to increase energy efficiency in data centers	All new buildings in Singapore **must be 50% more energy efficient than 2005 levels** Neutra DC employs **advanced cooling techniques** to ensure efficient heat dissipation while minimizing energy consumption in their data centers
Waste stream for biofuels production and low-carbon transition fuels for maritime	In 2023, **successful SAF pilot** by Singapore Airlines with Civil Aviation Authority of Singapore (CAAS) and GenZero to **generate SAF credits for sale** In COP 28, **Pacific International Lines**, Singapore-based shipping company, and **DP World**, Dubai-based port operator, agreed to **develop green solutions for maritime industry**

Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Singapore: Policy

Gov. commitments under NDC

Emission

- 60Mt CO2e — Unconditional emissions reduction by 2030

Energy

- 3% — RE contribution for power generation by 2030
- 100% — Electric vehicle of new vehicle sales by 2030

Nature

- 200ha — Additional green area by 2030
- 0% — Net forest loss by 2030

Recent developments on regulatory framework

Feb. 2021 — Bld. energy performance requirements

BCA[1] **increased minimum energy performance requirements for buildings**, where new building must be 50% more energy efficient than 2005 lv.

2022 — Green Plan

- **Outlines nationwide specific targets on sustainable development for five key pillars**
  - 1) city in nature, 2) sustainable living, 3) energy reset, 4) green economy, 5) resilient future
- Targets include increasing green spaces, waste management, solar energy deployment, etc.

Oct. 2023 — Eligibility criteria for ICC[2]

Published ICC framework that will allow companies to use ICC to offset up to 5% of tax obligations

Dec. 2023 — Launched Transition Credits Coalition (TRACTION)

- Monetary Authority of Singapore (MAS) has launched TRACTION, which will aim to **look for solutions to scale early retirement of coal-fired power plants**
- **Has launched pilot projects to test out high-integrity carbon credits** for early retirement of coal-fired power plants

2024~ — Increase in carbon tax

Increase from **S$5/tCO2e to S$25/tCO2e in 2024**, and increase to S$45/tCO2e between 2026 and 2027

Notes: 1) Building and Construction Authority; 2) International carbon credits
Sources: MAS; BCA; Green Plan; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Singapore: Accelerator

Finance mechanism

Policy

Partnership

Recent developments

New innovative mechanisms

- Sept. 2023: MAS[1] **launched new finance mechanism, transition credit,** to accelerate coal phase-out
- Dec. 2023: Singapore announced launch of **Asia-focused blended finance initiative FAST-P**
  - FAST-P **targets fund size of $5B**
  - Has partnered with **ADB, GEAPP, and MAS** to accelerate the initiative

Carbon tax

- Introduced **international carbon credits framework** in 2024 to offset up to 5% of taxable emissions
- **Progressive increase in carbon tax rates** from S$5/tCO2e in 2019 to S$25/tCO2e in 2024
  - S$45/tCO2e in 2026 and 2027
  - S$50~$80/tCO2e by 2030

Regional collaboration for renewables

- Singapore government targets to import **4GW of low-carbon electricity by 2035**
  - 4GW accounts for ~30% of Singapore's electricity supply
- In 2023, Energy Market Authority has **approved low-carbon electricity import from Cambodia, Indonesia, and Vietnam**

What is needed

Project implementation based on innovative finance mechanisms

- Build **track records of transition credits** projects, **showcasing successful use of carbon credits for coal phase-out**
- Fast-P initiative to focus on successfully **executing blended finance projects** in Asia through **partnering with both public and private stakeholders**

Further advances in carbon tax

- **Expand number of qualifying projects** under Eligible List as part of its carbon tax regime
- Continue to **align** carbon tax rate with **global carbon price** to ensure carbon price remains effective

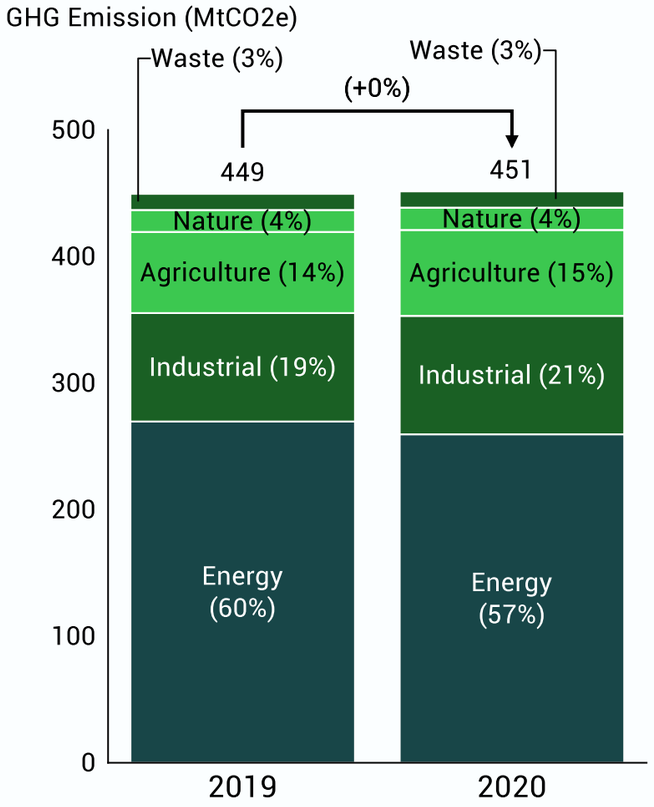
Support grid development

- Expansion of **SEA countries' grid infrastructure** is critical to **increase availability of electricity for import**
- Key is to build strong **G2G[2] relationships** and support other SEA countries through **funding and technical assistance**

Notes: 1) Monetary Authority of Singapore; 2) Government to government
Sources: MAS; NCCS; Lit. search; Bain analysis

Thailand: Country Snapshot

GHG Emissions Profile



2024 Thailand Progress Overview

Government commitments under NDC aim for **30% emissions reduction** compared to 2030's BAU level

- **30% renewable energy contribution** by 2030 (vs. 19% in 2021) and **100% EV of new vehicle sales** by 2035 (vs. 8% in 2022)

Upward trajectory in 2024 Green Index Score, driven by national roadmaps under energy sector

- National Energy Plan released by the government and Clean Energy Transition roadmap released by IEA

Established **Department of Climate Change and Environment** under Ministry of Natural Resources and Environment in 2023

- The department is to support achieving Thailand's commitment towards net zero by 2050

8% increase in 2023 private green investment, due to large-scale investment in wind sector

- **2023 private green investment of $393M,** accounting for ~6% of 2023 SEA total

Significant increase in wind power investment, making ~84% of 2023 total private green investment in Thailand

- $334M acquisition by Nusasiri in Wind Energy Holding

Thailand has successfully **accelerated EV ecosystem** within the country through **strong subsidies for EV consumers**

2024 Green Economy Index Score

39/100 (▲ +2)

Decarbonization Ideas

1. **Utility-scale solar and wind energy**
2. **Electric passenger vehicles and charging infrastructure**
3. **Alternate wetting and drying (AWD) for rice cultivation**

Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Thailand: Overall Progress Assessment

		Requirements and Assessment		Commentary
		'23	'24	
Ambition	Target-setting and quality			**Non-legally binding 2065 net-zero target with carbon neutrality milestone by 2050;** 2020 emissions at ~451 MtCO2e vs. ~389 MtCO2e 2030 unconditional target
	Target cascading			Sectoral emissions targets detailed out in LT-LEDS, **6/10 major emitting corporates have set net-zero targets**, with recent targets by Gulf Energy and Ratch Group
Progress	Current state			6.3t of emissions per capita, 19% RE share for power generation,~2% decrease in forest land, 8% of battery EV in annual 4W passenger car sales
Roadmap	National sector-level roadmap			**Well-established roadmap on net zero**; general LT-LEDS, PDP 2018-2037, Clean Electricity Transition released in 2023 with long-term targets and initiatives for energy transition
	Corporate roadmap			**1/10 major emitting corporates** has released roadmap to achieve net zero
Accelerators	Regulatory framework			**Mandatory emissions reporting for large facilities**; Climate Change Act still under drafting process **National registry of mitigation actions in place**; no mandatory certificate on organic cultivation
	Financial prerequisites			**Carbon tax in plans; incentives in place for solar, wind, and electric vehicles** ~122K carbon credits issued on local registry; presence of **microcredits scheme for smallholder famers**
	Infrastructure, tech, and human capital			**Strong infra-island grid connectivity, smart grid upgrades in process; ~2K EV charging stations in place** **Five certified NBS projects** on Thailand carbon registry, none under Verra; early stage of SRI adoption
Investment	Corporate investment			Required capital investment of $33B but only $0.4B private investments made in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

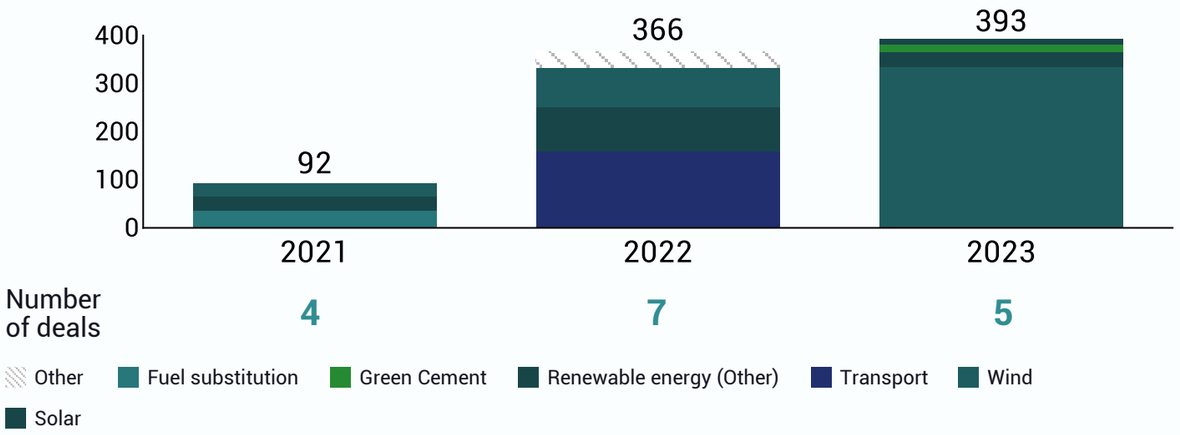
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Thailand: Investment Flows and Investment Opportunities

New investments made in Thailand

(Unit: M USD)

2023 total = $393M (~6% of SEA)



Recent deal examples

Wind: $334M acquisition by Nusasiri in Wind Energy Holding, acquiring additional 26.65% of Wind Energy Holding

Renewable energy: ~$32M acquisition of 25% stake in B. Grimm power by PEA ENCOM International Co.

Where further investments can be made

Investable ideas	Rationale
Utility-scale solar and wind energy	In 2024, **introduction of Green Utility Tariff** on prices of renewable energy sources aim to incentivize businesses to perform the shift In 2021, Thailand launched the then-**largest floating hydro-solar project**, 45 MW
Electric passenger vehicles and charging infrastructure	**EV registration has increased 380% in 2023 compared to 2022**, with 100,219 units in 2023 and 20,816 units in 2022 PTT Oil and Retail Business aims to **build 7,000 EV charging stations by 2030**
Alternate wetting and drying for rice cultivation	Thailand is the **second-largest exporter of rice** Thai Ministry of Agriculture and Cooperatives has launched **Thai Rice NAMA project in six provinces** to reduce GHG emissions from irrigated rice cultivation

Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Thailand: Policy

Gov. commitments under NDC

Emission

- 30% — Unconditional emissions reduction vs. BAU by 2030

Energy

- 30% — RE contribution for power generation by 2030
- 100% — Electric vehicle of new vehicle sales by 2035

Nature

- 55% — Forest coverage by 2037
- 0% — Net forest loss by 2030

Recent developments on regulatory framework

Launched FTIX, voluntary carbon credits exchange

Operated by Federation of Thai Industries, which consists of 12,000 companies across 45 sectors

Established Department of CCE[1]

Department within the Ministry of Natural Resources and Environment that **focuses on Thailand's climate change efforts**

Drafting National Energy Plan

In the process of integrating five different plans (e.g., National Power Development Plan, Alternative Energy Development Plan) into a single plan

Apr. 2019 — Sept. 2022 — Oct. 2022 — Aug. 2023

Power Development Plan 2018

- **Sets GHG emissions goals, energy efficiency targets, and renewable energy targets**
- Focuses on fuel diversification, maintaining appropriate cost of power, and decreasing GHG emissions
- Updates have been made in Power Development Plan in October 2020

National Economic and Social Development Plan

- **13th Plan** outlines five-year strategy from **2023-2028**
- **Includes strategies on sustainable agriculture and nature-based solutions**, such as rehabilitating wetlands and forests and improving land use to address climate change

Note: 1) Climate Change and Environment
Sources: Power Development Plan; National Economic and Social Development Plan; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Thailand: Accelerator

Recent developments

Finance mechanism

Thai Climate Initiative Fund

- **Aug. 2023 launch of Thai Climate Initiative Fund at a size of ~$7.1M** as one of the four outputs of Thai-German Cooperation on Energy, Mobility, and Climate (TGC-EMC)
- The fund will primarily focus on providing financial support for **climate mitigation and adaptation projects**

Policy

EV regulations

- Thailand has **successfully shaped EV market** through **attractive EV subsidies**
  - 150,000 baht/car, which has boosted EV sales in Thailand in 2022
  - Planning to decrease subsidy package to 100,000 baht/EV in 2023 as EV ecosystem can now operate on its own

Partnership

Lien Ha Thai industrial park

- 2021, Lien Ha Thai Industrial Park has been established **with favorable conditions for investors to invest in**
- By 2023, the industrial park has attracted **11 projects with investments >$1B**
  - 9 projects involve foreign direct investments

What is needed

New finance mechanism

- Need to **utilize new finance mechanism, such as blended finance,** to catalyze private finance in green investments
- **Build expertise and track record** through support from stakeholders with greater experience

Further developments in EV regulation

- Continue **enabling policies that attract foreign investment** in EV manufacturing
- **Gradual incentives reform** to remove universal fossil fuels subsidy and adopt targeted incentives for sector that brings competitive advantage

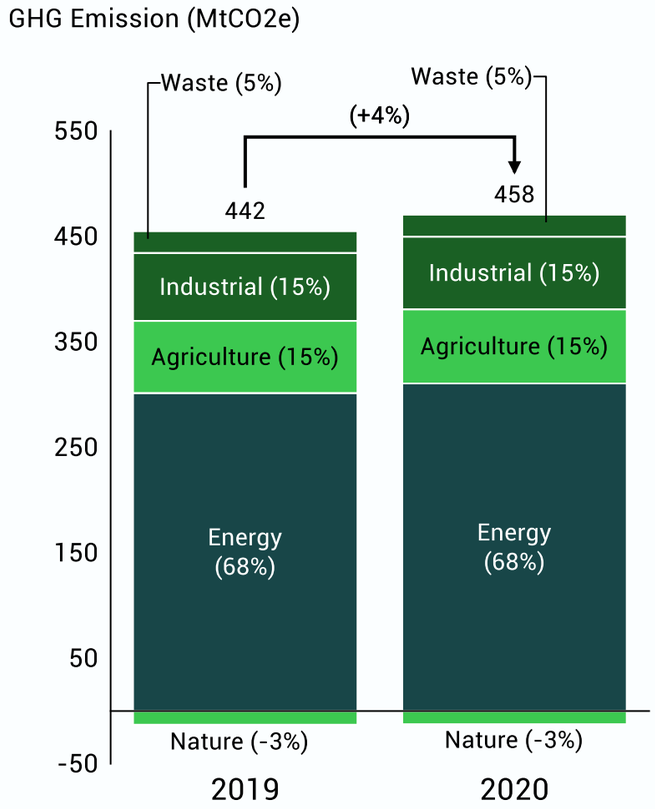
Growth of EV industrial hub

- **Attract international EV makers**, such as Chinese and Japanese EV makers
- **Expand industrial hub along EV value chain**, such as battery manufacturing, battery recycling, EV charging station

Sources: MSCI; Country NDC; UNFCCC; Expert interview; Lit. search; Bain analysis

Vietnam: Country Snapshot

GHG Emissions Profile



2024 Vietnam Progress Overview

Government commitments under NDC aim for **16% emissions reduction** compared to 2030's BAU level

- **47% renewable energy contribution** by 2035 (vs. 43% in 2021) and **50% EV of new vehicle sales** by 2030 (vs. 3% in 2022)

Upward trajectory in 2024 Green Index Score, driven by release of new national roadmap, increase in renewable energy and decrease in tree loss

- PDP8 (May 2023) and JETP Resource Mobilization Plan (Dec. 2023)
- 1.7% increase in use of renewables compared to 2021, and tree loss decreased by 14% compared to 2021

79% drop in 2023 private green investments compared to 2022, driven by freeze in investments from delays in major national roadmaps

- **2023 private green investments of $199M**, accounting for ~3% of 2023 SEA total

2023 green investment projects have been focused on **smaller-scale solar projects** compared to past years

- $165M acquisition by AC Energy of Super Energy's solar energy business and $20M investment by responsibility climate fund in CME solar

Progress seen in **initiatives related to carbon markets and eco-friendly industrial parks, but limitations exist in scaling blended finance projects**

- Launched **first voluntary carbon exchange in 2023** and plans to pilot exchange in 2025
- Has announced **conversion to eco-friendly industrial parks by 2030**
- **JETP faces roadblocks** implementing projects due to **1) fragmented source of funds, 2) large portion of earmarked funds, 3) small concessional funds**

2024 Green Economy Index Score

38/100 (▲ +5)

Decarbonization Ideas

1. **Alternative transmission and distribution infrastructure expansion**
2. **Precision agriculture practice**
3. **Utility-scale solar and wind energy**

Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; UNFCCC; Berkley Carbon Trading Project; Expert interview; Lit. search; Bain analysis

Vietnam: Overall Progress Assessment

		Requirements and Assessment		Commentary
		'23	'24	
Ambition	Target-setting and quality			**Non-legally binding 2050 net-zero target** with emissions reductions target for 2030; 2020 emissions at ~458 MtCO2e vs. ~781 MtCO2e 2030 unconditional target
	Target cascading			**2030 national target cascaded to sectors; corporate net-zero targets set by 3 major emitting corporates** (most recent target set by Vinamilk in 2023)
Progress	Current state			**Forest land area has increased as a result of forest conservation efforts**; 4.7t of emissions per capita, 43% RE share for power generation, 3% of battery EV in annual 4W passenger car sales, 14% decrease in tree loss
Roadmap	National sector-level roadmap			Recently established detailed **national roadmap on Energy: PDP8** (May 2023), **JETP** implementation plan (Dec. 2023) Has approved sustainable agriculture and rural development strategies in 2022
	Corporate roadmap			**Needs corporate-level efforts to develop roadmaps** as all major emitting corporates **do not have decarbonization roadmap**
Accelerators	Regulatory framework			Emissions reporting mandatory for sectors, but **no permitting process for RE electricity** REDD+ framework, regulations on fertilizers are well set, **but lack carbon market registry, VCM standards**
	Financial prerequisites			**Carbon tax under development; incentives for EV, solar, and green building** introduced No carbon credits issued and incentives on organic agriculture
	Infrastructure, tech, and human capital			**Lacks sufficient grid for RE,** so no new solar/wind projects in 2022; ~500 EV charging stations in place **No NBS projects** but has high level of SRI adoption
Investment	Corporate investment			Required capital investment of $34B but only **$0.2B private investments made** in 2023

Highly unlikely to be on track | Unlikely to on track | Likely to be on track | Highly likely to be on track

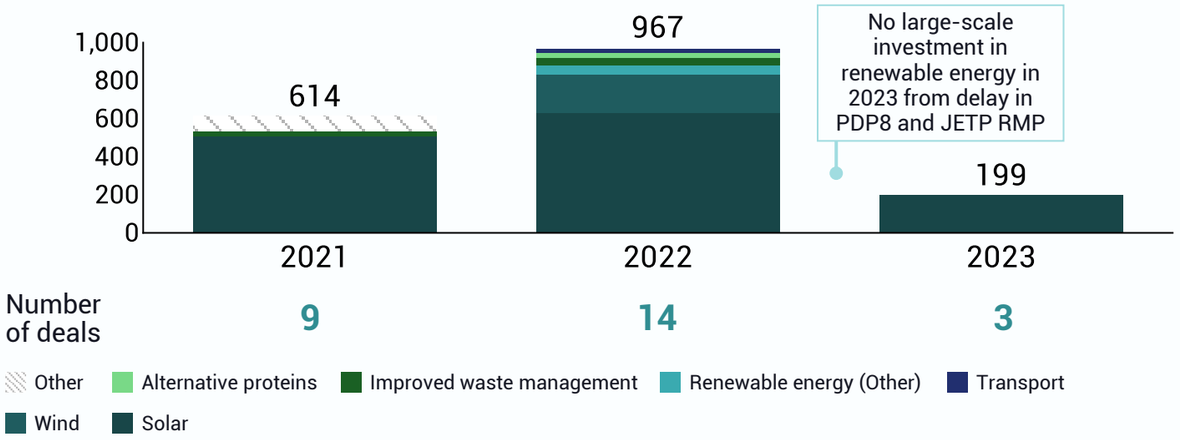
Sources: Country NDC; LT-LEDS; Climate Watch; IRENA; IEA; FAO; Euromonitor; UNFCCC; Expert interview; Lit. search; Bain analysis

Vietnam: Investment Flows and Investment Opportunities

New investments made in Vietnam

(Unit: M USD)

2023 total = $199M USD (~3% of SEA)



Recent deal examples

Solar: $165M acquisition by AC Energy of Super Energy's solar energy business

Solar: $20M investment by responsAbility climate fund in CME solar to promote usage of solar energy in Vietnam

Where further investments can be made

Investable ideas	Rationale
Alternative transmission and distribution infrastructure expansion	The rapid RE development has led to **grid congestion** issues and **halted deployment of utility-scale solar projects** ~$900M investment by EVNNPT[1] to construct a **North-South 500kV transmission line and improve interregional connectivity from current 2,200 MW to about 5,000 MW**
Utility-scale solar and wind energy	Coal accounts for **~30% of Vietnam's electricity generation,** and the government **aims to reduce this to ~20% by 2030** Solar has been **largest private green investment** sector since 2021, and the government is also **prioritizing solar and wind through JETP**
Precision agriculture practice	Agriculture accounts for **2nd largest emissions** in Vietnam, ~15% of total GHG emissions Government **signed $435M loan agreement with Japan International Cooperation Agency (JICA)** for funding projects for three different topics, which include expanding agriculture supply chains

1) National Power Transmission Corporation

Sources: AVCJ; S&P Capital IQ; Preqin; Pitchbook; Global Energy Monitor; Expert interview; Lit. search; Bain analysis

Vietnam: Policy

Gov. commitments under NDC

Emission

- 16% — Unconditional emissions reduction vs. BAU by 2030

Energy

- 47% — RE contribution for power generation by 2030
- 50% — Electric vehicle of new vehicle sales by 2030

Nature

- 42% — Forest coverage by 2030
- 0% — Net forest loss by 2030

Recent developments on regulatory framework

GHG emissions reporting — Jan. 2022

Issued list of 21 sectors that **must prepare report on GHG inventory from 2023** every two years

Environmental protection strategy — June 2022

Issued Decision 450, long-term strategy on environmental protection, **emphasizing renewable energy industry as one of the key drivers**

Under development of DPPA[1] — Sept. 2023

Ministry of Industry and Trade submitted **study of mechanism for DPPA between RE plants and consumers** to the Prime Minister

PDP8 — May 2023

- Vietnam's **8th Power Development Plan** with Vision to 2050
- Announced **phase-out of coal by 2050** and **increase in renewable energy**, such as wind, solar, and hydro
- Emphasized implementation of new technologies, including **battery storage, hydrogen, and ammonia**

JETP Resource Mobilization Plan (RMP) — Dec. 2023

- Outlines plan for **total $15.5B** worth of investment, expecting **$8B from public and $7.5B from private**
- Short-term priorities include **power transmission, battery storage, wind power development**
- Mid-term priorities include **EE, solar power, and coal phase-out**

Note: 1) Direct power purchase agreement
Sources: Power Development Plan; JETP RMP; MSCI; Country NDC; UNFCCC; Lit. search; Bain analysis

Vietnam: Accelerator

Finance mechanism

Recent developments

Vietnam JETP

- Investment **priorities specified** by JETP RMP (Dec. 2023) **but still faces challenges** in implementing projects
  - **Fragmented funding sources** that involve 11 IPG countries, ADB, and CIF
  - **20% of Vietnam's JETP funds earmarked** before release of the JETP RMP
  - **~70% of Vietnam's JETP loans at commercial** rate, making it difficult to scale blended finance to meaningful level

What is needed

Successful blended finance cases

- **Clear communication** between fund provider and recipient **on investment priorities (e.g., target, sector)**
- Provide funds with **greater flexibility (e.g., without earmark)** and in **catalytic terms** to scale blended finance

Policy

Incentives for energy transition

- In 2023, implemented an **updated feed-in tariffs mechanism** for new wind and solar projects
  - **Set annual prices** instead of on a 20-year basis to provide more flexibility and responsiveness to market conditions
  - Introduced solar radiation intensity factor to **increase price and promote development** in regions with lower radiation levels

Prioritize incentives

- **Focus incentives to accelerate implementation plan for expansion** of strategic critical industries and remove any distortion to market prices
- Allocate resources to **enhance grid infrastructure,** which is more crucial to advancing energy transition

Partnership

Industrial parks

- **Vietnam has 563 industrial parks** throughout the country
  - China Plus One strategy has initiated companies to move into Vietnam to decrease supply chain dependency on China
- Ministry of Planning and Investment released a report to **convert some existing industrial parks to eco-friendly parks** by 2030

Industrial park focused on decarbonization

- **Co-locate global companies** with rich experience in decarbonization and technology
- **Form industrial parks** with stakeholders that have **identified decarbonization priorities**

Sources: JETP RMP; MSCI; Country NDC; UNFCCC; Expert interview; Lit. search; Bain analysis

Appendix

New Investments: Glossary

Theme

Nature and agriculture

Agricultural productivity
Alternative proteins
Minimal food loss and waste
Forest protection

Transport

EV manufacturing
EV charging
Alternative-fuel ships

Buildings

Energy efficiency in buildings
IoT technology
Green data center[1]

Industrial and Waste

Improved waste mgmt.
Green cement
Alternative materials

Power

Solar
Wind
Bioenergy
RE (solar+wind)
RE (others) (e.g., geothermal)
Fuel substitution (e.g., LNG)

Investor type

Corporate

Included state-owned corporates

Sovereign wealth fund/ Government affiliate

Climate fund[2]

E.g., financial institutions-established funds, venture capitals

Private equity/ Venture capital

Included investment arm of a corporate or SWF[3]

Infrastructure fund

Investor origin

Domestic

If the investor HQ country is the same with target HQ country

Foreign (within SEA)

If the Investor HQ country is different from target HQ country but is in SEA

Foreign (outside SEA)

If the investor HQ country is outside of SEA

Notes: Themes are determined by considering the business area of a target and announced plan/purpose of the investments; 1) Determined by reviewing the purpose and requirement of the investment (e.g., must obtain environmental certification as part of loan criteria); 2) Determined by reviewing the fund's introduction and actual investment portfolios; 3) Sovereign wealth fund

[Backup] Nationally Determined Contributions (NDCs) targets of SEA countries

(Unit: MtCO2e)

	Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
NDC date of submission	Dec. 2020	Dec. 2020	Sep. 2022	May 2021	July 2021	Aug. 2021	Apr. 2021	Nov. 2022	Nov. 2022	Nov. 2022
Current emissions (2020)	12	75	1,476	43	368	247	228	64	451	458
Business-as-usual (2030)	30	155	2,869	104	1,339	843	360 (cumulative 3340[1], 2020-2030)	91[2]	555	928
Unconditional NDC target (2030)	24 (-20% from BAU)	N/A	1,953 (-32% from BAU)	42 (-60% from BAU)	736 (-45%[3] from base year)	598 (-245Mt[4] from BAU)	351 (-3% from BAU)	60 (absolute emissions target)	389 (-30% from BAU)	781 (-16% from BAU)
Conditional NDC target (2030)	N/A	90 (-65Mt from BAU)	1,632 (-43% from BAU)	34[5]	N/A	428 (-415Mt[3] from BAU)	90 (-75% from BAU)	60	333 (-40% from BAU)	524 (-44% from BAU)

Notes: 1) BAU emissions in 2030 calculated by solving for CAGR based on cumulative BAU emissions for the period 2020 to 2030; 2) Calculated by applying CAGR (2010-18) to 2018 emissions; 3) Reduction of carbon intensity; 4) Sum of reduction target of each sector; 5) Conditional targets set for sectors including land use, energy, agriculture and waste; NDC=nationally determined contribution—a country's official commitment to greenhouse gas emission reduction as submitted to the UNFCCC
Sources: Climate Watch; UNFCCC Country NDCs

[Backup] SEA Green Economy Index Methodology

Index (100%)

Ambition — 20% weightage

Target-setting and Quality (50%)

6 binary questions asked on target-setting and quality

+

Target Cascading (50%)

Sector level

1 binary question on whether a country has sector level targets

+

Corporate level

Count number of corporate with net-zero target among top 10 (Weighted average scores based on emissions level)

Progress — 25% weightage

GHG emissions per capita (33%)

Total country GHG emissions level/ population

+

Sector progress (66%)

Energy

% of renewable energy in total power generation

+

% of electric vehicles in new car sales

+

Nature

Net % change in forest land

+

Agriculture

Nutrient efficiency

Roadmap — 20% weightage

Sector level roadmap (33%)

Energy | Nature | Agri.

Score based on existence and quality of sector level roadmap

Quality evaluated on the level of detail and timeline of roadmap

+

Corporate level roadmap (66%)

Count number of corporates with roadmap among top 10 (Weighted average scores based on emissions level)

Accelerators — 25% weightage

Regulatory framework (33%)

- **Energy** — Fraser Index, permit/legal mandates on RE, …
- **Nature** — Forest conservation, carbon markets, …
- **Agriculture** — Inorganic fertilizer registry, sustainability certificate, ..

+

Financial prerequisites (33%)

- **Energy** — Carbon tax, incentives for RE/EV/green bld.
- **Nature** — Carbon credits issued relative to forest area
- **Agriculture** — Organic fertilizer incentives, SME loan/credit

+

Infra., tech and human capital (33%)

- **Energy** — National grid infra, # of EV changing stations
- **Nature** — # of registered NBS projects
- **Agriculture** — System of Rice Intensification(SRI) adoption

Investment — 10% weightage

Green investment size (100%)

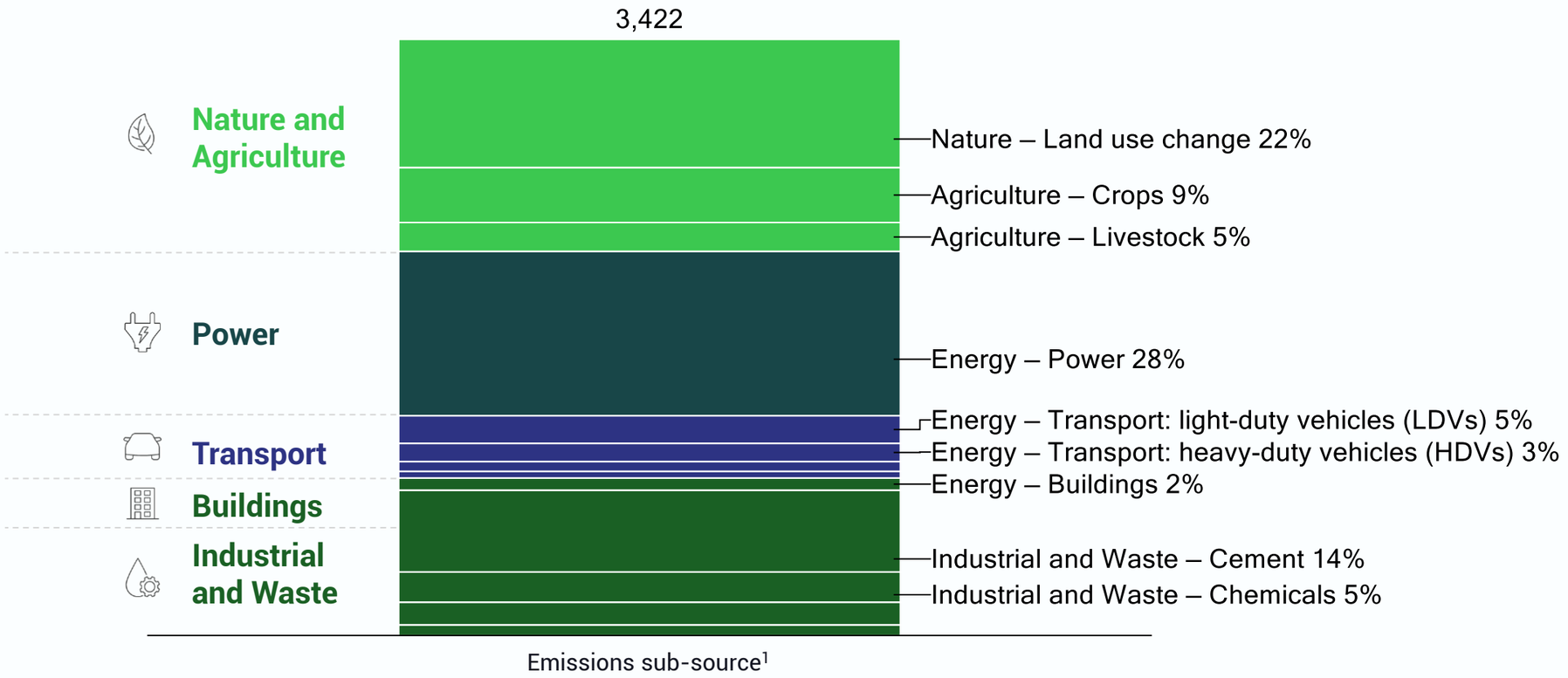
% of actual private green investment against the required amount of investment

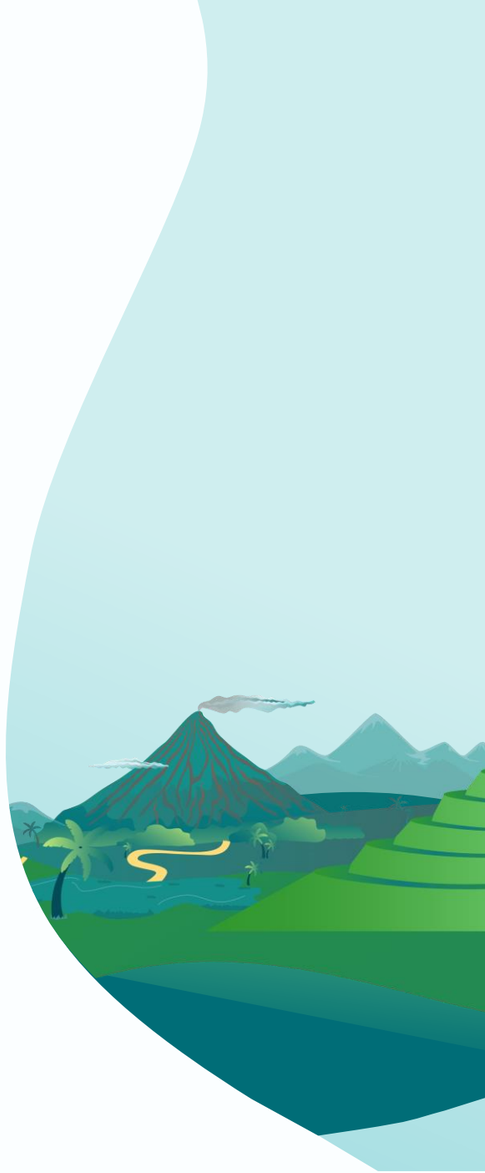
(Required amount of investment is proportional to the size of GHG emissions in each country)

Sources: Bain analysis

[Backup] **Investable Ideas Assessment:** Nature and Agriculture, Power, Transport, Buildings, and Industrial and Waste are the major sources of emissions for SEA

SEA emissions breakdown (2020 GHG emissions, MtCO2e)



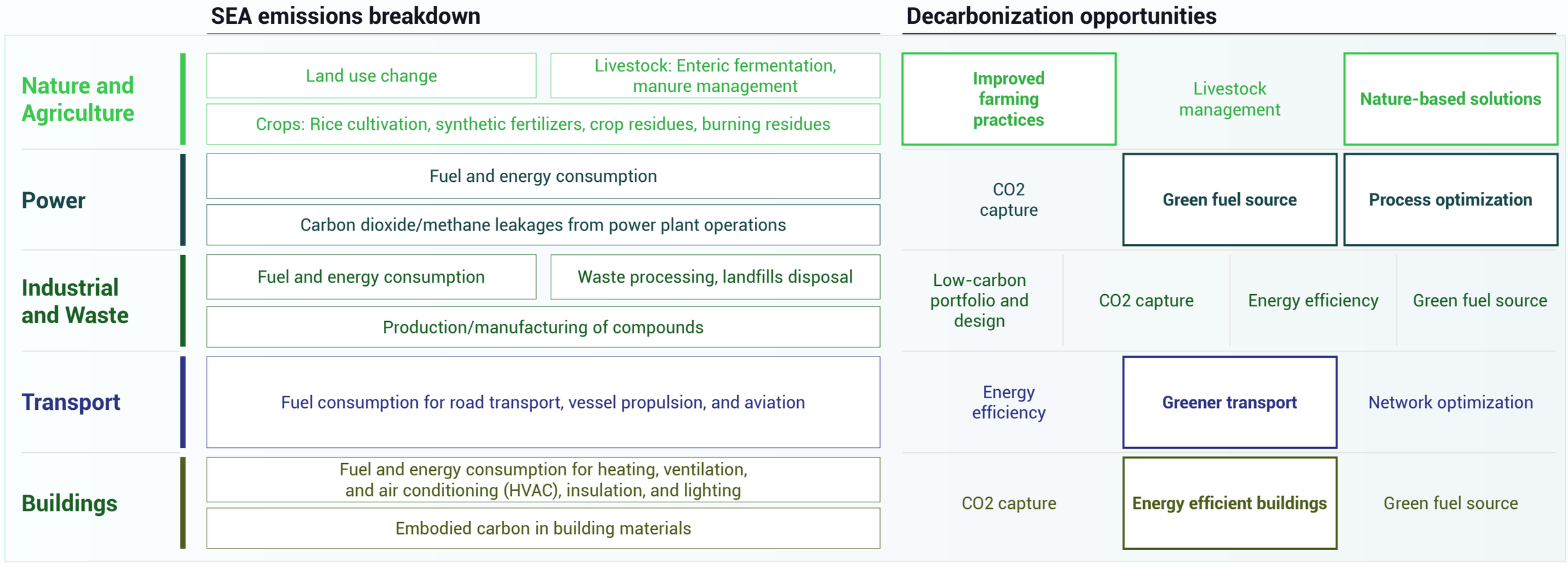


Note: 1) Emissions sub-source percentages are from 2018 ASEAN-6 data
Sources: ClimateWatch; IEA; country Biennial Update Reports

[Backup] **Investable Ideas Assessment:** Decarbonization opportunities prioritized based on assessment of attractiveness, technical feasibility, and commercial interest to date

Ideas category	Sector	Abatement impact Abatement potential of ● >100 MtCO2e (3%) ◕ 75–50 MtCO2e ◑ 50–25 MtCO2e ◔ < 25 MtCO2e	Technical feasibility Technology maturity range ● Commercially viable ◕ Mature but viable at scale ◑ 2–5 years from maturity ◔ 5–10 years from maturity	Commercial interest Private investment deal made from 2020 to 2023 in SEA ● > 2 deals ◑ 1 deal	Short-listed category
1 **Improved farming practices**	Nature and agriculture	●	●	●	✓
Livestock management	Nature and agriculture	◑	●	○	
2 **Nature-based offsets**	Nature and agriculture	●	●	◑	✓
CO2 capture	Power, Industrial and Waste, Buildings	●	◑	○	
3 **Green fuel source**	Power, Industrial and Waste, Buildings	●	●	●	✓
4 **Process optimization**	Power	●	●	●	✓
Low-carbon portfolio and design	Industrial and Waste	◕	●	●	
5 **Greener transport mode**	Transport	●	●	●	✓
6 **Energy efficiency**	Industrial and Waste, Transport, Buildings	●	●	●	✓
Network optimization	Transport	◑	●	○	

[Backup] **Investable Ideas Assessment:** Six opportunities were identified as key decarbonization opportunities for SEA based on major emissions sources



[Backup] **Investable Ideas Assessment:** Long list of 94 investable ideas created across the six decarbonization opportunities

Nature/agriculture · Transport · Buildings · Power · **[Bold]** Ideas with abatement potential >100MtCO2e

1 Improved farming practices

- **Regenerative agriculture practice**
- **AWD for rice cultivation**
- **Precision agriculture practice**
- Bamboo production
- Organic soil restoration
- Vertical farming
- Scale green (low-carbon) fertilizer production
- Farm irrigation efficiency
- Broaden emission visibility and tool usage transparency

2 Nature-based solutions

- **Forest conservation**
- **Peatlands conservation**
- **Blue carbon mangrove restoration**

3 Green fuel source

- **Utility-scale solar and wind energy**
- **Enable virtual power purchase agreement via bilateral grid interconnection**
- **Alternative transmission and distribution infrastructure expansion**
- **Captive solar with incremental battery storage system (industrial park)**
- Coal-to-bioenergy with carbon capture, utilization, and storage (CCUS)
- Switch from fossil fuels to hydropower
- Switch from fossil fuels to geothermal
- Gas-to-bioenergy with CCUS
- Gas-to-solar with hydrogen storage
- Gas-to-wind with hydrogen storage
- Gas-to-solar with battery
- Gas-to-solar with pumped hydro storage
- Gas-to-wind with battery
- Gas-to-wind with pumped hydro storage
- Oil-to-bioenergy with CCUS
- Switch from fossil fuels to nuclear
- Use battery energy storage systems (BESS)
- Use vehicle-to-grid systems
- Implement dynamic charging tariffs
- Gas-to-hydrogen boiler
- Heat pumps running on energy seasonally stored via hydrogen
- On-site renewable generation (solar photovoltaic [PV])
- On-site renewable heat (solar thermal)
- Hydrogen (partial use)—cement
- Solar thermal power as fuel
- Waste as fuel
- Hydrogen as fuel

4 Process optimization

- **Optimization of "subcritical" coal plants during transition**
- Implementation of smart grids for peak load management
- Coal generation efficiency gains
- Gas leak infrastructure and reduced venting
- Gas generation efficiency gains
- Oil generation efficiency gains

5 Greener transport

- **Electric passenger vehicles and charging infrastructure**
- **Agricultural waste stream for biofuels production**
- **Low-carbon transition fuels for maritime**
- Scale dual-fuel methanol ship
- Direct air capture with carbon storage (DACCS)—maritime
- DACCS—LDV
- DACCS—HDV
- HDV—natural gas
- HDV—electric
- HDV—biodiesel
- Ammonia ships
- DACCS—aviation
- Synthetic sustainable aviation fuel
- Hydrogen fuel cell electric vehicles (FCEVs)
- Hydrogen ships
- Electric ships
- Hydrogen/electric plane

6 Energy efficiency

- **Energy efficiency improvements for data centers**
- **Energy efficiency improvements for buildings**
- Building automation and control systems
- Efficient appliances (e.g., display screens, cooking, television)
- Electrification of HVAC
- Heat pumps (air to air)
- LED and increased efficiency
- Smart design insulation
- Water heating (ground source)
- Expand energy efficient equipment replacement through remote sensing
- Use of natural light
- Natural ventilation
- Thermal conductivity improvements
- Minimizing uncontrolled infiltration
- Demand controlled ventilation
- Seasonal energy storage
- Water source heat pumps
- LDV—machinery improvements
- HDV—machinery improvements
- Aviation—machinery improvements
- Scale energy-efficient ship designs focused on wind propulsion
- Expand energy-efficient equipment replacement through remote sensing
- Higher-efficiency mills
- Waste heat recovery—reuse as electricity
- Automate and optimize equipment and processes
- Recycled concrete fines
- Heat exchanger for waste heat recovery
- Improved insulation
- Combined heat and power
- Coke dry quenching with thermal energy recovery
- Top gas recycling
- Increase usage of steel scrap as a raw material