

Green Finance Opportunities in ASEAN



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More information on the Inquiry is at: <http://web.unep.org/inquiry> and www.unepinquiry.org or from: Ms. Mahenau Agha, Director of Outreach mahenau.gha@un.org.

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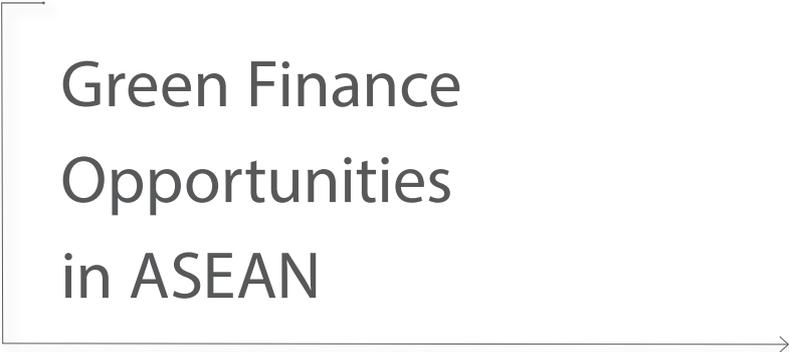
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Green Finance
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FOREWORD

ASEAN is undergoing transformational changes as it adapts to climate change and pivots towards a more sustainable path of development.

The role of financial institutions is significant in this transition. By providing financing solutions through their core expertise, from lending to catalysing capital markets, financial institutions can tap into an immense and increasingly critical opportunity while creating positive impact. At DBS, we believe there is no trade-off between promoting sustainable development and value creation for our shareholders – green finance can be good business too.

In addition, for solutions to be effective in ASEAN, the unique features of this region must be considered. This ASEAN-focused report is therefore a timely input to our deliberations as we undertake our own journey in sustainable finance. I trust that this report will be of help to other financial institutions deliberating their involvement with this complex topic.

Piyush Gupta
CEO
DBS Group Holdings

PREFACE

With a collective GDP of over US\$2.5 trillion, ASEAN is one of the world's largest economies, with a workforce larger than Europe or North America. Its successful development over the coming decades will bring benefits to hundreds of millions of the region's citizens. Such development must, however, be sustainable.

Today, many countries face deteriorating environmental conditions. Air pollution, scarcity of potable water and contaminated land have become major concerns across the region and globally, with implications for public health and also for productivity and economic success. Climate change, furthermore, is exacerbating these trends, and creating natural disasters of growing frequency and severity, driving human tragedy and economic damage.

Our challenge is to transition towards an inclusive, green economy. This in turn requires green finance to support investments that are environmentally-friendly, low carbon and climate resilient. Such investments will not only protect the environment, but underpin balanced and sustained growth.

UN Environment places much emphasis on mobilizing green finance, most directly through the work of its Inquiry into the Design of a Sustainable Financial System, and its Finance Initiative of over 200 private financial institutions. There has been much progress in recent years across the world, from Brazil to China, and from Kenya to the UK, and through the actions of leading banks, insurers and institutional investors.

UN Environment has been honoured to partner with DBS in producing the first estimates of green finance flows and opportunities across ASEAN. Building on this, "*Green Finance Opportunities in ASEAN*" identifies profitable green finance opportunities for private investors and lenders, as well as highlighting where effort and resources need to be placed to governments, regulators and development finance institutions.

Turning these opportunities into practice will support ASEAN's success, and enable the region to realize the 2030 Agenda and meet the Paris Agreement's commitments on climate.

Simon Zadek

Co-Director, UN Environment Inquiry into the Design of a Sustainable Financial System
Visiting Professor, DSM Senior Fellow in Partnership and Sustainability, Singapore Management University

BACKGROUND FOR THIS REPORT

This report was prepared in collaboration between DBS and UN Environment Inquiry. The objective was to gain an insight into the green finance opportunities, the characteristics of those opportunities, and current green finance flows in ASEAN from 2016-2030. The report also covers some of the more general barriers to scaling green finance across ASEAN, and options to overcome those barriers. This critically important and highly complex area has significant potential implications for financial institutions in ASEAN.

The report has been written to help catalyse discussions on green finance in ASEAN. It is relevant to a broad spectrum of actors, including financial institutions looking to understand the contours of a fast-growing investment opportunity, policy makers interested in market and financial system development, and civil society actors working on harnessing the power of financial and capital markets to deliver environmental and societal goals.

Green finance is a broad topic. It is acknowledged that there are significant areas relevant to green finance in ASEAN that are not covered in this report, and considerable further work is required to cover gaps in knowledge and data. While the report hopefully catalyses broader conversations on green finance within ASEAN, as well as highlighting the motivations for doing so, detailed recommendations related to specific countries and sectors are outside the scope of this report.

WHY READ THIS REPORT?

There is a growing global body of knowledge on green finance. This report was intended to differentiate itself in three aspects.

Firstly, it has a specific focus on the green finance opportunities in ASEAN. The ASEAN region is characterized by a set of features that differentiate it from other regions around the world. These relate to a range of social, economic, institutional, political and geographical attributes. As a result, scaling up green finance in ASEAN requires some different solutions to those required elsewhere.

Secondly, it brings together the currently fragmented sectoral and country green finance research in ASEAN with international best practice where relevant. This has allowed estimates of ASEAN green finance opportunities, the characteristics of those opportunities, and green finance flows to be developed with a specific focus on ASEAN for the first time.

Thirdly, at a more granular level, it provides a structured framework to help understand the core green investments opportunities in ASEAN. These are spread across four categories and 17 sectors. Directional estimates of the quantum of investment required for each sector have been generated, alongside various insights relevant to financial decision making.

HOW THIS REPORT IS STRUCTURED

This report comprises five sections. In Section 1 and 2, the report outlines why green finance in ASEAN is needed (Section 1) and introduces the concept of green finance (Section 2). This sets the scene for the following parts.

In Section 3 the report looks at the demand for green finance in ASEAN and the characteristics of this demand. It provides estimates of the green investment demand from both a top-down and bottom-up (or sectoral) perspective.

Section 4 considers the current and expected future supply of green finance.

Finally, in Section 5, the report considers the current barriers to matching demand and supply in ASEAN and outlines potential solutions to overcome these barriers.

HOW THIS REPORT WAS PREPARED

The research supporting this report is primarily based on secondary sources of literature. In addition, a number of subject matter and industry experts have been consulted to add perspectives and insights not directly available from the literature reviewed.

ACKNOWLEDGEMENTS

The authors and researchers commissioned for this report are Ms. Chui Fong Lee and Mr. Prajwal Baral.

Mr. Mikkel Larsen (DBS) and Mr. Iain Henderson (UN Environment Inquiry) oversaw the preparation of the report and provided guidance and contributions as needed.

DBS and UN Environment Inquiry would like to acknowledge the contributions of a number of parties that have provided invaluable insight and commentary on the report.

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ABBREVIATIONS

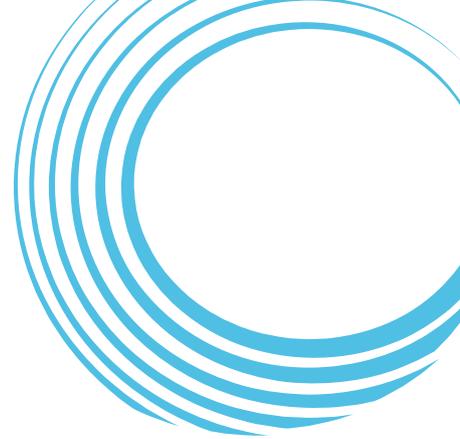
ABS	Asset-backed Securities
ADB	Asian Development Bank
AIF	ASEAN Infrastructure Fund
AIGCC	Asia Investor Group on Climate Change
AIIB	Asian Infrastructure Investment Bank
ASEAN	Association of Southeast Asian Nations (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam)
AUM	Assets Under Management
BOT	Build-Operate-Transfer
CIF	Climate Investment Funds
CTF	Clean Technology Fund
EE	Energy Efficiency
ESCO	Energy Service Company
ESG	Environmental, Social and Governance
ETF	Exchange-traded Fund
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIH	Global Infrastructure Hub
GFS	Green Finance Solution
IBRD	International Bank for Reconstruction and Development
ICT	Information and Communications Technology
IEA	International Energy Agency
IFC	International Finance Corporation
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
MDB	Multilateral Development Bank
MSME	Micro, Small and Medium-sized Enterprise
MFI	Microfinance Institution
OECD	Organisation for Economic Co-operation and Development
OJK	Otoritas Jasa Keuangan (Indonesian Financial Services Authority)
PBOC	People's Bank of China
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PSI	Principles for Sustainable Insurance
RE	Renewable Energy
REIT	Real Estate Investment Trust
SDGs	Sustainable Development Goals
SOE	State-Owned Enterprise
SME	Small and Medium-sized Enterprise
SFCA	Sustainable Finance Collective Asia
SPV	Special Purpose Vehicle
SRI	Socially Responsible Investing
UNEP FI	United Nations Environment Programme – Finance Initiative



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EXECUTIVE SUMMARY



The high-carbon, resource-intensive growth path that humanity has followed since the Industrial Revolution has caused serious damage to both the planet and the people who live on it. Aside from the human cost, pollution, natural resource depletion and climate change are bringing significant economic stresses that we have historically not accounted for, or properly addressed, in our development plans.

Asian Development Bank (ADB) research shows that members of the Association of Southeast Asian Nations (ASEAN) are even more exposed to such risks, sitting above the global average of vulnerability to environmental shocks.¹ Many factors are at play, including significant poverty rates, economic dependence on environmentally sensitive industries, geographic vulnerability to climate effects, and rapid population growth. To reduce its vulnerability, and provide long-term economic stability and prosperity, the ASEAN region needs to put itself on a sustainable trajectory, which will require substantial amounts of green investment.

This report lays out ways in which the ASEAN region can unlock this investment and protect its people, environment and economies. It provides an analysis of green investment opportunities in the region from 2016 to 2030, assesses the characteristics of those opportunities, and estimates current green finance flows. Based on a literature review and expert interviews, it also lays out some of the barriers to scaling up ASEAN green finance and how to address them.

THE INVESTMENT OPPORTUNITY

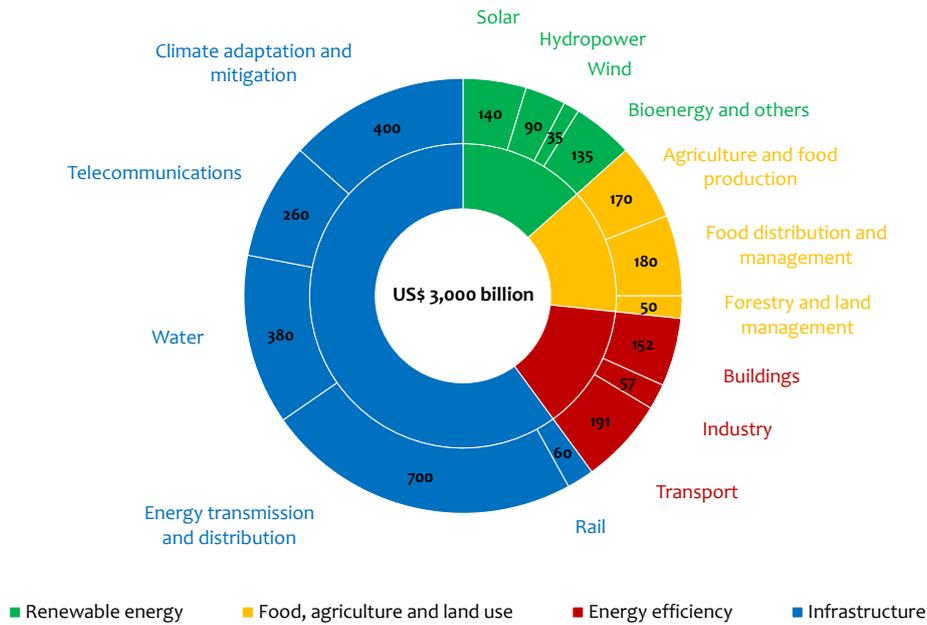
Drawing on both top-down and bottom-up analysis, the report finds that the demand for additional ASEAN green investment from 2016 to 2030 is an estimated US\$3 trillion. This opportunity represents a new ASEAN green investment market 37 times the size of the global 2016 green bond market.

This investment is spread across four sectors: infrastructure (US\$1,800 billion), renewable energy (US\$400 billion), energy efficiency (US\$400 billion) and food, agriculture and land use (US\$400 billion). Indonesia will require the largest volume of green finance. Substantial investment opportunities also exist in Thailand and Viet Nam.

Despite many data availability, methodological and definitional issues, the current annual ASEAN flow of green finance supply was estimated at US\$40 billion against an average annual demand of roughly US\$200 billion between 2016 and 2030. This implies that total annual green finance will need to increase by 400% to ensure that ASEAN green investment opportunities are met by 2030.

Approximately 75% of current flows come from public finance and 25% from private finance, largely in the form of commercial loans. Future public green finance contributions are anticipated to drop to around 40% of total green finance, with private finance increasing to 60%. This will require private green finance flows to scale up by a factor of over ten.

FIGURE ES1 ASEAN GREEN FINANCE OPPORTUNITIES – SECTORAL BREAKDOWN (IN US\$ BILLION)



Source: Authors

To meet the demand, financial capital allocation patterns will need to change in two ways. Firstly, capital invested in polluting and environmentally damaging activities will need to decrease, while allocations to activities with environmental benefits will need to rise. This report focuses largely on the mobilization of new and additional green finance. It is recognized that mainstreaming environmental considerations into existing asset allocation patterns is vital, and represents a considerable element of the green finance challenge ahead, but this vast area remains outside the scope of this report. Secondly, the speed at which capital is allocated to ASEAN green investments will need to increase rapidly. As things stand, near-term capital expenditure will have a disproportionately large environmental impact as a result of the long-term implications it has on future consumption patterns (technologies with long asset lives are ‘locked in’).

Meeting these dual objectives will require a detailed understanding of unique characteristics of the ASEAN region. Small and medium-sized enterprises (SMEs) are widespread across markets that are highly diverse in terms of economic attributes, culture, language and religion. Banks dominate the financial systems, and the pools of investment capital are small but growing fast. Further challenges include a high percentage of personal savings in cash, and the absence of a regional currency that could reduce the cost of cross-border transactions.

BARRIERS TO SUCCESS

The report identifies several barriers to scaling green finance, which need to be understood against the backdrop of various regional characteristics. These include:

- Many of the SMEs that dominate ASEAN economies have issues accessing finance, which could be used for green investment in three broad categories. The first is for conventional SMEs looking to improve their environmental performance, such as through energy efficiency (EE) investments. The second is for SMEs looking to expand their sales of green goods and services, which could be related to emerging green innovation in areas such as renewable energy (RE) or agriculture. The third relates to agricultural smallholders, who play a key role in many aspects of agricultural supply chains, including the production of palm oil in several ASEAN countries.



- ⦿ Structural features of the ASEAN financial system create maturity mismatches, due to the dominance of relatively short-term bank financing. Investment pools that could substitute for bank lending are relatively shallow. This is in turn a function of high volumes of ASEAN household personal financial assets held in cash or deposits.
- ⦿ There is insufficient environmental disclosure from companies, and limited information-sharing platforms. This makes it more difficult for financial decision makers to identify, price and manage environmental risk. It also creates challenges in identifying new opportunities, and for companies trying to attract new sources of green funding.
- ⦿ The definitions of a green project or asset are not clear – both in the region and globally. This increases search costs for investors, banks and companies looking to invest. Without clarity on what is, and what is not, green, internal budgeting, accounting and performance measurement functions will struggle to allocate capital towards green projects and assets.
- ⦿ The pipeline of commercially viable green investment opportunities is relatively limited. This can be due to high real or perceived risks, including political and regulatory risk, technology risk, and credit and capital market risk. Exchange rate volatility across the ten ASEAN member currencies is singled out as a significant barrier to ASEAN green investment.
- ⦿ National environmental and broader sustainability objectives have not been translated into coherent financial policy frameworks. The lack of incentives for providers of capital and financial services prevents the financial system from being effectively aligned with broader sustainability objectives.

SOLUTIONS TO INCREASE GREEN INVESTMENT

No single solution set will deliver the green finance required in ASEAN. Identifying the optimal ecosystem of interventions across the region will require more detailed analysis. However, several promising areas have emerged that would benefit from further exploration. A non-exhaustive list follows:

- ⦿ Developing green investment platforms would support the collaboration required for many green investments. They could unite the diverse ecosystem of financial institutions required in more complex transactions. They could also bring together a broader universe of stakeholders, including commercial entities, academia and non-governmental organizations (NGOs).
- ⦿ Investors with medium- to long-term liability profiles, such as insurance companies or pension funds, could help scale up green investment in several ways. They could lend directly to green projects with longer-term investment needs. They could also increase financial system effectiveness by purchasing green assets channelled by banks into the capital markets. This could be achieved by transforming assets such as green bank loans into liquid, tradeable and rated securities such as asset backed securities or investment trusts (e.g., ‘YieldCos’).
- ⦿ Initiatives could be undertaken to develop voluntary, consistent environment-related financial risk disclosures for use by companies in providing relevant information to investors, lenders, insurers and other stakeholders.
- ⦿ Practical green finance tools could be developed for the financial markets. This could include green definitions and typologies, green asset tagging and new tools to improve environmental risk management.

- ⦿ A deeper green investment asset pipeline could be developed. This could be achieved through aggregation of assets into financial products, the strategic use of public funds, and new financial products such as forms of environmental insurance.
- ⦿ Digital finance offers promising avenues to connect SME users of green finance to lower cost sources through a growing range of intermediaries, such as mobile or crowdfunding platforms. Green fintech solutions can also help mobilize pools of domestic savings for green investment by harnessing the ability to acquire and process information at greater speed, with lower costs and with increased levels of trust.
- ⦿ Green finance roadmaps could enhance the ability of the financial system to mobilize green finance. These long-term, systemic plans involve identifying system-wide needs, barriers to scaling and priority actions.

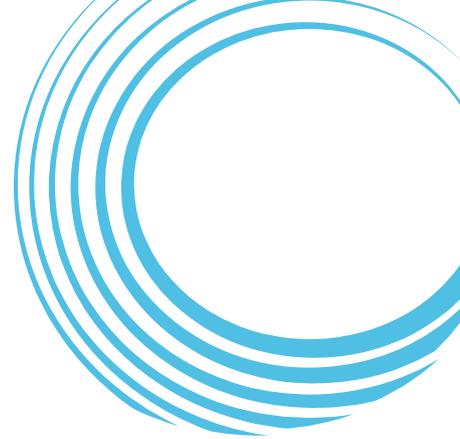
CONCLUSION

Green investment in the ASEAN region in the years up to, and beyond 2030 clearly represents a huge opportunity. It can help transform the region into a resilient, green economic powerhouse that can comfortably support a growing population in a sustainable manner, and provide competitive risk-adjusted returns for investors.

However, current flows of ASEAN green finance remain wholly inadequate to capitalize on this opportunity. Some of the solutions outlined here can help remove the barriers to green finance described above.

The time is ripe for ASEAN nations and investors to take advantage of the investment opportunity at hand, thus ensuring that climate change, population growth, unsustainable consumption and production, pollution and many other challenges do not hold back this dynamic region.

1 A NEED TO ACT



Green finance is now widely acknowledged in financial markets and policy circles as a key tool in tackling the challenges the planet faces today. China's introduction of green finance into the G20 agenda in 2016, and Germany's continuation of the subject under its 2017 Presidency, has established the topic as a legitimate concern of finance ministers and central bank governors. A report by UN Environment, released at the time of the G20 Leaders' Summit in Hamburg in July 2017, highlights the broad acceleration of green finance initiatives being taken by policymakers, regulators and market actors.²

The impact of high-carbon, resource-heavy development pathways on the planet has driven this trend. Regionally, the economic and social implications of business-as-usual are sobering. Economic losses from the impacts of climate change in South-East Asia could reduce the region's gross GDP by up to 11% by 2100.³ Approximately 20,000 people in the region die every year from air pollution linked to coal-fired power stations, while 70,000 annually could die by 2030 if all proposed coal-fired power plant projects in the region are built.⁴ Associated annual health costs have been calculated to total US\$280 billion in recent years.⁵

The ASEAN region is particularly vulnerable to environmental shocks for several reasons. Many economies are highly dependent on environmentally sensitive industries, such as agriculture and fisheries.⁶ In addition, the urban population is growing at a high rate, due to population growth and rapid urbanization.⁷ This has been a factor in an estimated 28% (57 million) of the ASEAN population living in communities with poor hygiene conditions, which are often disproportionately exposed to environmental shocks.⁸ The region includes the world's two largest archipelagos – in Indonesia and the Philippines – and, more broadly, accounts for 15.8% of the world's total coastline.⁹ Coastal systems are vulnerable to sea-level rise, tropical cyclones and saltwater intrusion.¹⁰

The region is now at a crossroads. Adopting a green growth model can address environmental concerns and deliver economic benefits. The Organisation for Economic Co-operation and Development (OECD) states that South-East Asia has a “golden opportunity to leapfrog over the low-performing, polluting, resource-inefficient technologies and practices of more-developed countries.”¹¹ More green finance can stimulate the growth of high-potential green industries, promote job-creating technological innovation and open business opportunities for the financial industry through the creation of new instruments and services, while helping to access new markets.

A more sustainable growth trajectory will require substantial investment in various high-growth sectors, including renewable energy, electric vehicles and smart cities, and critical measures addressing climate adaptation and agriculture. New markets could grow rapidly. The demand for electricity in South-East Asia is projected to increase by 83% between 2011 and 2035, twice the global average.¹² Although considerable related research has been carried out at the global, regional and national levels, there is still neither a systematic estimate of global financing opportunities for environmentally sustainable growth, nor robust data on outstanding stocks and flows of green finance. However, numerous studies have provided directionally similar estimates and conclude that trillions of dollars will be required globally for green investments in areas such as infrastructure, energy, waste management and agriculture.

This report synthesizes current thinking on green finance in the ASEAN region specifically and collates estimates for ASEAN green investment opportunities. It describes the financial characteristics of those opportunities, assesses existing green investment flows, outlines barriers to scaling green finance and summarizes some options for overcoming these barriers.



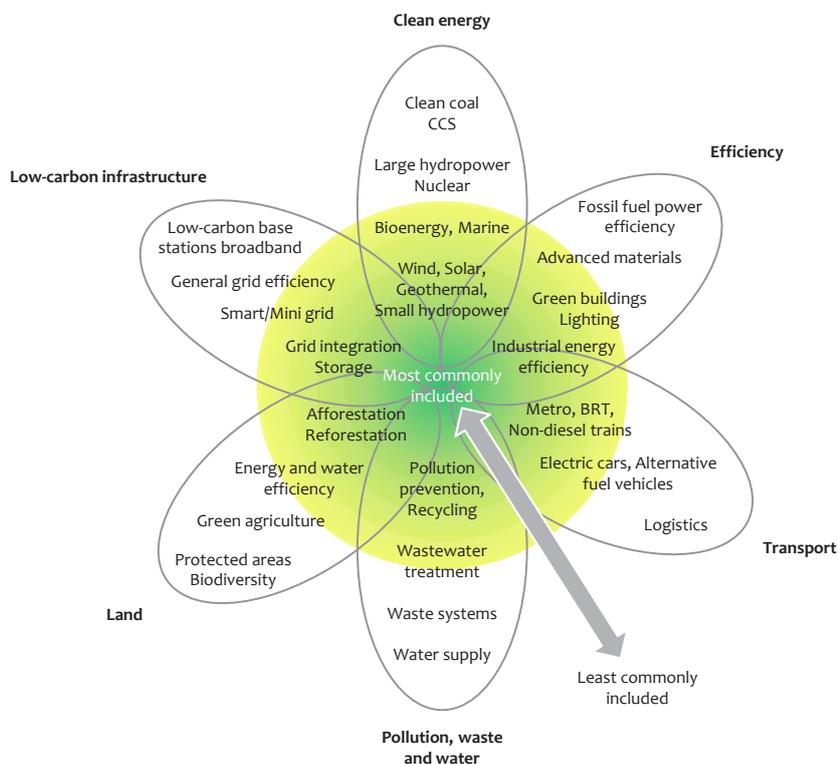
2 GREEN FINANCE – DEFINITIONS AND TYPOLOGY

While the term ‘green finance’ is increasingly used globally, it does not have a universally agreed definition. The G20 Green Finance Study Group in 2016 described green finance as the “*financing of investments that provide environmental benefits in the broader context of environmentally sustainable development*”.¹³

Where terminology does exist, it is often context-specific. It includes definitions at the level of financial instruments (e.g. green indices or green bonds), subsectors of the financial market (e.g. green insurance or green banking), definitions used by international organizations (e.g. OECD), as well as national and international definitions (e.g. the G20 Green Finance Study Group). Country definitions are a function of national circumstances and it is outside the scope of this report to attempt to develop an ASEAN definition.

This report is concerned with identifying opportunities for green finance in ASEAN. Although the absence of a universal definition creates methodological challenges, the mapping of existing definitions has highlighted a broad convergence of definitions, as well as some areas of divergence as illustrated in Figure 1 below. Some of the areas of divergence are uncontroversial whereas others (such as large-scale hydro or clean coal) reveal significant differences in opinions among stakeholders.

FIGURE 1: COMPONENTS OF GREEN FINANCE DEFINITIONS



Source: UN Environment, 2016 http://unepinquiry.org/wp-content/uploads/2016/09/1_Definitions_and_Concepts.pdf

BOX 1: EXAMPLES OF GREEN FINANCE DEFINITIONS

A number of working definitions have been established internationally in order to describe green finance.

- Organisation for Economic Co-operation and Development (OECD): Green finance is finance for “achieving economic growth while reducing pollution and greenhouse gas (GHG) emissions, minimising waste and improving efficiency in the use of natural resources.”¹⁴
- People’s Bank of China (PBOC): “Green finance policy refers to a series of policy and institutional arrangements to attract private capital investments into green industries such as environmental protection, energy conservation and clean energy through financial services including lending, private equity funds, bonds, shares and insurance.”¹⁵
- Indonesian Financial Services Authority (OJK): Sustainable finance in Indonesia is defined as “comprehensive support from the financial service industry to achieve sustainable development resulted from a harmonious relationship between economic, social and environmental interests.”¹⁶

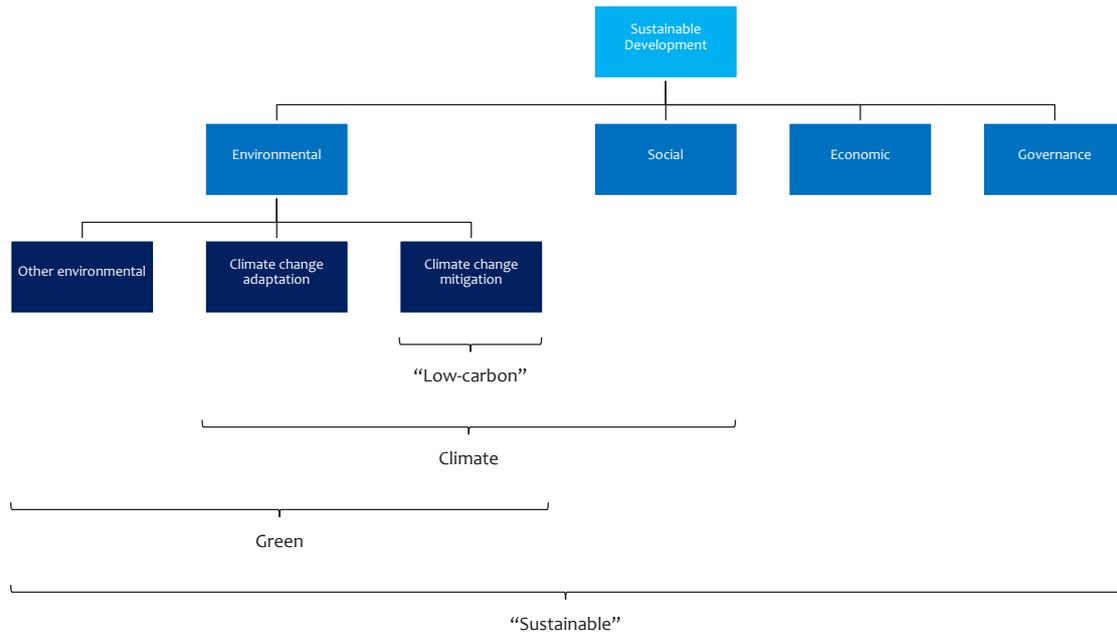
Beyond these high-level definitions, the following typologies have been developed, which target thematic industries and technology sectors. A further category of definitions focuses on impact (e.g. GHG reduction):

- Climate Bonds Standard (CBS): Green technologies specified in energy, buildings, industry, waste, transport and information and communications technology (ICT).¹⁷
- China Banking Regulatory Commission – Green Credit Statistics: Green agriculture, green forestry, industrial energy and water conservation and environmental protection, nature protection, ecological restoration and disaster prevention, resource recycling, waste disposal and pollution prevention and treatment, renewable and clean energy sources, water supply, energy saving, green buildings and green transportation, and overseas projects where international conventions and standards are adopted.¹⁸
- Deutsche Bank Climate Change Investment Universe: Specific green technologies identified in clean energy, agriculture, energy efficiency, water, waste, transport.¹⁹

Definitional challenges are not confined to an assessment of the environmental integrity of sectors or themes. There can be considerable differences in definitions of the underlying sectors and thematic areas themselves. Literature on infrastructure investment highlights the range of interpretations of terms used in the sector. These can range from narrow definitions focused on an infrastructure subsector, such as transport, to definitions encompassing all economic and social infrastructure (such as hospitals or schools) at the other end of the continuum.

While green investment categories are not mutually exclusive, a mapping of definitions by UN Environment (2016) found broad agreement in the distinctions between “climate”, “green” and “sustainable” finance. “Sustainable finance” is recognized as being the most inclusive term, encompassing social, environmental and economic aspects. “Green finance” is generally accepted as including climate finance but excluding social and economic aspects, whereas there are some social spill-over effects linked to “climate”. A simplified schema for understanding the broad terms is displayed in Figure 2 below illustrating how ‘green’ relates to other terms.

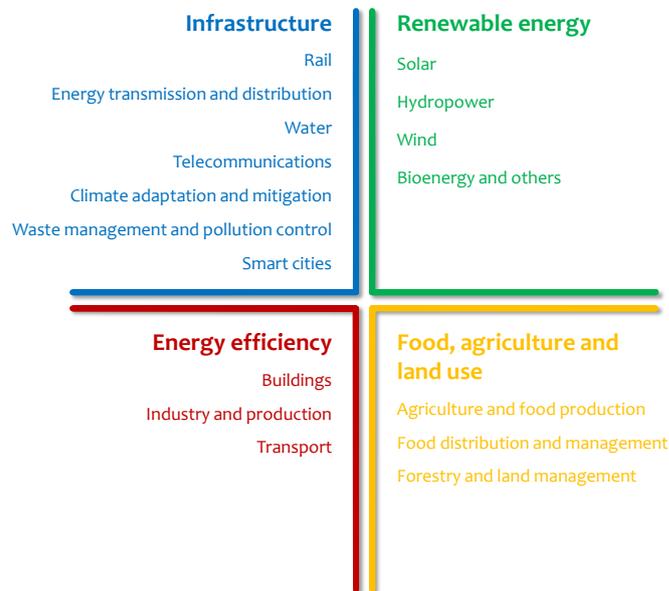
FIGURE 2: GREEN AND SUSTAINABLE FINANCE



Source: Adapted from UN Environment, 2016 http://unepinquiry.org/wp-content/uploads/2016/09/1_Definitions_and_Concepts.pdf

This report uses the framework in Figure 3 to structure its findings and to help simplify a complex space. This covers all major green investment categories surfaced by secondary research. It is recognized that due to definitional challenges, emerging new green technologies and the rapid scaling of existing technologies, the typology might not be comprehensively exhaustive.

FIGURE 3: TYPOLOGY OF GREEN FINANCE



Source: Authors

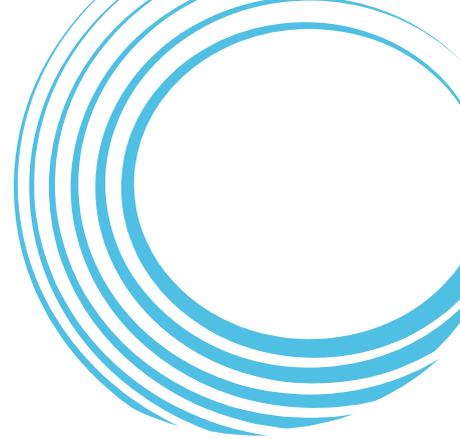
As illustrated in Figure 2, ‘green’ is a subset of ‘sustainable’. This allows a broad mapping of the green investment sectors against the Sustainable Development Goals (SDGs). The SDGs are increasingly used by the financial markets as a lens to view green and sustainable finance.²⁰ Green investment has the potential to help deliver many of the SDGs, including SDGs 6, 7, 9, 11, 12, 13, 14 and 15 (see Figure 4).

FIGURE 4: THE SUSTAINABLE DEVELOPMENT GOALS



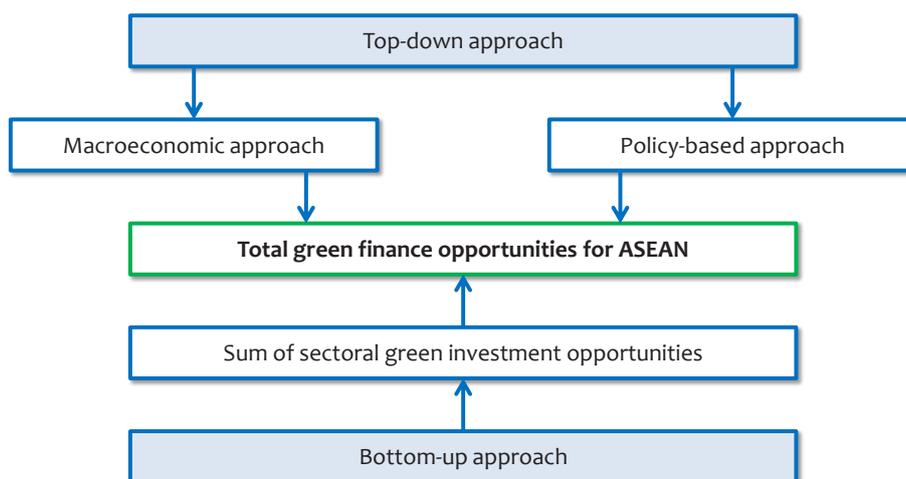
Source: United Nations, 2015. <https://sustainabledevelopment.un.org/>

3 DEMAND FOR GREEN INVESTMENT



Estimating green finance opportunities at the national or regional scale remains an embryonic topic. Estimates can be derived using a variety of methods, assumptions and perspectives.²¹ Existing estimates are not always mutually exclusive, nor are they always additive. However, despite the methodological and definitional challenges, they can collectively generate a directional estimate for the value of green finance investment opportunities. These numbers are based on secondary research and will evolve as the economics of rapidly advancing green technologies, consumer preferences and the broader policy landscape change. The report uses both top-down and bottom-up approaches in deriving ASEAN green investment opportunities.

FIGURE 5: APPROACHES TO ESTIMATING GREEN FINANCE OPPORTUNITIES



Source: Authors

3.1 TOP-DOWN APPROACH

The top-down approach uses two different methods for estimating green investment opportunities. One is based on macroeconomic data and the other uses estimates linked to international policy commitments.

MACROECONOMIC APPROACHES

UN Environment carried out one of the earliest modelling exercises on investment needs for a transition to a green economy in 2011.²² It estimated that additional annual investments required to deliver sustainability outcomes would cost 2% of global gross domestic product (GDP). More recently, China calculated in 2015 that annual average green investment needs would exceed 3% of China’s GDP. In 2017, the Research Bureau of the People’s Bank of China estimated that green investment needs would be even higher. Green investment needs were estimated to be between RMB3-4 trillion (roughly US\$450-600 billion per year) and that this annual need will grow in line with China’s GDP in the short term.²³ This

implies a range of 4.0% to 5.3% of China's GDP although there is growing consensus from domestic green finance experts in China that the upper end of this range is more likely.²⁴

While acknowledging the limitations of such an approach, China's experience can be used as a proxy to help generate a directional estimate for ASEAN green finance opportunities. China and ASEAN have similarities in terms of infrastructure needs, industrial structures and economic development levels.²⁵ Using simplistic assumptions, if China's annual green investment range of 4% to 5.3% was applied to ASEAN GDP between 2016 and 2030, ASEAN green investment opportunities for the 2016-2030 period would range from US\$2.3-3 trillion.²⁶

POLICY-BASED APPROACHES

The SDGs collectively set out a global policy framework to 2030 as part of the 2030 Agenda for Sustainable Development.²⁷ Numerous papers have attempted to estimate the specific investment opportunities implied by the SDGs since their adoption in 2015. While the SDGs are broader than 'green' (see Figure 2), they provide another lens through which to calculate the scale of capital reallocation implied by international policy agreements. Based on a 2015 Sustainable Development Solutions Network study, the cost implementing the SDGs from 2016 to 2030 for all low-income and lower-middle-income countries globally would cost approximately US\$22 trillion.²⁸ Using 2016 GDP as an allocation proxy for ASEAN members that fall into this category, this implies an investment opportunity above US\$5 trillion for the region.

SUMMARY OF TOP-DOWN ESTIMATES

Green finance opportunities for ASEAN for the period 2016 to 2030 are estimated to range from US\$2.3-3 trillion, with a mean of US\$2.65 trillion using a top-down methodology.²⁹ If investment costs are viewed through the broader lens of sustainability, the costs associated with implementing the SDGs could go beyond US\$5 trillion over the same period.³⁰

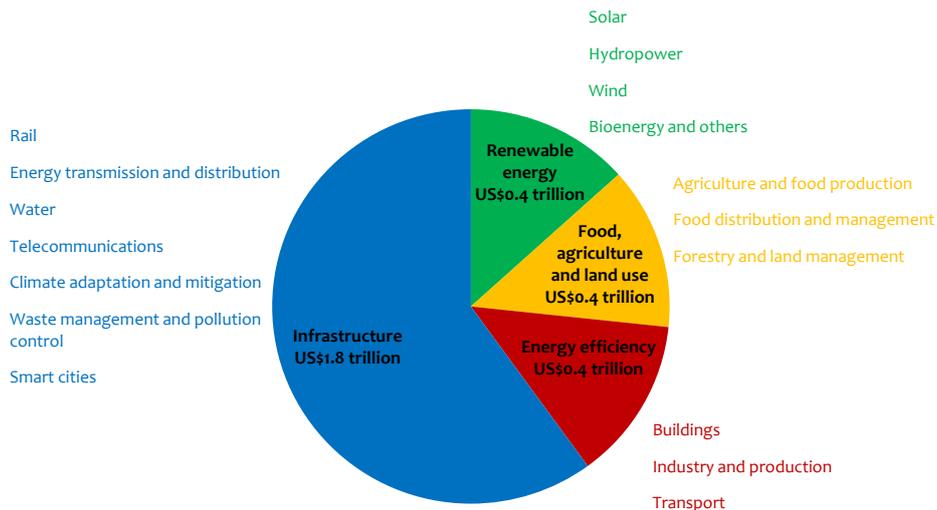
3.2 BOTTOM-UP APPROACH

The bottom-up approach generates a green investment requirement of US\$3 trillion for ASEAN from 2016 to 2030 (Figure 6). For the purpose of this report, green investment opportunities are assessed across four primary sectors (Figure 3). These are renewable energy, energy efficiency, infrastructure, and food, agriculture and land use. The following section provides a high-level overview of each of the primary sectors. More details on the sectors can be found in Section 3.4. The methodology underlying these calculations is described in more detail in Appendix A.

Renewable energy (US\$400 billion). The ASEAN region has considerable potential to develop renewable energy based on its geography and geology. The International Energy Agency (IEA) estimated an ASEAN renewable energy investment opportunity of US\$400 billion from 2016 to 2030 to satisfy the region's growth in low-carbon energy demand.³¹ These estimates may change considerably over time due to factors including rapidly falling cost curves and volatility across the commodity complex.

Based on the 2016 International Renewable Energy Agency (IRENA) analysis, renewable energy can account for 29% of the region's total primary energy supply by 2030,³² a tripling of the 2014 renewable energy share (9.4%). Solar photovoltaics and hydropower make up more than half of the projected investment opportunities. Bioenergy is likely to remain an important source of renewable energy for the region.

FIGURE 6: ASEAN GREEN INVESTMENT OPPORTUNITIES



Source: Authors

Energy efficiency (US\$400 billion). With the IEA study as the reference, investment opportunities of US\$300 billion were projected to improve end-use energy efficiency in the buildings, industrial and transport sectors by 2030. Industry experts forecast that a further US\$100 billion of investment will be required to scale up electric vehicles across the region.³³ Energy efficiency is a rapid and cost-effective way to address energy security as well as environmental and economic challenges.³⁴ ASEAN aspires to reduce its energy intensity by 20% in 2020 and 30% by 2025 compared with 2005 levels.³⁵ Nearly 40% of the investment opportunity is expected in the buildings sector where significant energy efficiency potential remains untapped.

Just under half of the investment opportunities are estimated to be in the transport sector. Bloomberg projects that by 2040, electric vehicles will represent 54% of all cars sold globally compared to 2% today.³⁶ ASEAN is well positioned to capitalize on this growth, and is already showing strong growth as a car production hub.³⁷

Infrastructure (US\$1,800 billion). Green infrastructure has considerable potential to support ASEAN’s growth and build resilience to environmental shocks. Studies by the ADB³⁸ and the Global Infrastructure Hub (GIH)³⁹ indicate a total ASEAN infrastructure investment opportunity of US\$3,100 billion between 2016 and 2030. While the definitional challenges associated with green infrastructure are considerable, US\$1,800 billion of the infrastructure total identified in both studies can be assigned to green sectors. This covers rail transport, power transmission/distribution grids, telecommunications, water supply and sanitation plants.

The larger investment opportunities are in power transmission and distribution grids (US\$700 billion), followed by water (US\$380 billion), telecommunications (US\$260 billion) and rail transport (US\$60 billion). The climate change adaptation and mitigation cost to make all these investments climate resilient over the period 2016-2030 is estimated to be US\$400 billion. The investment opportunity of US\$1.8 trillion is likely to be conservative given that critical green sectors such as waste management and smart city infrastructure are not included in the estimate due to a lack of available data.

Food, agriculture and land use (US\$400 billion). The agriculture and food export sector is a vital contributor to the ASEAN economy, representing more than 25% of GDP in some member states. The sector also generates strong social benefits in terms of livelihoods and jobs. A 2016 study commissioned by the Business and Sustainable Development Commission estimated that the business opportunities related to building food security and increasing exports would amount to approximately US\$400 billion

between 2016 and 2030.⁴⁰ This investment covers technology innovation linked to improving productivity during production and harvesting as well as climate-resilient and sustainable agricultural practices. Food supply management, reduction of food waste and reforestation opportunities are also included.

3.3 TOTAL ASEAN GREEN INVESTMENT OPPORTUNITIES

Applying top-down and the bottom-up estimates generates an **investment opportunity range of US\$2,650 billion to US\$3,000 billion** between 2016 and 2030. This range is likely to be conservative for at least two reasons. First, there is empirical evidence of an acceleration in policies related to the environment and sustainable development more broadly.⁴¹ Secondly, technological advances and associated cost curves are falling more rapidly than many experts predicted.⁴²

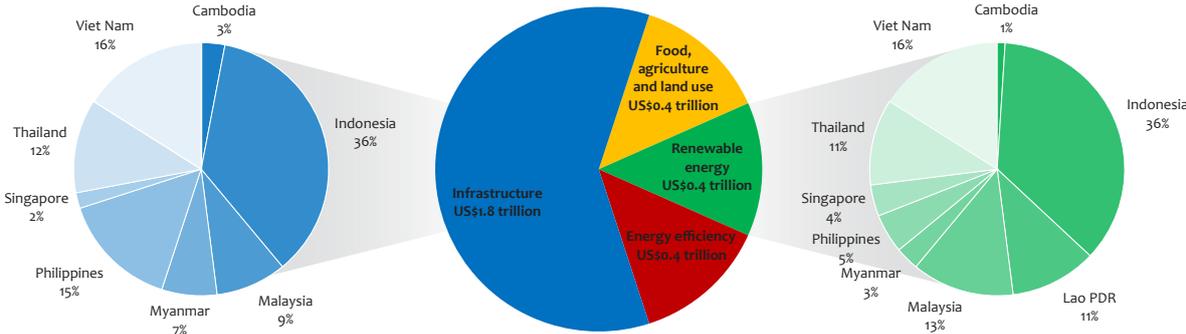
For practical reasons, the remainder of the report will use an estimate of US\$3,000 billion for ASEAN green investment opportunities from 2016 to 2030. This estimate is based on the bottom-up sectoral methodology, which allows for more detail in linking investment opportunities to possible financing solutions.

Despite the vast scale of green investments needed, it is important to note that many of the foundational elements to deliver against this opportunity are already in place. Financial institutions are already financing many of the enterprises requiring green investment. As such, while the configuration of sources, actors and instruments may change as new insights emerge related to green risks and opportunities, it represents more of a natural progression within an industry that is continually evolving, rather than a paradigm shift.

3.4 OVERVIEW OF THE SECTORAL INVESTMENT OPPORTUNITIES

Following the broad overview of each sector in Section 3.2, the following section examines the characteristics of each of the 17 subsectors that constitute the ASEAN green investment opportunity. Figure 7 provides an overview of the general features of each sector. Further detail on each subsectoral investment opportunity then follows, including typical barriers and examples of relevant transactions.

FIGURE 7: ASEAN GREEN INVESTMENT OPPORTUNITIES BY COUNTRY (IN US\$ BILLION)



Note: No breakdown is available for Energy efficiency and Food, agriculture and land use
 Source: Authors

FIGURE 8: OVERVIEW OF THE KEY SECTORAL ESTIMATES

	Renewable energy US\$400 billion	Energy efficiency US\$400 billion	Infrastructure US\$1,800 billion	Food, agriculture and land use US\$400 billion
Main countries	Significant opportunities are in Indonesia, Viet Nam, Thailand, Lao PDR and Malaysia, making up 90% of ASEAN investment opportunities.	The largest opportunities are in Indonesia and Thailand, based on the respective national targets.	Indonesia (over US\$600 billion by 2030), followed with Viet Nam and the Philippines (US\$280 billion each).	Extensive opportunities for agriculture and food export countries such as Indonesia, Thailand, Viet Nam and the Philippines.
Asset owners	Likely to be medium- to large-scale independent power producers, utilities and RE project development corporates for on-grid projects.	Building and industrial production owners, automobile manufacturers, EE service and equipment providers.	Most often state-owned. Emerging trend of private ownership for telecommunications.	Broad based – ranging from smallholder farms, medium-scale food producers to large-scale plantations and soft commodities exporters.
Project characteristics, financing considerations and barriers	<p>RE projects tend to experience uncertain project development and are vulnerable to changes in regulatory framework.</p> <p>Proximity to existing power transmission and distribution grids and resilient power purchase agreement are critical considerations in assessing RE projects viability.</p> <p>Characterized by high upfront capital costs and low ongoing operating costs; some public financing may be required where development of technology is nascent. Debt refinancing opportunities exist when operating revenue and cost are more predictable.</p> <p>Off-grid RE projects continue to show increased feasibility and bankability.</p> <p>Insurance companies can play dual roles – to hedge revenue risk and to provide private financing.</p>	<p>Regulatory policies and financial incentives in encouraging the adoption of minimum energy performance standards across the building, industry and transportation sectors will be critical in driving EE progress.</p> <p>Aggregation of small-scale projects will be key to attract large-scale financing.</p> <p>Malaysia, Singapore, and Thailand have implemented financial incentives to drive EE effort in partnership with the energy service companies (ESCOs).</p>	<p>Infrastructure projects tend to be financed via public-private partnership given the complexity with uncertain project development and approval processes. The usually steady and long-term income stream with low correlation to the return on other investment could make it an attractive investment option, if currency risk is managed.</p> <p>National contexts and asset ownership structures differ considerably. For countries like Cambodia, Lao PDR, Myanmar, the Philippines and Viet Nam, there is a tendency to lean on the multilateral agencies for finance. Indonesia has established successful public-private partnership arrangements. Malaysia and Thailand see a good mix of commercial and capital market interest in supporting infrastructure related investments. Singapore adopts a similar approach, with the addition of government issued guarantees in some instances.</p>	<p>Many smallholders face challenges linked to land tenure, lack of collateral and exposure to a wide range of risks, including weather risk. This results in low visibility over payback profiles.</p> <p>Government grants, crowdfunding and microfinancing are possible financing means.</p> <p>A global emerging trend is the engagement of large food producers to lead in financing sustainable agriculture and food production practices via their stakeholders in the food supply chain</p> <p>ASEAN is seeing increased investment in agricultural technology. Products such as sensors to help farmers to detect abnormalities, better water management and also knowledge sharing platforms for farmers, supply chain and e-market management.</p> <p>Investments in agricultural technology reached a record of US\$25 billion globally in 2015. Early-stage funding reached US\$3 billion globally, up from US\$900 million in 2013 and US\$400 million in 2010.</p>
Asset useful life	Average of 20 years; Hydropower plants may stretch to 40 years.	Range from 5 years for lighting to 15 years for heating and cooling technologies.	Power grids and water plants may average 30 years; telecommunication may be lower at 15 years.	Average of 11 years for agriculture and the average for certain types of forestry can be more than 40 years.



RENEWABLE ENERGY – SOLAR

Opportunities US\$140 billion

MAIN COUNTRIES

Feasible in all ASEAN countries given locations close to the Equator.

Political and Regulatory Risk



Vulnerable to changes in policies such as feed-in tariffs.

Technology Risk



Solar power technology development is relatively mature.

Credit and Capital Markets Risk



Most off-takers are likely to be state-owned.

Investment is mainly for on-grid projects as utility-scale solar accounts for more than 95% of all capacity added to the grid in ASEAN.⁴³ Small-scale and off-grid solar have considerable potential in many parts of ASEAN, especially for island nations like Indonesia and the Philippines. Brunei commenced its solar power experimental farm with a 1.2 MW build.⁴⁴

Although the attractiveness of a solar project is determined by national context and the associated regulatory conditions, solar is considered one of the most attractive sectoral investment prospects. Typical deal size for financing is approximately US\$50 million, based on 30-40% debt funding for a 50 MW project. Payback period may range from 10 to 20 years.

Financing considerations: Where the creditworthiness of power-producing entities, without government guarantees, are below investment grade, it would make them more difficult to bank. Financing may be a challenge in markets where local banks have limited capacity to fund large-scale projects. Insurance underwriting to manage the resource risk of delivery shortfalls may make private investment more palatable.

Examples: Debt/equity to finance high upfront costs

La Carlota and Manapla 80 MW solar farms (Philippines):⁴⁵ US\$173 million of equity investment was secured from the Philippine Investment Alliance for Infrastructure (PINAI) in November 2015. PINAI is a partnership between the Government Service Insurance System, Macquarie Group and the Asian Development Bank.

Cambodia first large-scale 10 MW solar farm (US\$12.5 million):⁴⁶ The plant facility has a 20-year operational expectancy. In early 2017, ADB provided Sunseap Asset (Cambodia), with a debt financing package of US\$9.2 million, which includes co-financing from a private sector financial institution through ADB's B Loan programme and a concessional loan from the Canadian Climate Fund for the Private Sector in Asia (CFPS).



RENEWABLE ENERGY – HYDROPOWER

Opportunities US\$90 billion

MAIN COUNTRIES

Lao PDR, Viet Nam, Myanmar, Philippines and Thailand. Indonesia has shown interest in mini hydropower to increase electrification access.

Political and Regulatory Risk



Acknowledging possible complex social and environmental impact with large hydropower plants.

Technology Risk



Construction processes can be sensitive to the natural setting.

Credit and Capital Markets Risk



Possible social and technical issues may lengthen the project cycle.

ASEAN has some of the best untapped hydropower potential globally⁴⁷ and projects can vary in scale. Large hydropower projects, usually undertaken by large independent power producers (IPPs) can take up to ten years for planning and assessment purposes before actual financing. Small and micro-hydropower projects, which can be on- or off-grid, could be developed with relatively low capital start-up costs to accelerate the clean energy transition and increase electricity access.

Financing considerations: Small hydropower projects between 6 and 7 MW may require a capital cost of US\$30 million or more for a 2-year project.⁴⁸ In some instances, multilateral development banks (MDBs) may be engaged to support large-scale initiatives in driving clean energy development nationally. Lao PDR's Institute of Renewable Energy Promotion (IREP) utilized financing from the International Finance Corporation (IFC) for off-grid micro-hydropower in rural areas. Many micro-hydropower projects in the Philippines have an average capacity of less than 1 MW and could be completed in six months, costing US\$1-2 million each.⁴⁹ Such projects are likely to support small rural communities only and are less bankable.

Example: Export credit agencies providing business financing insurance

Hasang Hydroelectric Power Project (Indonesia), scheduled for completion in 2019, will consist of three 13 MW generators.⁵⁰ The US\$211 million project included a limited recourse loan commitment of US\$147 billion via commercial financing (including the Korea Development Bank) and overseas business financing insurance worth US\$141 million by the Korea Trade Insurance Corp (K-sure), an export credit agency.



RENEWABLE ENERGY – WIND

Opportunities US\$35 billion

MAIN COUNTRIES

Most potential in highland and coastal areas – Philippines, Thailand, and Viet Nam.

Political and Regulatory Risk



Vulnerable to changes in policies such as feed-in tariffs.

Technology Risk



Wind technology development is relatively mature.

Credit and Capital Markets Risk



Most off-takers are likely to be state-owned.

The progress of wind power is second only to solar in the ASEAN region.⁵¹ Installed capacity, mainly onshore, has expanded with a compound annual growth rate of 45% over the last 10 years. The total installed capacity approximated 750 MW in 2015, of which 400 MW in the Philippines. Thailand has a set wind power target of 3 GW by 2036 while the Philippines aspires for 2.3 GW by 2030. Some ASEAN countries may be limited by low wind speed, but technology development is evolving to enable viability. With offshore wind farms picking up speed in Asia, a similar potential for ASEAN may exist.

Financing considerations: Financing the import of the power-generating assets like wind turbines can be made more bankable with guarantees issued by export credit agencies. Payoff may be subjected to higher risk of weather fluctuations, thus impacting committed energy delivery and revenue flow. Weather transfer risk financing is nascent in ASEAN. Insurance companies can provide insurance with payoff to the power producers to underwrite the risk where minimum output is not achieved.

Example: MDB plays an important financing role

Chaiyaohum wind farm in Thailand (81 MW onshore):⁵² A special purpose vehicle (SPV) was set up for the project in 2015, valued at US\$157 million, with a 90%-10% arrangement between an IPP – Electric Generating Public Co – and a German wind power developer – Pro Ventum. The project was secured by a local currency loan of up to US\$55 million from ADB and US\$30 million from the Clean Technology Fund.



RENEWABLE ENERGY – BIOENERGY AND OTHERS

Opportunities US\$135 billion

MAIN COUNTRIES

Bioenergy – Indonesia, Malaysia, Thailand; Geothermal – Indonesia, Philippines.

Political and Regulatory Risk



Additional vulnerability to indirect policy changes such as agriculture and land use as these may impact the energy sources.

Technology Risk



Evolving technology on biofuels; supply of agricultural waste may be reliant on crop harvesting.

Credit and Capital Markets Risk



Fluctuations in soft commodities prices would impact the production costs.

Bioenergy forms the bulk of investment expected on modern biofuel for power generation and industrial use. Others may include geothermal, especially for Indonesia, which accounts for 40% of the world's total geothermal reserves, but is currently utilizing only 5% of its resources.⁵³ Thailand has set a target of bioenergy capacity of 5,570 MW by 2036, Malaysia of 1,065 MW by 2020 and Indonesia of 810 MW by 2025.⁵⁴ Investment opportunities reside with the transition process from traditional (the use of animal waste and fuelwood) to modern (liquid biofuels, biogas, or bioenergy for electricity generation) bioenergy sources.

Financing considerations: Bioenergy is considered relatively risky due to evolving technology and operational risks, which results in a higher percentage of public finance in the capital stock compared to other renewable energy sources.

Example: MDB can help to facilitate foreign investment

Bioenergy power plants in the Philippines: IFC, a member of the World Bank Group, with support from the government of Canada and the Clean Technology Fund, announced an investment of US\$161 million in three bioenergy power plants in the Negros Occidental province of the Philippines.⁵⁵ The project is expected to generate 70 MW of clean, renewable energy.



ENERGY EFFICIENCY – BUILDINGS

Opportunities US\$152 billion

MAIN COUNTRIES

Thailand, Singapore, Philippines, Viet Nam, Malaysia.

Political and Regulatory Risk



EE is often encouraged by regulators.

Technology Risk



EE technology is often well established.

Credit and Capital Markets Risk



Some asset owners are likely to be companies of all sizes and property developers, while others might be building owners with limited collateral value.

Residential and commercial building sectors are projected to have investment opportunities of US\$88 billion and US\$64 billion respectively, in the form of building retrofits, new buildings, lightings and home appliance use. For EE initiatives to be of interest to building owners, the payback period would often have to be short, perhaps an average of five years but may extend up to eight years or more. The collateral value of installed equipment is higher when the equipment does not require significant tailoring. Returns on EE projects can be attractive, exceeding 20%.

Financing considerations: Can be financed entirely by private finance. Government incentives can help accelerate uptake, like the Energy Performance Contracting Fund in Malaysia. ESCOs have become popular financing vehicles across ASEAN. Guaranteed saving Schemes can be applied for buildings, where the ESCO takes the performance risk of the EE savings. This may be important for arrangements involving residential buildings where the building management will need agreements with the apartment owners for such initiatives, and thus where a guaranteed fixed saving may be more palatable. Larger building developers and corporates may use green bonds as a form of financing.

Example: Potential for green bonds to support EE projects

City Developments (CDL), a property developer in Singapore issued a two-year secured bond of SGD100 million (US\$74 million)⁵⁶ at a 1.98% fixed rate due 2019 for the retrofit of an office building including an upgraded chiller plant, energy efficient lights and motion sensors to reduce energy waste.



ENERGY EFFICIENCY – INDUSTRY AND PRODUCTION

Opportunities US\$57 billion

MAIN COUNTRIES

Manufacturing and industrial intensive states like Indonesia, Malaysia, Philippines and Singapore.

Political and Regulatory Risk



EE investments have low exposure to policy and regulation.

Technology Risk



EE technology is often well established.

Credit and Capital Markets Risk



Asset owners are likely to be SME; short payback period may reduce the credit risk.

The bulk of the investment opportunities is projected for the energy-intensive industrial sector (US\$39 billion). Applying technology and specific expertise such as high energy efficiency motors will support the reduction of energy consumption. According to a 2011 study by ReEx Capital Asia,⁵⁷ the average payback profile for ASEAN projects was around 3 to 5 years, with the Philippines and Singapore offering the shortest payback period among the countries studied. This suggests the need for relatively short-term financing. Financing institutions can rely on the fixed assets as collateral.

Financing considerations: The relevant finance considerations mirror closely those for energy efficiency programs for buildings, and thus ESCO structures are also relevant in industrial projects. An important determinant for the ability to obtain private finance is national targets for energy efficiency in production processes. In the absence of stable energy prices or financial parties interested in taking on the energy price risk, industrial standards are needed to promote energy efficiency projects.

Example: Build-own-operate or build-operate-transfer model

SDCL – Panasonic (Singapore):⁵⁸ The project developer (SDCL) supported the build, own and operation (with or without eventual asset ownership transfer to the client) to enhance the energy efficiency of its air compressor systems for the client (Panasonic). SDCL provided 100% of the capital including the audit costs of the energy savings tracking.



ENERGY EFFICIENCY – TRANSPORT

Opportunities US\$191 billion

MAIN COUNTRIES

Thailand, Malaysia, Viet Nam, Singapore, Philippines, Indonesia.

Political and Regulatory Risk



Reliant on national requirement for transport fuel efficiency and emission, and introduction of electric vehicles.

Technology Risk



Evolving technology on electric vehicles.

Credit and Capital Markets Risk



Asset owners are likely to be the automobile sector, which is under the pressure of low-carbon transition.

The opportunities for passenger transport (US\$131 billion) are more than double those for freight transport (US\$60 billion). They include investment to enable changes to the design and engines of current transport types, and the projected production of electric vehicles (US\$90 billion) for the region. The investments on current transport types will remain important while electric vehicles are introduced as the transition will happen gradually and not at the same pace for all vehicles (e.g., buses, trucks, airplanes, ships). Investments are needed first for research and development (R&D) into new technologies and subsequently for changes to production facilities and automobile parts to produce more energy-efficient vehicles. The asset owner needing finance will frequently be automobile producers or suppliers of components of vehicles. Further investment opportunities can be explored as innovation, such as battery storage and the concept of sharing economy, evolves.

Financing considerations: Financing will likely be part of the general lending programmes companies have in place for capital expenditure. Payback periods are expected to be relatively short. Deal sizes would likely exceed US\$10 million and may, for complete design programmes, be much larger. The collateral value would, among other things, depend on the intellectual property rights to the new technology.

Example: Green bonds can be the alternative financing option besides debt/equity

Viet Nam's leading property developer Vingroup started building its first car manufacturing plant,⁵⁹ with plans to produce the first batch of electric motorbikes by the end of 2018. Credit facilities of US\$800 million were secured to finance the construction of the plant.

Tesla US\$1.8 trillion 8-year debt issue (US),⁶⁰ a B3/B-rated bond aimed at supporting production of its mass-market Model 3 electric car. The 5.3% coupon was a record low for a bond of its rating and maturity.



INFRASTRUCTURE – RAIL

Opportunities US\$60 billion

MAIN COUNTRIES

Malaysia, Viet Nam, Thailand.

Political and Regulatory Risk



Complexity may arise in decentralized decision making authorities, legal framework and regulations.

Technology Risk



Infrastructure technology is relatively well established.

Credit and Capital Markets Risk



Long payback period may impact credit risk.

Green transport projects are most frequently large-scale projects, covering civil engineering works on railways, tunnels, general and special purpose machinery and equipment in rail transport as well as ICT machinery and equipment. Significant upfront investments are required with payback profiles that may extend to 25 years. The asset owner, or rather the party requesting the build, will nearly always be the national government or a state. As electric vehicles are introduced, the estimate of the related infrastructure needs for ASEAN is not included due to the lack of available data at this early stage.

Financing considerations: Although historically publicly financed, more effective deal structuring has driven an increase in private finance. A key constraint is credit risk on the off-taker. The most common structures are various types of public-private partnership (PPP) such as build-operate-transfer (BOT) arrangements. For emerging ASEAN countries, MDB involvement is likely needed. Increasingly, green bonds and “infrastructure bonds” have been issued to attract capital market investors.

Example: Transport projects can be fully financed privately

Bangkok’s Sky train is a BOT scheme with a 30-year concession agreement. Tanayong Corporation, who won the bid for this project, created a project company, Bangkok Mass Transit System Public Company Limited (BTSC). The total financing package was approximately US\$1.4 billion, financed by the private sector – US\$650 million – in equity, with the remainder in debt coming largely from IFC, KfW and Thai banks.⁶¹



INFRASTRUCTURE – ENERGY

TRANSMISSION AND DISTRIBUTION

Opportunities US\$700 billion

MAIN COUNTRIES

Viet Nam, Indonesia, Thailand

Political and Regulatory Risk



Complexity may arise in decentralized decision making authorities, regulations and procurement process.

Technology Risk



Technology on grid infrastructure is relatively established.

Credit and Capital Markets Risk



Long payback period may impact credit risk.

Key investments will be concentrated in distribution grid development driven by the current low electrification ratios in the region.⁶² Deal sizes may range between US\$100 million and US\$1 billion with an average payback time of more than 15 years. Enderati reports that Indonesia, Viet Nam and Myanmar are the fastest growing markets in the region for high voltage transmission.⁶³ The Philippines, Thailand and Malaysia are also big markets. State-owned power and electrical utilities are likely to be the major asset owners. The privatization of distribution grids in Cambodia and the Philippines, and the expected privatization of grids in Viet Nam is expected to drive private sector investment towards transmission and distribution power grid projects in the region.⁶⁴

Financing considerations: PPPs will continue to be used as significant private investment is needed to fill the financing gap that demand for new transmission and distribution grids creates. The private participation can be in various forms such as build-own-operate or build-operate-transfer models. The role of MDBs and bilateral donors will still be crucial in emerging ASEAN countries to support grid expansion projects.

Example: A blend of public financing to support infrastructure projects

Power transmission system improvement (Myanmar): A US\$80 million loan from ADB and US\$100 million loan from the Export-Import Bank of Korea was approved in 2016 to construct and upgrade the power transmission lines in the Yangon region of Myanmar.⁶⁵



INFRASTRUCTURE – WATER

Opportunities US\$380 billion

MAIN COUNTRIES

Indonesia, Philippines, Viet Nam

Political and Regulatory Risk



Complexity may arise in decentralized decision-making authorities, regulations and procurement process.

Technology Risk



Innovation in business model may be required to convert non-revenue water to revenue generating water.

Credit and Capital Markets Risk



Long payback period may impact credit risk.

The water market in South-East Asia is expected to grow at an annual rate of 20%.⁶⁶ Indonesia and Viet Nam are likely to be key investment countries over the next few years. State utility companies/municipalities own most assets. Investment may comprise of civil engineering works and machinery for dams, irrigation and flood control waterworks, water treatment plants (e.g., seawater desalination), smart metering/real-time surveillance and automated maintenance. Payback period may stretch beyond 20 years.

Financing considerations: Mostly publicly financed as they are upfront capital-intensive in nature and do not generate cash flows as users may not pay for services directly. The design-build-operate model is common where the operator receives a lump sum payment for completed stages of construction and an operating fee to cover the operation and maintenance of the project. The structure of off-take contracts varies. Commercial finance can be hard to attract in the absence of highly concessional public finance or grants. Such financing has taken place in places like Viet Nam, Lao PDR and Cambodia.

Example: Public Private Partnership supported by debt equity financing

Tuas desalination project (Singapore): The first PPP project of Singapore in the water sector followed a build-own-operate model. The Public Utilities Board of Singapore awarded this 20-year contract to SingSprint (a special purpose company), a consortium comprising Hyflux Ltd (70%) and Ondeo (30%). Equity financing of US\$20 million was supplemented by syndicated debt financing involving four banks for a total amount US\$97 million.⁶⁷



INFRASTRUCTURE – TELECOMMUNICATIONS

Opportunities US\$260 billion

MAIN COUNTRIES

Indonesia, Viet Nam, Philippines

Political and Regulatory Risk



Complexity may arise in decentralized decision-making authorities, regulations and procurement process.

Technology Risk



Tower maintenance work can be challenging for some remote locations.

Credit and Capital Markets Risk



Long payback period may impact credit risk.

Investment may cover civil engineering works for telephone and internet systems, land- and sea-based cables, communication towers, and telecommunication transmission lines. The tower market can be promising in emerging ASEAN countries. The cost of building a telecommunications tower is typically US\$200,000-300,000.⁶⁸ Indonesia is one of the most mature tower markets in the world, and its tenancy ratio growth compares favourably to many other global tower markets.⁶⁹ There is also demand for new structures to support 4G in countries like Malaysia. Payback period may average three to five years.

Financing considerations: PPP activity has historically been high in the ASEAN telecommunications market, particularly in Indonesia, the Philippines, Malaysia and Thailand. It is reasonable to expect that such models will continue. PPP projects tend to be highly leveraged. MDBs and national development banks will continue to support financing in emerging ASEAN countries in the form of debt, equity and guarantees.

Example: Public-private partnership supported by debt equity financing

Sumatra Telecom Project (Indonesia): This US\$624 million project was financed through a joint ownership structure comprising of various stakeholders including IFC. IFC provided a US\$50 million loan and 30 commercial banks provided a US\$300 million syndicated loan.⁷⁰



INFRASTRUCTURE – CLIMATE ADAPTATION AND MITIGATION

Opportunities US\$400 billion

MAIN COUNTRIES

Indonesia, Viet Nam, Philippines.

Political and Regulatory Risk



Commitment to mitigate climate change and adapt to its impact.

Technology Risk



Evolving technology, e.g., in carbon capture and storage.

Credit and Capital Markets Risk



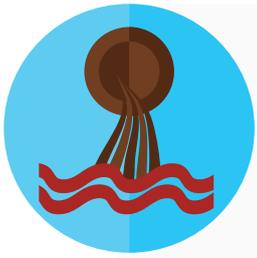
Risk/return profile of climate adaptation investment may not be easily understood and managed.

All essential infrastructure assets will be impacted by climate change. Thus, investment into climate mitigation and adaptation will be an additional investment in order to make those assets compliant to climate mitigation commitments, and resilient to current and future climate risks. The bulk of the projected mitigation investment will be in power and transport infrastructure, while adaptation investment will be increasingly required to make water and agriculture assets climate-resilient. Mitigation projects are usually larger in terms of investment volume, and the size of investment depends on the level of mitigation ambition. Climate change projects financed by the UN Green Climate Fund are in the range of US\$10-250 million. Adaptation projects often have no direct financial returns, but only social, economic and environmental co-benefits; however, commercial returns are possible when blended with mitigation projects.

Financing considerations: Most climate mitigation costs are integrated into future infrastructure spending. Climate adaptation costs will be mostly met from public sources (governments, multilateral and bilateral agencies), primarily in the form of grants, concessional loans and guarantees. Governments and public financial institutions will increasingly use insurance instruments to mitigate the risk from weather-related disasters. Private adaptation investment from the corporate balance sheet is also likely, mostly in cases where the private asset is in imminent threat from climate change impacts.

Example: Insurance companies well positioned to support climate initiatives

One Storm Philippines: Since ASEAN is one of the regions most exposed to natural disasters and extreme weather events,⁷¹ access to risk capital and immediate liquidity post-disaster is critical for investments in the region. Munich Re and JLT Asia recently launched the One Storm Philippines insurance plan⁷² that covers the cost of preparing for an extreme weather event even when no actual losses are incurred. This provides incentives for those companies most affected to prepare for extreme weather events, thus reducing the overall cost to society from extreme weather events.



INFRASTRUCTURE – WASTE MANAGEMENT AND POLLUTION CONTROL

MAIN COUNTRIES

Most ASEAN developing countries.

Political and Regulatory Risk



Legislation on waste management and pollution reduction may require further enhancement.

Technology Risk



Technical knowledge of waste management and evolving technology on waste-to-energy.

Credit and Capital Markets Risk



Potential dependency on municipalities' credit and state support.

Waste management and pollution control has a very long value chain, involving a number of asset owners at various stages – generation, storage, collection, transfer and transport, processing and disposal. There are no well-defined asset owners for disposal because disposal methods are mostly open dumping and sanitary landfill. Public financing tends to steer towards building waste-to-energy and sanitary refill infrastructure. Waste treatment facilities demand huge capital. The average payback period may approximate five years for waste management projects and 20 years for waste-to-energy projects.

Financing considerations: National governments (incentives and grants), MDBs, the private sector (technology innovation and process changes) and consumers (waste reduction and pollution control) each play an important role. PPPs (waste treatment equipment manufacturers from Japan, US and Europe are active in the region), green bonds, environmental, social and governance (ESG) funds, crowdfunding and microfinance may be viable options.

Example: Driving financing innovation with green bonds and crowdfunding

Bank of China (BoC) issued a China Green Covered bond on the offshore market in November 2016. Over 12% of the proceeds were dedicated to pollution prevention and control projects.⁷³

METech International, a Singapore-listed waste management company raised SGD2 million (US\$1.5 million) through a crowdfunding bond issuance. The two-year, non-convertible bonds were issued with a coupon rate of 8% to be paid out quarterly.⁷⁴



INFRASTRUCTURE – SMART CITIES

MAIN COUNTRIES

Indonesia, Philippines, Thailand, Malaysia, Viet Nam and Singapore.

Political and Regulatory Risk



Dependency on nation's strategic prioritization.

Technology Risk



Technology continues to evolve globally.

Credit and Capital Markets Risk



Potential dependency on municipalities' credit and state support.

The term 'smart city' goes beyond green and incorporates both hard (e.g., mobility, buildings) and soft (e.g., education, culture) domains of urban development, with ICT at the core. Most projects today relate to retrofitting existing cities. Consequently, projects are likely to be piecemeal and embedded in the investment needs of other sectors, which is why no separate investment need is identified for smart cities. Additional financing may be required for R&D to bring concepts to life in ASEAN.

Besides Singapore, which has a number of smart city initiatives under its Smart Nation programme, Indonesia, Malaysia, Viet Nam, Thailand and the Philippines have also started various smart city initiatives. Asset owners can be both states and private entities. Depending on the scale and scope of smart city interventions, the payoff period can range from five to more than 20 years.

Financing considerations: Public grants and incentives may encourage innovation into emerging technologies. Various forms of PPP models such as build-own-operate or build-operate-transfer may be used to finance large-scale infrastructure investments. Infrastructure bonds and MDB financing may be considered as alternate options.

Example: Public-private partnership remains the key financing model for building infrastructure

Korea (Songdo): The US\$35 billion smart city project is expected to be completed by 2018. PPP agreements have been entered into with operators on aspects such as mass transit and buildings.⁷⁵



AGRICULTURE AND FOOD PRODUCTION

Opportunities US\$170 billion

MAIN COUNTRIES

Agriculture and food export countries – Indonesia, Thailand, Viet Nam, Philippines, Malaysia.

Political and Regulatory Risk



Financing support for farming is generally well received.

Technology Risk



Generally low, although risk may arise from engineering and construction.

Credit and Capital Markets Risk



Producers include many SMEs that may be on the low end of the income disparity curve.

Investment is broad-based given the wide range of asset owners, including technology and machinery improvement. Financing challenges are often observed for small investments in SMEs and smallholders. For example, deal sizes may be low for improving machinery for harvesting. The collateral value will often be low as the collateral may not be easily liquidated. The payoff profile is based on the cost savings coming from the introduced improved technology and may span 5-10 years or more. Difficulties with private financing arise when investments are required to improve environmental protection without a notable increase in productivity. Smallholders in the palm oil industry provide an interesting case study. Smallholders individually may not have the capacity to comply with global standards such as the Roundtable on Sustainable Palm Oil, and thus revert to unsustainable practices like planting on peat or burning land. Models are being developed to allow smallholders to engage in cooperation to share costs and obtain cheaper funding via commercial loans.

Financing considerations: A smaller portion of SMEs may avail themselves to commercial loans. Microfinance institutions, well established in places like the Philippines and Thailand can offer the expertise to price the risk at economically viable terms using collective guarantees on behalf of a group of borrowers. For nationwide initiatives, government grants and incentives are likely to remain a requirement. Micro-insurance companies can play a role by providing insurance for failed harvests for example. Partnerships with MDBs can be leveraged to tap on their expertise in credit management and administration.

Example: Multi-stakeholders collaborative value chain and financing partnership

In Indonesia, the private sector, led by Cargill, Monsanto, and Syngenta collaborated with the national and regional governments as well as Mercy Corps to improve corn farmers' livelihoods⁷⁶ through improved access to technology, finance and knowledge. Bank Andara, Bank Perkreditan Rakyat and Bank Rakyat Indonesia were engaged in the multi-stakeholder partnership, which channelled US\$25,000 in small-scale loans to farmers in order to invest in higher quality inputs. As the partnership matured, ACA assurance was engaged to help mitigate the risk of borrowing for smallholder farmers.



FOOD DISTRIBUTION AND MANAGEMENT

Opportunities US\$180 billion

MAIN COUNTRIES

Applicable to all ASEAN countries, especially for agricultural produce exporting countries.

Political and Regulatory Risk



Investment to increase productivity and livelihood should enjoy broad public support.

Technology Risk



Technology is generally mature and applicable to ASEAN context.

Credit and Capital Markets Risk



Varies between established retailers and food producers.

Significant food waste is observed at every step, from post-harvesting, storage, transportation, processing and packaging till final consumption. Investment needs will be driven to a large extent by regulatory frameworks that promote and require reduction in food waste. Asset owners thus will range from small-size producers to large retailers and food distributors. Investment will often be in the form of private infrastructure (storage), transportation (cold storage vehicles) and production logistics management (redesign of food packaging).

Financing considerations: A significant portion of the investments required by larger food distributors can be financed via commercial loans. Green bonds can be an alternative. Early seed money in the form of private equity and venture capital to finance R&D insofar as local adaptation is required by smallholders. Public finance is often required to develop the infrastructure to transport food. This aspect is covered in “Transport”.

Example: Technology and multi-stakeholders engagement in food supply chain

Many recent early-stage deals have focused on food waste technology. In the US, **Full Harvest**⁷⁷ secured a US\$2 million seed round of financing from venture capital and angel investors to develop farm level food waste technology. Developers of an application aimed at reducing food waste secured DKK1.6 million (US\$230,000) from **Innovation Fund Denmark’s InnoBooster** arrangement.

Tyson New Ventures⁷⁸ is a venture capital fund established to focus on the development of safe and affordable alternative proteins, tackling food insecurity and food loss through market making and other commercial models, and tapping the Internet of Food to promote more precise and productive resource application, safety, and consumer empowerment in the food chain.



FORESTRY AND LAND MANAGEMENT

Opportunities US\$50 billion

MAIN COUNTRIES

Cambodia, Indonesia, Myanmar.

Political and Regulatory Risk



Possible obstacles for reforestation on occupied farmland and disputes in land titles.

Technology Risk



Reforestation is relatively well established.

Credit and Capital Markets Risk



Borrowers are likely to be SMEs and farmers with generally low collateral value.

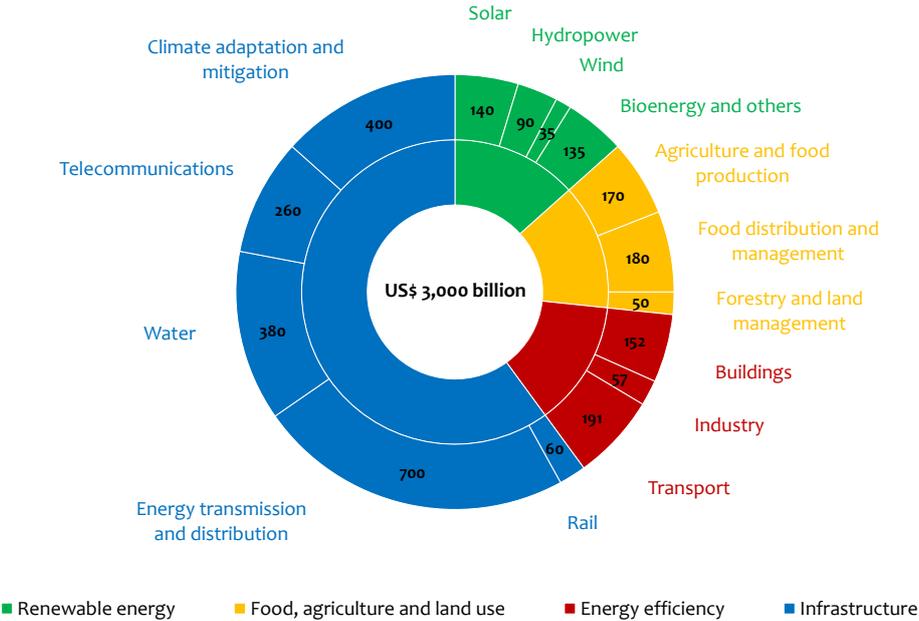
South-East Asia has lost around 14.5% of forest area in the last 15 years with an annual average loss rate of 1%.⁷⁹ Investment in sustainable forestry/reforestation can be significant. Forests in ASEAN are still predominantly held by the government. Actual investments are mainly channelled to buy and plant forests. Individual investment programmes for replanting will vary in size depending on the land to be reforested. The collateral value of assets is high as both land and timber can be readily sold.

Financing considerations: The long-term financial payback period and regulatory risk of reforestation programmes may make it more difficult to obtain private financing, which is why they have generally been funded by government programmes such as national reforestation funds. Reforestation contracts where farmers receive grants for the reforestation and a part of the yield for (sustainable) logging to replace current farm lands have seen some success. Private finance in the form of forestry bonds and specialized equity funds has started to add to private sector financing.

Example: Potential to extend dedicated forest fund to sustainable forestry

Tropical Asia Forest Fund (TAFF),⁸⁰ managed by Sydney-based New Forests, is the only institutional forestry fund dedicated to investing in sustainably-managed timber plantations in South-East Asia. It raised US\$170 million in 2013, now invested in plantations in Lao PDR, Malaysia and Indonesia. TAFF manages capital commitments from nine investors, including pension and superannuation funds.

FIGURE 9: ASEAN GREEN FINANCE OPPORTUNITIES – SECTORAL BREAKDOWN (IN US\$ BILLION)



Source: Authors

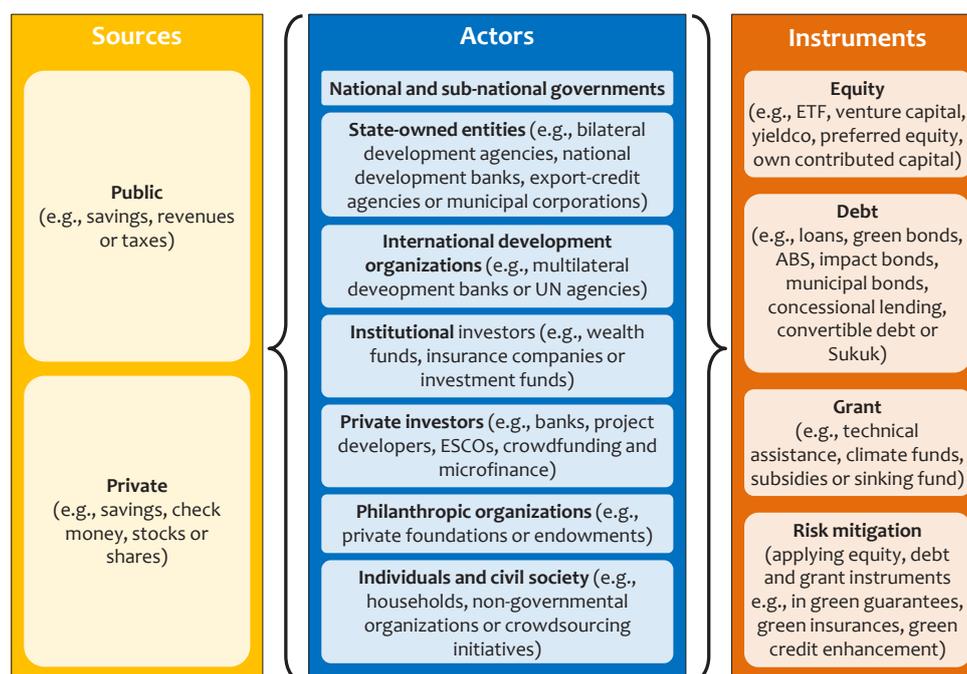
4 SUPPLY OF GREEN FINANCE



This section looks at current supply of green finance in the ASEAN region. Data gaps, definitional inconsistencies, and methodological complexities create many challenges and these issues are explored in greater detail in Appendix B. Although often used interchangeably, the term ‘finance’ is used here to describe the raising of capital. This finance is then deployed as ‘investment’. ‘Funding’ describes revenue that can be used to pay back finance.

The landscape of finance is complex and diverse. Although ultimately all finance stems from either a public or private source, it is intermediated by many different actors and channels, and invested using a variety of instruments. These instruments will vary depending on a variety of factors, including risk and return expectations, levels of liquidity, legal forms and differing investment horizons.

FIGURE 10: SOURCES, ACTORS AND INSTRUMENTS



Source: Authors. Adjusted from Mehta, A. (2017). *Catalyzing Green Finance: A Concept for Leveraging Blended Finance for Green Development*. Manila: Asian Development Bank. Available at: <http://dx.doi.org/10.22617/TCS178941>

Appendix C provides a description of some of the actors and instruments shown in Figure 10 as well as their level of use in various regions and globally. Although comprehensive data are lacking, several indicators reveal that ASEAN lags behind Asia and other parts of the world (especially Europe and the US) in the use of many green finance instruments. This contrast is particularly apparent in capital markets (such as asset-backed securities (ABS), exchange-traded funds (ETF) and green bonds). Section 5 explores some of the associated opportunities in more detail.

In order to determine the green finance opportunities in ASEAN, we first consider the 2016 green public expenditure and green finance flows. These total US\$40 billion in 2016. Figure 11 summarizes these flows and compares the total to the annual investment opportunities of US\$200 billion (US\$3,000 billion/15 years).

FIGURE 11: CURRENT GREEN FINANCE FLOWS (2016, IN US\$ BILLION)

Yearly green investment opportunities	200
<i>Green finance flows (2016)</i>	
Public finance*	25
Other investment (public)**	2
MDB	3
Private	
Commercial loans	7
Corporate bonds	1
Microfinance	-
Green bonds	1
Other investment (private)	1
Total	40
Yearly increase in finance required to meet the need	160

*Public finance refers to government/municipal/state expenditure.

** Includes bilateral aid and any other missing Development Finance Institution financing

Source: Authors

The annual green investment opportunity of US\$200 billion will need to be met by a blend of public and private capital. Putting the magnitude of this annual opportunity in context, annual ASEAN opportunity is approximately 2.5 times the size of the entire 2016 global green bond issuance.⁸¹ From current levels, total annual green investment will need to increase by 400% to ensure that ASEAN green investment opportunities are met by 2030.

Public finance has played a dominant role in ASEAN green finance to date. Although the nominal amount of public green finance will likely increase between 2016 and 2030, it is expected that the average percentage of public finance will fall. The current level of public finance is estimated to be around 75% of total capital. However, for the purpose of this report, the proportion is expected to fall to about 43% of total capital between 2016 and 2030 (see Appendix B). It is acknowledged that there is a high degree of variance in forecasts related to the blend of public to private capital. This will vary over time, sector and geography. A recent ADB report estimates that 10% to 50% of public finance will be required to meet ASEAN investment demands out to 2030.⁸²

US\$10 billion of the current annual flow of US\$40 billion is private finance. Reflecting the dominance of banks within many ASEAN financial systems, commercial loans represent the majority of private ASEAN green finance transactions, approximately 70% of all 2016 private green finance transactions. Transparency over green finance flows is currently poor, but based on best available data it is estimated that about 2% of the loan and bond issuances in 2016 are green (see Appendix B for more details).

Next, we consider the aggregated private green finance opportunities between 2016 and 2030. It is assumed that public funding will cover 43% of the green investment need. It is also assumed that MDB finance remains at its current level. This would imply the 2016-2030 private green finance opportunity is US\$1,635 billion.

FIGURE 12: PRIVATE GREEN FINANCE OPPORTUNITIES, 2016-2030 (US\$ BILLION)

	Yearly	2016-2030
Green investment opportunities	200	3,000
Of which estimated to be covered by Public Finance* (43%)	86	1,290
MDBs (including GCF, CIF and national development banks)	3	45
Other public investment (e.g., bilateral aid)	2	30
Total private green investment opportunities	109	1,635

*Public finance refers to government/municipal/state expenditure.

Source: Authors

As can be seen from Figure 12 based on assumptions over the ratio of public finance required, future annual private finance requirements will need to be US\$109 billion a year. This suggests green private finance will need to scale up by over more than ten times from current levels to meet investment opportunities in ASEAN.

The examples below help contextualize the scale of the opportunity from different perspectives:

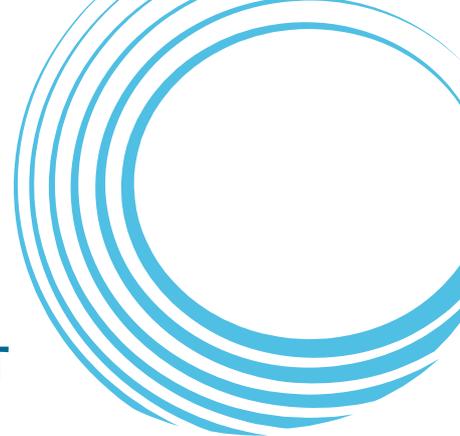
- 1 The size of the current ASEAN commercial loan book is estimated at US\$2,007 billion.⁸³ Assuming that all the future private green finance required (US\$1,635 billion) is provided in the form of private commercial loans, the loan book would grow to US\$3,642 billion by 2030. Assuming no other changes to the loan book, and a loan book growth similar to that of ASEAN GDP (5%), four out of every five dollars of every new loan from 2016-2030 would need to be green to meet forecast demand.
- 2 Developing the above scenario, it could be assumed that the ASEAN loan book grows in line with GDP at a rate of 5% per year and that there will be no crowding out effect from green investment.⁸⁴ It is assumed that the average tenor of green finance is about 12 years (see Appendix B). This suggests that 20% of the loans will have expired by 2030 assuming an equal level of finance each year between 2016 and 2030.⁸⁵ The projected 2030 bank loan book would then total US\$5,480 billion. If green finance represented US\$1,308 billion of this loan book, it would imply that green loans would comprise 24% of the lending portfolio. This would roughly represent a 12 times increase from the current estimated percentage of green loans in the region's loan books (see Appendix B). This magnitude of increase would be very challenging for banks to cover given capital adequacy ratios and other regulatory constraints. It would probably require instruments to move assets off bank balance sheets and into the capital markets (see Section 5).

FIGURE 13: PROJECTED 2030 LOAN BOOK AND PROPORTION OF GREEN LOANS

Current loan book	2,007
+ Growth from GDP (5%)	2,165
+ Net growth from green finance	1308
Of which growth from green finance	1,635
Of which portion expired (12-year tenor)	-327
Total 2030 loan book	5,480
Share of green finance in loan book (1,308 / 5,480)	24%

- 3 Although investment calculations vary, China's Belt and Road Initiative is estimated to require annual investments of about US\$150 billion for the next decade.⁸⁶ This implies that ASEAN green investment opportunities are comparable to that of the Belt and Road Initiative.⁸⁷

5 SCALING UP GREEN FINANCE – MAKING SUPPLY AND DEMAND MEET



5.1 INTRODUCTION

Green finance investment opportunities in ASEAN from 2016 to 2030 far outstrip the current supply of green finance. Failing to address this imbalance will have material environmental, social and economic costs for ASEAN and other regions. In order to address this imbalance, current financial capital allocation patterns will need to change along two dimensions.

First, capital allocation to polluting and environmentally damaging activities will need to decrease while allocations to activities with environmental benefits will need to increase. Second, the speed at which capital is allocated to green investments needs to increase rapidly in order to meet international and national policy goals on time. The rate at which green finance is deployed is important. Despite linear assumptions of investment opportunities between 2016 and 2030 for simplification purposes, near-term capital expenditure will have a disproportionately large environmental impact on the ASEAN region, due to the long-term implications it has on future consumption patterns as technologies with long asset lives are ‘locked in’.

The following sections will examine how these dual objectives can be met in ASEAN. Some of the unique characteristics of the region are described, and are a crucial backdrop to understanding the two sets of barriers that hinder green finance in ASEAN. The context and barriers create a universe of opportunities that can be mapped according to the size of the opportunity and the perceived risk-adjusted returns. However, the context and barriers are also integral to the specific solutions that can help scale up green finance and satisfy investment needs within the ASEAN green investment universe.

5.2 ASEAN CHARACTERISTICS

ASEAN has many distinctive features related to the structure of ASEAN economies and financial systems. Several of the more prominent characteristics are summarized in Figure 14 and are expanded upon below. These are grouped into broad economic characteristics and broad financial market characteristics, although it is acknowledged there is considerable variance within both in the region.

FIGURE 14: SUMMARY OF ASEAN MARKET CHARACTERISTICS

Economy	Financial markets
<ul style="list-style-type: none"> • SMEs dominant in many ASEAN economies • High diversity of ASEAN economies along economic, cultural, religious and linguistic dimensions 	<ul style="list-style-type: none"> • Heavy dominance of bank-funded financing within ASEAN financial systems • Relatively small but growing pools of investment capital • High percentage of personal financial assets held in cash and deposits • No single regional currency and a lack of foreign exchange risk management options

5.2.1 CHARACTERISTICS OF ASEAN ECONOMIES

SMEs: SMEs dominate in many ASEAN economies. Malaysia, Indonesia, Thailand, the Philippines and Singapore all have economies where SMEs contribute between 30% and 60% of the countries' GDP, while employing between 60% and 90% of the workforce.⁸⁸ The universe of SMEs is vast, but SMEs in ASEAN that might require green finance for investment can be grouped into three broad categories.

1. Conventional SMEs looking to improve their environmental performance, such as through energy efficiency investments.
2. SMEs looking to expand their sales of green goods and services, which could be related to emerging green innovation in areas such as renewable energy or agriculture.
3. Agricultural smallholders, who play a key role in many aspects of agriculture, such as in the production of palm oil in several ASEAN countries.

Diversity: ASEAN is a diverse region. Its membership includes both a G20 member as well as frontier markets. Its members range from second on the World Bank's *Doing Business* index to the bottom quartile.⁸⁹ GDP per capita in Singapore is over 40 times higher than some other ASEAN members.⁹⁰ This diversity also extends beyond economic variables to language, culture and religion. This prevents a 'one size fits all' strategy and requires solutions that consider local preferences and cultural sensitivities across widely varying markets. However, it can also create opportunities in terms of intraregional demand for goods, services, investments and labour.

5.2.2 CHARACTERISTICS OF ASEAN FINANCIAL MARKETS

Banks: Banks dominate in many ASEAN financial systems. In Indonesia, banks hold just under 80% of all financial assets.⁹¹ Short-term bank financing also provides most of the debt in many ASEAN financial systems. In countries such as Singapore, Indonesia and the Philippines, bank debt as a percentage of total debt is greater than 75%, which contrasts globally with countries with more developed capital markets, such as the US, where bank debt is less than 45% of total debt.⁹²

Investors: Alternative pools of capital to bank finance are in relatively short supply across ASEAN. In the US, insurance and pension fund assets are 150% the size of bank assets. In Asia, they represent less than 40% of bank assets.⁹³ Although Singapore has relatively deep pools of investment capital, representing over 1,150% of GDP, many other ASEAN countries have relatively less deep pools of domestic investment funds. Indonesia, Thailand Malaysia and the Philippines have considerably smaller investment pools ranging from 59% to 348% of GDP.⁹⁴

Households: The relative scarcity of deep investment pools across many ASEAN financial markets stems in part from households' savings patterns. Households have relatively low levels of personal financial assets (PFA), with a high percentage in cash and deposits. In Indonesia and the Philippines, roughly 40% and 60% respectively of total PFA are held in cash deposits. This contrasts with many European countries where cash and deposits represent less than 20% of total PFA and a larger proportion is invested over longer time horizons and with different risk appetites.⁹⁵

Currency: ASEAN has no single regional currency, and the currencies of many ASEAN members are less liquid than many other global currencies. This limits the options to manage risk and increases the associated cost, especially in the context of large-scale transactions. These features contribute to currency risk being viewed as a significant barrier to investment in ASEAN.⁹⁶

5.3 BARRIERS TO SCALING GREEN INVESTMENT

The economic and financial market characteristics of ASEAN economies are intrinsically linked to many barriers to scaling up ASEAN green finance. These barriers can be broadly grouped into two categories. The first set relates to generic finance barriers that can affect all transactions. The second one relates to the green dimension of investments. These sets of barriers are often interrelated and there can be considerable overlap between them in many instances. Many longer-dated green investments have higher capex requirements relative to more carbon-intensive investments, for example. This means that although access to longer tenors of finance might be a generic challenge for many projects seeking finance across ASEAN, the higher capex component of a green project can create an additional hurdle. Both sets of barriers will need to be addressed to effectively scale up green finance.

While a comprehensive review of barriers and solutions is outside the scope of this report, several generic and green barriers to scaling green finance in ASEAN have been consistently highlighted during expert interviews and the literature review. A non-exhaustive list covering some of these barriers is listed below.

5.3.1 GENERIC FINANCE BARRIERS

Generic barriers apply to all sectors, and not just the green investments identified in Section 3.4. Many are highly relevant to green investment and will ultimately need to be addressed to scale up green finance.

Maturity mismatches: these are a common feature of many financial systems. Maturity mismatches are caused by a structural asymmetry between the characteristics of the supply and demand for finance. Although ‘maturity transformation’ (i.e. borrowing short-term and lending for longer periods) is a fundamental function of the banking system, this feature can create barriers to the types of finance required by many green projects. As highlighted in Section 3.4, many ASEAN green investment opportunities, such as infrastructure and some types of agriculture, are characterized by relatively large medium- to long-term capex requirements with associated asset lives of 10 to 25 years. The tenor of banking liabilities across the global financial system is generally short-term, with weighted average maturities of commercial loans often under three years.⁹⁷ Average loan tenors in ASEAN appear to be above the global average at just over six years, although maturities of loans to SMEs can often be shorter due to higher perceived risk.⁹⁸ 70% of all loans in the Credit Surety Fund for SMEs in the Philippines are under one year.⁹⁹

Scarce investment pools: Alternative sources of medium- to long-term finance to bank lending are relatively scarce in ASEAN. Sources of equity held by investors with longer-term investment horizons, such as insurers and pension funds, are in relatively short supply across the region. Pension and insurance funds can have average liability lengths of around 20 years. The liabilities of investors such as sovereign wealth funds can extend up to 50 years.¹⁰⁰ Such liability profiles are potentially suitable for many green assets identified in Section 3.4 that are characterized by the need for medium- to long-term investment.

SME access to finance: Access to finance for SMEs has been highlighted as a material problem in ASEAN. Contributing factors include a lack of credit history, a reliance on collateralized lending with high collateral requirements, and high interest rates. Given their relatively small size, SMEs generally cannot borrow through international markets, which can be a source of finance for larger enterprises.

Credit and capital market risk: Several barriers related to credit and capital market risk can hinder investment. These include the creditworthiness of counterparties, which has been highlighted as a common problem with renewable energy offtake agreements, along with offtake contracts that permit early termination and therefore uncertain cash flows. Further risks include high transactions costs, risks linked to currency volatility and the associated risk management, as well as issues related to the low liquidity of some large, long-term assets like many infrastructure investments highlighted in Section 3.4.¹⁰¹

Policy and regulatory risk: These include an unstable political environment, national or local security concerns, policies that encourage higher carbon-intensive growth (such as subsidies for fossil fuels), weak legal frameworks and the limited enforcement of regulations, as well as frequent changes to regulations.

5.3.2 GREEN FINANCE BARRIERS

Green finance barriers are specific to the green dimension of an asset or security. These barriers are relevant at the level of the asset, but also at a structural level. A non-exhaustive list can be found below.

Green investment pipeline: Expert interviews highlighted the challenge of a relatively limited pipeline of commercially viable green investment opportunities in ASEAN countries. Only 45% of current renewable projects in South-East Asia are estimated to be bankable without support from outside the private sector, according to industry experts.¹⁰² Similarly, analysis by Marsh and McLennan estimates that around 60% of infrastructure projects in emerging markets in Asia are not ‘bankable’ without non-commercial financing that often comes from public sources.¹⁰³ The scarcity of green investments in a single country can mean that it is challenging to accumulate a portfolio of commercially viable green assets. Accumulating a diversified ASEAN green investment portfolio can therefore potentially introduce currency risk that can be expensive or hard to manage as highlighted above.

Underdeveloped green toolkit for financial decision makers: The lack of clear definitions and clarity over what a ‘green’ project or asset is throughout the ASEAN region increases search costs for investors, banks and companies looking to invest. Without clarity on what is, and what is not green, internal budgeting, accounting and performance measurement functions will struggle to allocate capital towards green projects and assets. It will also hinder measuring environment-related risks. Even where asset or enterprise level data is available, the lack of common standards and metrics makes comparison challenging.

Inadequate analytical capabilities: Understanding of the financial implications of environmental variables by financial institutions is still at an early stage. In many financial institutions, the capacity to identify and understand the credit and market risks remains relatively low. This can hinder more effective risk management, and lead to an overinvestment in environmentally harmful projects. This in turn can limit the volume of finance that can be mobilized for green investment.

Lack of non-financial environmental data: Limited disclosure from companies and financial institutions in a comparable format makes it difficult for financial decision makers to make risk assessments and for companies to attract new sources of green funds. There are also few projections of how business models will vary along different established trajectories (such as business-as-usual and a 2-degree pathway scenario), which can be valuable information for understanding medium- to long-term risks in some sectors.

Technology risks: Green projects, including areas highlighted in Section 3.4, can require highly specialized knowledge. Expertise in the techniques to build and maintain such technologies can take time to develop. Some types of investment can also depend on supporting infrastructure: for example the reliance of many types of renewable energy on the resilience of the grid, or the infrastructure a farmer requires to get produce to processing facilities or markets.

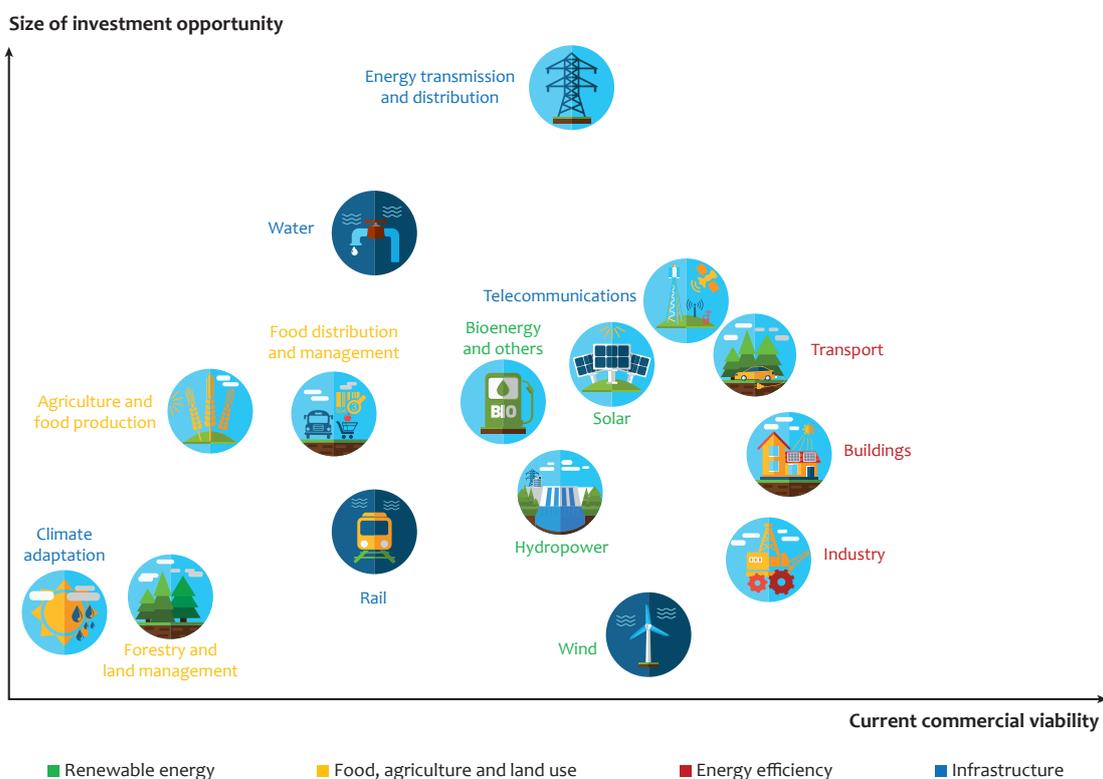
Policy frameworks: National environmental and broader sustainability objectives have not been translated into coherent financial policy frameworks. The lack of incentives for providers of capital and financial services prevents the financial system from being effectively aligned with broader sustainability objectives such as Nationally Determined Contributions (NDCs), renewable energy targets or the delivery of the SDGs. In 2016, China issued a comprehensive policy framework to align its financial system with green growth objectives and the goal of ‘ecological civilization’. The *Guidelines for Establishing the Green Financial System* contains 35 measures to scale up green finance, including green guarantees, green insurance, environmental disclosure guidelines and the development of equity and bond green indices.¹⁰⁴

5.4 IMPACT ON GREEN INVESTMENT UNIVERSE

The barriers described above are also shaped by the unique characteristics of the ASEAN region. These factors combine to produce different impacts across sectors. While acknowledging the challenges associated with such an exercise, ASEAN green investments can be mapped along two axes. The first relates to the size of the potential opportunity. The second dimension relates to the perceived commercial viability.¹⁰⁵ This is largely a function of the degree of visibility over the repayment profile and the credit quality of the cash flows generated by green assets.

Figure 15 is an illustrative mapping of where these green investment opportunities broadly fall. In reality, there is considerable diversity in variables such as transaction size, the nature of the financial benefit (e.g., an adaptation project might not generate cash flow, but might avoid future cost) and the composition of actors and financial instruments required in any project.

FIGURE 15: MAPPING ASEAN GREEN INVESTMENT OPPORTUNITIES



For illustrative purpose only, based on the authors' perception and not drawn to scale.

Investment opportunities of "Climate mitigation" are applicable across all infrastructure sectors, thus excluded in context to allow meaningful comparison.

Source: Authors

Figure 15 is illustrative of a static point in time; the actual risk profile and the perceived commercial viability of any sector will change over time and across countries. Projects move through distinct phases from planning to construction to operation. Risk and return profiles will vary considerably, along with the time profile of cash flows. These phases require different combinations of public and private actors, as well as different instruments to cover different risk and return profiles. Figure 15 highlights some clear differences between sub-sectors. Investments related to land use, for example, are often perceived to be considerably less commercially viable than some investments in renewable energy or energy efficiency. While some sectors are perceived as commercially viable at the level of the region, interviews revealed that this perception does not necessarily apply across all countries for all asset stakeholders at a more detailed level.

Similarly, risks differ across countries. Investments in locations with less attractive investment conditions, such as those with a weaker regulatory environment or where off-takers are of lower credit quality, will rely more heavily on public sector actors such as MDBs, and instruments including grants. Lower-risk projects can access a higher proportion of their finance through commercial channels, including banks or through the capital markets.

Attracting investment at scale for green infrastructure in ASEAN therefore requires a diverse ecosystem of financial actors with expertise in the relevant green investment area, which can be underdeveloped in emerging green sectors. As highlighted above, financial systems are not as diverse in ASEAN as in other parts of the world, and the relevant platforms to bring relevant players together do not exist at scale, which could hinder access to finance for ASEAN green infrastructure. This point is explored in further detail in the section below.

5.5 OPTIONS TO SCALING UP GREEN FINANCE

As with many complex, multi-faceted challenges, no single solution set will deliver the green finance required at scale and within the timeframe required across multiple countries. Based on international experience, interventions are likely to be required at the national, regional and even international level, and might include a blend of policy and financial market innovations.¹⁰⁶ This will result in changes to the balance of financial sources, the types and relative importance of financial intermediaries, and the range of instruments used to deliver green finance.

Identifying the optimal basket of interventions across ASEAN will require more detailed country-specific analysis. Financial transactions can also be complex and context-specific. However, several areas have emerged from the research and interviews that would benefit from further exploration. The following illustrative, non-exhaustive list highlights a selection of possible market and policy innovations that have the potential to address the generic and green barriers to mobilizing green finance at scale in ASEAN.

5.5.1 GENERIC SOLUTIONS

Institutional Investors: although pools of investment capital are relatively small in ASEAN, it is clear from Section 4 that domestic ASEAN bank finance alone is unlikely to meet the ASEAN green investment demand. Banks will remain vital players in ASEAN green finance. This is in part due to their deep understanding of the differing characteristics of the local markets and their key role as primary lenders. However, institutional investors can help address some of the limitations of bank finance and the associated issue of maturity mismatch in several interconnected ways.

Firstly, institutional investors can help free up operating stage debt and equity capital initially provided by banks. This becomes increasingly important as the capital requirements for financial institutions become increasingly stringent. Techniques including securitization and products such as green bonds or investment trusts (e.g. 'YieldCos') can help transform unrated, illiquid assets on bank balance sheets into public, rated and freely tradable investment products. Once transformed, institutional investors can purchase these green instruments on the capital markets within their existing product, liquidity and creditworthiness constraints. Such active bank balance sheet management opens up a broader universe of investors with a range of investment horizons and return expectations. The process might also encourage more bank lending if there is a low-cost and predictable means to refinance the assets once early stage projects are operational.

ABS are a specific example of such a product. They also illustrate the interconnected nature of the barriers to green finance and the importance of the sequencing of solutions. The prevalence of SMEs in the region generates many finance opportunities of smaller size with idiosyncratic risk. These are almost all

financed today by commercial loans. However, by combining green assets in ABS structures that diversify non-systemic risk, it is possible to engage capital market investors with a product that is tailored to the risk, return, liquidity and product characteristics that large investors are willing to accept. Commercial banks that may issue such ABS structures may reap many benefits, including helping to reduce regulatory capital requirements while allowing the banks to maintain core client relationships.

In order to capitalize on the opportunity offered by ABS, expert interviews have highlighted that several barriers will need to be addressed, highlighting the importance of sequencing and collaboration. A definition of what is, and what is not green, is a precondition to sourcing a sufficient pipeline of green assets and this process must involve multiple stakeholders. A system to tag or track green assets to help identify suitable products to be pooled is then required. Without a deep investment pipeline, a cross-border portfolio would involve the hedging of currency risks, which could require new risk mitigation products. Other factors, such as a lack of standardization of loan contracts will also have to be addressed.

A second area where institutional investors can help scale up green finance is by directly lending to projects. Although there are numerous, well-documented challenges within ASEAN, investments in sectors like infrastructure can offer long-term, predictable income streams, low sensitivity to business cycles, and low correlations to other asset classes.¹⁰⁷ However, as anecdotal evidence suggests that ASEAN investor appetite for green assets is currently limited, careful design will be required to ensure that suitable products are developed with attractive risk-adjusted return profiles that meet the product and liquidity requirements of investors.

Microfinance: Although there is no ASEAN green microfinance fund today, industry experts noted the potential of green microfinance in ASEAN and suggested several reasons for its potential. The broader microfinance market is becoming more mature in ASEAN, so offering green financial products could be a new axis along which microfinance companies can differentiate themselves. Several MDBs have helped scale the broader microfinance market in ASEAN markets like Cambodia and the Philippines. These same MDBs have extensive green finance expertise that could be combined with the microfinance knowledge and capacity to help support and scale up the green microfinance market.

Digital finance: The universe of green digital finance solutions covers a broad spectrum of technologies including mobile payment platforms, crowdfunding, the Internet of Things and big data. While advances in digital finance have been most pronounced in the field of social inclusion, there is emerging innovation where environmental considerations are central to the design of 'green fintech'. Given the relatively high and rapidly growing digital penetration rates in ASEAN, the application of digital solutions to environmental issues warrants further analysis.¹⁰⁸ Green digital applications that might address some of the barriers outlined above include:

- a. **SME access to finance:** Trine is a Scandinavian start-up that links private sources of capital to distributed solar energy systems through green loans in rural Africa.¹⁰⁹ Trine uses the 'pay as you go' model to circumvent the challenge of high upfront costs associated with installing renewable technology, and which is a significant challenge for many SMEs.
- b. **Mobilizing domestic savings pools:** While PFA per capita might be relatively low in many ASEAN countries, green digital solutions could help to unlock pools of PFA currently allocated to cash and deposits. If mobilized, such savings could help offset challenges associated with a relatively small institutional investment pool, especially as PFA grow. The government of Kenya issued the M-Akiba bond in March 2017, which was designed to mobilize retail savings to fund Kenyan infrastructure. M-Akiba can only be subscribed to through a mobile platform and has helped mobilize household savings for infrastructure.¹¹⁰

5.5.2 GREEN SOLUTIONS

ASEAN green investment platforms: delivering the green investment potential in ASEAN will involve competition, but will also require collaboration through an ecosystem of actors. Collaboration could take several forms and could be enhanced by the development of green investment platforms. Given the international nature of finance and the structural limitations of some ASEAN financial markets, such platforms could connect an ecosystem of actors beyond national and regional borders.

- a. Many green investment opportunities are complex and cannot be solved by a single financial actor or instrument. The risk profile of an entire transaction may not be attractive to a financial institution. However, elements of the transaction or risk profile may be attractive to individual financial institutions if packaged correctly. Collaborating across a complex transaction might therefore allow risks to be managed by those best suited to managing them. This might allow a transaction to take place that would not have otherwise been financed by a single counterparty. Complex risks in areas where capacity might be underdeveloped can also be collectively assessed. An ASEAN example is the Sustainable Finance Collective Asia (SFCA),¹¹ which is a public-private platform designed to accelerate investment into projects covering circular economy, sustainable energy and social impact.
- b. Beyond financial institutions, a broader array of actors including commercial enterprises, non-governmental organizations, and academia can be highly relevant to green investment. Such an ecosystem can harness multiple, interconnected leverage points, including training, labelling, technical support, off-take agreements or price premiums to alter the risk/reward profile of green investment. Initiatives under development in countries such as Indonesia offer an example of such collaboration. In the palm oil sector in Indonesia, producers, financiers, smallholder organizations, NGOs, academia and consumer goods companies are coming together under the umbrella of the Tropical Forest Alliance 2020 (TFA2020) to develop viable solutions to scale green investment.¹² This might involve a downstream consumer goods company providing an offtake agreement to an agricultural cooperative, which in turn makes an unbankable counterparty bankable. Such initiatives harness relationships between and along supply chains that may span national and regional boundaries.

Improved non-financial disclosure: environmental disclosure by the users and preparers of financial information could be enhanced and made more consistent, drawing on international best practice where appropriate. This would allow more informed financial decision-making, including improved understanding of environmental risks and opportunities.

Toolkit for financial decision makers: a broad range of innovations could be considered for development in ASEAN to improve the green finance toolkit available to financial decision makers. This could include:

- a. **Definitions/taxonomies:** relevant green finance definitions and taxonomies for green assets and financial products could be developed. This could help scale up green finance in many ways, including accessing new and more diversified pools of capital searching for green assets, it could facilitate the inclusion of assets in green market benchmarks, and could improve the ability of policymakers to create effective and efficient policy.
- b. **Green Tagging:** based on the development of a green classification system outlined above, a system to facilitate the tagging of green assets could be developed, especially by primary lenders such as banks. This could enhance the visibility over internal green stocks and flows, satisfying the growing global demand by investors for more environmental financial visibility.¹³ It could also help banks measure their green asset quality and performance versus non-green assets. Green tagging could also help financial institutions create green investment products such as green ABS.

- c. **New Tools:** financial market actors can develop new tools to support new product development and stimulate demand. Globally there is evidence of such innovation along the whole investment chain. This includes new risk management tools developed by assets owners (e.g. Transition Pathway Initiative toolkit),¹¹⁴ data providers (e.g. MSCI ESG data)¹¹⁵ and investment banks (e.g. HSBC's Climate Risk Analysis Framework), listing requirements for stock exchanges (such as the Johannesburg Stock Exchange's green bond listing requirements), toolkits (such as the G20 Energy Efficiency Investment Toolkit)¹¹⁶ and new green standards (ISO in partnership with 2 Degrees Investing will launch a standard to measure investor's contributions to climate change goals).¹¹⁷

Green investment pipeline: scaling up the creation and identification of green assets can be achieved in several ways. This could include:

- a. **Aggregation:** innovations such as green definitions and taxonomies, as well as green asset tagging, can facilitate the development of a green investment pipeline. Such innovations would allow the creation of new products such as green ABS that could aggregate a variety of assets, including green SME loans. These would individually be too small for institutional investors to invest in directly, but could become suitable once transformed into larger, liquid and familiar investment products.
- b. **Public finance:** public finance includes a diverse range of instruments and institutions, including development banks and in some cases, central banks. Uses can include improving the bankability of projects by altering the risk profile of green assets. This often involves types of early stage financing, where project risks are higher and there is often no positive cash flow. Other examples of using public funds to increase a green product pipeline include initiatives to address environmental externalities (e.g., through the World Bank Group's work on carbon markets);¹¹⁸ or help in scaling up new investment product (e.g., Singapore's green bond grant fund).¹¹⁹
- c. **New products:** expert interviews mentioned various other tools that could help scale up green finance. These include new green indices (e.g., China alone has launched seven green bond indices since mid-2016 to complement the 19 existing green equity indices),¹²⁰ and the encouragement of their use as benchmarks by money managers. A variety of risk management tools, including insurance, are also of potential significance. They can help improve the bankability of projects by hedging technology risks associated with new types of renewable energy, weather risks for farmers, and there is emerging evidence of insurance covering costs associated with adaptation.¹²¹

Green finance roadmaps: International experience shows that action to develop sustainable financial systems is more coherent and effective where there is a comprehensive, long-term plan or roadmap.¹²² Globally, there is evidence of a rapid increase in such plans in 2017, including by many international financial centres that shape the norms of global finance.¹²³ The national context will determine the relevant blend of policy-led, market-led and public-private initiatives that could be considered. Despite variations in their content, all have at their core the development of long-term, systemic plans to enhance the ability of the financial system to mobilize green finance. This involves identifying system-wide needs, barriers to scaling and priority actions.

The unique characteristics of the ASEAN markets, along with many variables described above will mean there is no 'one size fits all' solution for scaling green finance in ASEAN. More country-specific work is required to design the most efficient and effective levers to scale green finance to specific sectors and subsectors. However, it is clear that many of the potential solutions surfaced through a literature review and expert interviews have the potential to address one or more of the barriers to scaling green finance in ASEAN. Figure 16 is a simplified illustration of where some of these linkages might lie, although understanding sequencing issues and factoring in capacity constraints are examples of additional important considerations in arriving at a set of solutions.

FIGURE 16: MAPPING BARRIERS AND SOLUTIONS

		Generic				Green								
		Institutional Investors	Microfinance	Digital - SMEs	Digital - Mobilizing Savings	Green Investment Platforms	Improved Environmental Disclosure	Toolkit- Definitions	Toolkit - Green Tagging	Toolkit - New Tools	Pipeline - Aggregation	Pipeline - Public Finance	Pipeline - New Products	Green Finance Roadmaps
Barriers		Solutions												
Generic	Maturity Mismatch	✓			✓	✓	✓			✓		✓	✓	✓
	Scarce Investment Pools		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
	SME Access to Finance		✓	✓				✓	✓		✓		✓	✓
	Credit and Capital Market Risk				✓	✓				✓	✓	✓	✓	✓
	Policy and Regulatory Risk					✓						✓		✓
Green	Green Investment Pipeline		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Underdeveloped Toolkit					✓	✓	✓	✓	✓		✓	✓	✓
	Inadequate Analytical Capabilities					✓		✓		✓		✓	✓	✓
	Lack of Environmental Data						✓	✓	✓	✓		✓		✓
	Technology Risks					✓						✓	✓	✓
	Lack of Policy Frameworks											✓		✓

Source: Authors

5.6 CONCLUSION

Green investment in the ASEAN region in the years up to, and beyond 2030 clearly represents a huge opportunity – to both transform the region into a resilient, green economic powerhouse that can comfortably support a growing population in a sustainable manner, and provide returns for investors. ASEAN green finance could grow into a new market 37 times the size of the 2016 global green bond market, clearly demonstrating the scale of the investment opportunity.

However, current flows of ASEAN green finance – into the key sectors of green infrastructure, renewable energy, energy efficiency and land use – remain wholly inadequate to capitalize on this opportunity. The barriers outlined in this report – a function of many factors specific to the region, including a high proportion of SMEs, the structure of the financial system, and a lack of a green finance tools for financial decision makers – need to be addressed.

Although more analysis is needed, this report outlines some options that could be used to overcome these barriers, such as ASEAN green investment platforms, engaging institutional investors, developing a better toolkit, digital finance and developing national green finance roadmaps.

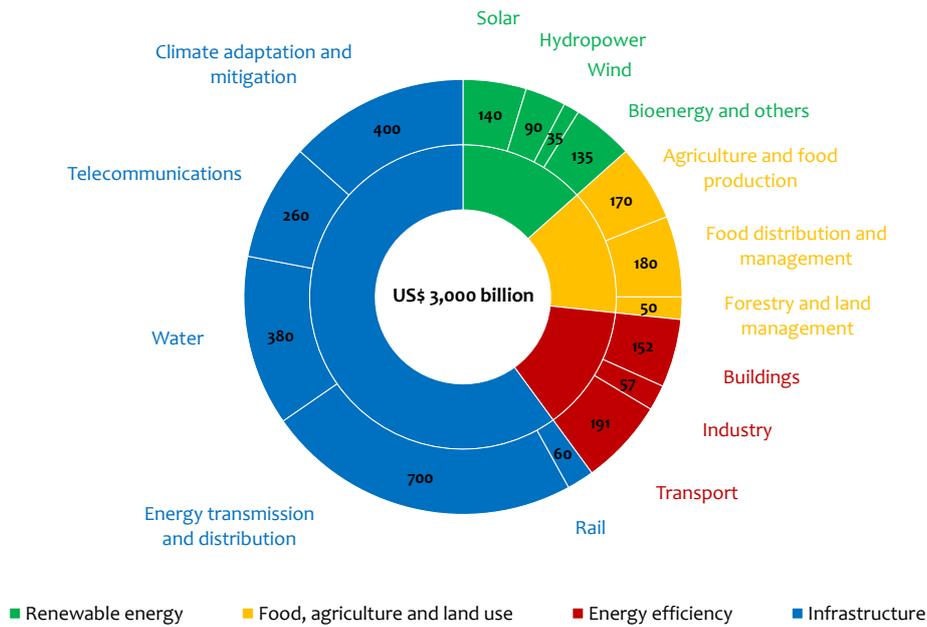
The time is ripe for ASEAN nations and investors to push hard to take advantage of the investment opportunity at hand, thus ensuring that climate change, population growth, unsustainable consumption and production, pollution and many other challenges do not hold back this dynamic region.

APPENDIX A – METHODOLOGY FOR ESTIMATING THE DEMAND FOR GREEN FINANCE

This appendix outlines the methodology and assumptions used to derive the analysis in Section 3.4.

The following provides details on how the bottom-up sectoral estimates were derived, with references made to the relevant literature and assumptions as applied in this report.

FIGURE 17: ASEAN GREEN FINANCE OPPORTUNITIES – SECTORAL BREAKDOWN (IN US\$ BILLION)



Source: Authors, based on:

Renewable energy: International Energy Agency (2016) Southeast Asia Energy Outlook 2015; IRENA (2016) Renewable Energy Outlook for ASEAN

Food, agriculture and land use: Business & Sustainable Development Commission (2017) Better Business Better World

Energy efficiency: International Energy Agency (2016) Southeast Asia Energy Outlook 2015; DBS Asian Insight

Infrastructure: ADB (2017) Meeting Asia's Infrastructure Needs; Global Infrastructure Hub & Oxford Economics (2017) Global Infrastructure Outlook; International Energy Agency (2016) Southeast Asia Energy Outlook 2015

ASEAN GREEN FINANCE OPPORTUNITIES – INFRASTRUCTURE

FIGURE 18: AVERAGE ANNUAL INVESTMENT IN INFRASTRUCTURE, 2016-2040 (US\$ BILLION)

	Road	Airports	Ports	Rail	Telecoms	Electricity	Water	Total
Cambodia	1.1	0.0	0.1	0.1	1.0	1.6	0.3	4.2
Indonesia	30.1	1.0	0.4	0.4	4.0	26.8	10.6	73.3
Malaysia	7.0	0.1	0.4	1.1	1.1	7.1	1.8	18.6
Myanmar	4.1	0.2	0.2	0.3	2.0	3.7	1.8	12.3
Philippines	5.5	0.2	0.2	0.3	3.3	10.7	3.8	24.0
Singapore	0.9	0.2	0.1	0.1	0.1	1.5	0.8	3.7
Thailand	6.0	0.1	0.5	0.5	1.8	9.2	2.3	20.4
Viet Nam	5.3	0.2	0.3	0.8	4.0	10.7	3.8	25.1
ASEAN total	60.0	2.0	2.2	3.6	17.3	71.3	25.2	181.6
Cumulative 2016 - 2030	900.0	30.0	33.0	54.0	259.5	1,069.5	378.0	2,724.0
Cumulative 2016 - 2030 (rounded)	900.0	30.0	30.0	60	260	1,070	380	2,730

Notes: Road, Airports and Ports not included as green sectors; Data were not available for Brunei and Lao PDR in the source report.
Source: Global Infrastructure Hub & Oxford Economics (2017) Global Infrastructure Outlook

The *Southeast Asia Energy Outlook 2015* (IEA, 2016) approximated the investment opportunity for power plants build (2016-2030) to be US\$300 billion. For the purpose of this report, this amount was excluded given the inability to specifically differentiate the underlying nature of the power plants build between renewable and non-renewable. The residual amount of approximately US\$700 billion was assumed to be mainly attributable to energy transmission and distribution grid.

In *Meeting Asia's Infrastructure Needs* (ADB, 2017), the difference for 2016-2030 infrastructure investment needs between the baseline case (US\$2,759 billion) and the climate-adjusted case (US\$3,147 billion) implies climate adaptation and mitigation opportunities of US\$400 billion

ASEAN GREEN FINANCE OPPORTUNITIES – RENEWABLE ENERGY

The *Renewable Energy Outlook for ASEAN* (IRENA, 2016) gives an estimate of US\$27.16 billion of annual investment opportunities for renewable energy between 2015 and 2025 under the REmap scenario. The report assumes that the same annual investment opportunities apply for the 15-year period from 2016-2030 and rounds the value down to US\$400 billion. The IRENA breakdown by sector is then applied to this total.

ASEAN GREEN FINANCE OPPORTUNITIES – ENERGY EFFICIENCY

The *Southeast Asia Energy Outlook 2015* (IEA, 2016) Bridge Scenario, estimates energy efficiency investment opportunities at US\$300 billion for the period 2016-2030, inclusive of some upside potential estimate by the authors given the pace of growth in energy efficiency initiatives over the recent one to two years. An additional investment opportunity of US\$100 billion was added to the transport sector for key ASEAN countries' electric vehicles and automobile parts production, based on preliminary estimates made by DBS Asian Insight in 2017.

For the purposes of this report, the IEA New Policies Scenario split by sectors is used as a proxy to split the estimates of US\$300 billion under the Bridge Scenario.

ASEAN GREEN FINANCE OPPORTUNITIES – AGRICULTURE, FOOD AND LAND USE

The *Better Business, Better World* (Business Sustainable Development Commission, 2017) report indicated that to support SDG - Food in the "Rest of developing Asia (including Southeast Asia)" region, US\$45 billion in investments are needed each year.

Assuming a South-East Asia GDP contribution of 72% of that category, ASEAN investment opportunity will approximate US\$486 billion (72% x 45 x 15).

For the purposes of this report, we have mapped the components of the Food sector from the *Better Business, Better World* report for Asia (below) to the key categories and excluded the “Low-income food markets” category as non-green. This implies that 81% of the estimate of US\$486 billion may be classified as “green”, amounting to US\$400 billion.

Agriculture and food production	350
Food distribution and management	375
Forestry and land management	100
Low-income food markets	190
Total	1,015

APPENDIX B – METHODOLOGY FOR ESTIMATING THE SUPPLY OF GREEN FINANCE

This appendix outlines the methodology and assumptions used to derive the analysis in Section 4 (Figure 11). The following figure summarizes the estimates obtained.

FIGURE 19: SUMMARY OF ESTIMATES

Estimation of 2016 finance (both public and private) (US\$ billion)	Estimation of future public finance (%)
A. Public Finance (25)	G. Public Finance Proportion – Future Investment (43)
B. Commercial Loans (7)	G.1 Infrastructure (60)
C. Corporate Bonds (1)	G.2 Renewable Energy (15)
D. Green Bonds (1)	G.3 Energy Efficiency (17)
E. Multilateral Development Banks (MDBs) (3)	G.4 Food, Agriculture and Forestry (20)
F. Other Investments (3)	

A. PUBLIC FINANCE – CURRENT INVESTMENT (2016)

The budget expenditure of respective governments for the fiscal years 2015 or 2016 were analysed to determine the 2016 investment in green assets by the governments (see Figure 20).

The green expenditure estimation in this table has applied the following green percentage allocations to individual sectors based on IFC's study on the green share of commercial loans issued in the following industries: transport (10%); telecommunications (10%); land use (13%); water, sanitation and waste (100%); power (100% if only clean energy is considered and 0% if fossil fuels are considered); real estate (17%).¹²⁴ The report arrives at an initial estimate of US\$22.7 billion for the fiscal year 2016. Since the commercial banking sector is assumed to be relatively more conservative than public financiers in terms of green financing, government expenditure could actually have a slightly larger green share, leading to potential underestimation in our analysis. To account for this shortfall, this report has added roughly 10% of the initial estimate to arrive at an approximate figure of **US\$25 billion**.

FIGURE 20: TOTAL GOVERNMENT EXPENDITURE IN 2016 (UNLESS SPECIFIED) (US\$ MILLION)

Countries	Power ¹²⁶	Water, sanitation and waste (All assumed green)	Transport	Telecom	Land use (agriculture and forestry)	Other relevant sectors/areas	Grand total (green)
Brunei Darussalam (FY 2014/15) ¹²⁷	~100% fossil fuel-based generation and consumption, hence no green expenditure	Negligible	Total: 190 Green: 19		Negligible	Not applicable	19
Cambodia (FY 2016)	Total budget used for investing in public projects such as roads, bridges, railroads, ports, irrigation system, and other economy-driven projects: 1,430 ¹²⁸ Green: ¹²⁹ 140						140
Indonesia (FY 2015) ¹³⁰	Total: ¹³¹ 77,560 Green: 7,750					Environment function: 801	8,550
Lao PDR (FY 2011/12) ¹³²	Total (infrastructure spending, breakdown not available): 80 Green: ¹³³ 8				Total: 17.8 Green: 2.3	Not applicable	10
Malaysia (FY 2016) ¹³⁴	Total (including expenditure on other public utilities such as water and sewerage): 880 Green: ¹³⁵ 44	Data not available	Total: 3,440 Green: 344	Total: 29 Green: 2.9	Total (includes rural development as well): 1,800 Green: 234	Real state total: 370 Green: 60	680
Myanmar (FY 2015/16) ¹³⁶	Total: 4,170 Green: ¹³⁷ 3,130	Data not available	Total: 520 Green: 52	Total: 150 Green: 15	Total (including environment conservation and irrigation): 1,170 Green: 150	Not applicable	3,350
Philippines (FY 2016) ¹³⁸	Total: 2,110 (no breakdown of fossil fuel and non-fossil fuel) Green: ¹³⁹ 549	1,020	Total: 7,850 Green: 785		Total: 1,780 Green: 230	Not applicable	2,579
Singapore (FY 2016) ¹⁴⁰	Green: ¹⁴¹ 1.4	1,926	Total: 10,100 Green: 1,010	Total: 1,173 Green: 117.3	Data not available	R&D for urban solutions and sustainability ¹⁴² which includes clean energy, smart grids, and storage research (2016-2020): 662 Yearly Green: 130	3,183
Thailand (FY 2016) ¹⁴³	Total (no breakdown of fossil fuel and non-fossil fuel): 85 Green: ¹⁴⁴ 1.7	430	Total: 4,870 Green: 487	Total: 97.2 Green: 9.7	Total: 5,580 Green: 730	Environmental protection (also includes waste management): 210	1,870
Viet Nam (FY 2016) ¹⁴⁵	Green: ¹⁴⁶ 2,292						2,292
Grand total (green)							22,673

B. COMMERCIAL LOANS (2016)

The estimate is derived from data from the World Bank and various other national sources.

FIGURE 21: ASEAN LOAN BOOK BY COUNTRY (IN US\$ BILLION)

	Total Outstanding Loan as of 2016
Brunei Darussalam ¹⁴⁷	5
Cambodia ¹⁴⁸	14
Indonesia ¹⁴⁹	314
Lao PDR ¹⁵⁰	7
Malaysia ¹⁵¹	361
Myanmar ¹⁵²	15
Philippines ¹⁵³	150
Singapore ¹⁵⁴	457
Thailand ¹⁵⁵	468
Viet Nam ^{*156}	216
ASEAN - Total	2,007
Of which assumed to finance green assets (2%)	40.14

*Viet Nam's data are for 2015.

Source: World Bank and others

For commercial loans, IFC estimates that about 15% of the total value of syndicated loans globally in 2014 was green.¹⁵⁷ This is an average across several countries. Many of these are developed nations and most reported loans were in the US. By comparison, the proportion of loans to green assets/projects in China is an estimated 9%. Recognizing that the amount of green finance in ASEAN likely is lower than industrialized nations and China, an estimate of 2% is conservatively used across all ASEAN countries. This also aligns with a survey of 29 banks in Indonesia conducted by Bank Indonesia between 2011 and 2013, where the share of green lending among the surveyed banks was found to be 1.4% in 2013 (UN Environment, 2015).¹⁵⁸

According to Bloomberg Finance, commercial banks in ASEAN have an average loan tenor of 6.23 years. With a growth rate of 5% (similar to the projected ASEAN GDP growth for the period 2016-30), gross issuance of commercial green loans in 2016 is calculated as **US\$7 billion**.

C. CORPORATE BONDS (2016)

Corporate Bonds are conventional bonds issued by corporations. They are distinguishable from green bonds in that they are not issued with a specific stated intention to finance green assets. The estimate is derived from data from the Asia Bond Online as shown in Figure 21.

The report applies the same assumptions as for commercial loans (2%) in absence of more specific data. According to Bloomberg Finance, corporate bonds in ASEAN have an average tenor of 6.46 years. With a growth rate of 5% (similar to projected ASEAN GDP growth for the period 2016-30), gross issuance of corporate bonds (green) in 2016 is calculated as **US\$1 billion**.

FIGURE 22: ASEAN OUTSTANDING BONDS BY COUNTRY (IN US\$ BILLION)

	Total Local Currency Bonds Outstanding Dec 2016	Government Issuance	Corporate Issuance
Brunei Darussalam	NA	-	-
Cambodia	NA	-	-
Indonesia	163	139	23
Lao PDR	NA	-	-
Malaysia	260	141	119
Myanmar	NA	-	-
Philippines	98	80	18
Singapore	230	133	97
Thailand	303	222	81
Viet Nam	44	42	2
ASEAN - Total	1,098	758	341
			Of which assumed to finance green assets (2%)
			6.81

Source: Asian Development Bank (ADB), 2016⁵⁹

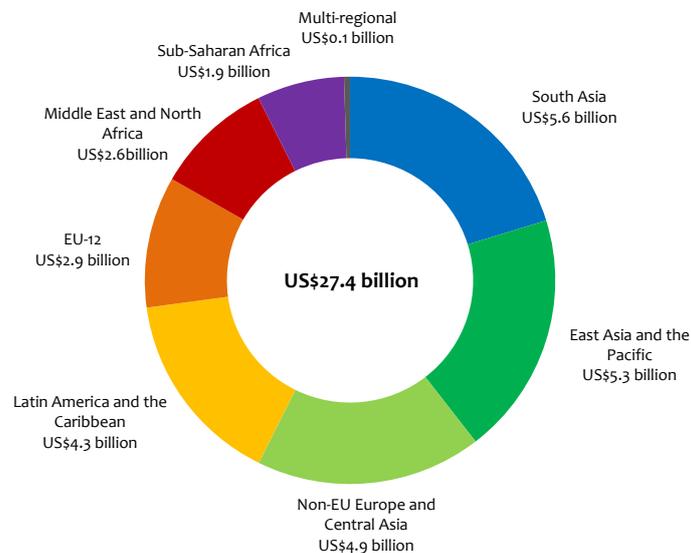
D. GREEN BONDS (2016)

Singapore is the only known ASEAN country where a non-financial company has issued a certified green bond so far. Singaporean City Developments Limited has issued the first green bond with a S\$100 million (US\$74 million) issue. **US\$1 billion** is estimated for this study, as other issuances might not yet labelled as green.

E. MULTILATERAL DEVELOPMENT BANKS (2016)¹⁶⁰

A joint report issued by the major MDBs estimates the total amount of climate finance from the major MDBs in 2016 for East Asia and the Pacific (the grouping includes all ASEAN countries except Brunei Darussalam and Singapore) at US\$5.3 billion.

FIGURE 23: MDB CLIMATE FINANCE BY REGION



Source: 2016 Joint Report on Multilateral Development Banks' Climate Finance¹⁶¹

Since the estimate covers climate change finance for 24 countries in East Asia and the Pacific, this report uses an ASEAN share of approximately 60% (which was the case in 2015 as reported by the 2015 Joint Report on Multilateral Development Banks' Climate Finance¹⁶²). This gives a total of **US\$3.17 billion** in 2016 climate change financing by MDBs in ASEAN.

This result can be corroborated by green finance data from some of the largest MDBs operating in the ASEAN region (including global climate funds and national development banks) as follows:

FIGURE 24: MDB ASEAN INVESTMENT 2016

	ASEAN Investment 2016 (US\$ billion)
World Bank	1.4
IFC	0.2
Asian Development Bank	1.1
Development Bank of the Philippines	0.2
Green Climate Fund	0.0
Climate Investment Funds (CIF)	0.2
Total	3.1

THE WORLD BANK

FIGURE 25: WORLD BANK (IBRD AND IDA) GREEN FINANCE (IN US\$ MILLION)¹⁶³

	Commitment in 2016	Of which: green
Brunei Darussalam	NA	NA
Cambodia	150	39
Indonesia	1,734	442
Lao PDR	30	7.8
Malaysia	NA	NA
Myanmar	404	105
Philippines	983	255.6
Singapore	NA	NA
Thailand	3	0.8
Viet Nam	2,174	565.2
ASEAN - Total	5,478	1,424*

Note: 1,424 calculated as 26% of the total

Source: World Bank Website¹⁶⁴

INTERNATIONAL FINANCE CORPORATION (IFC)

Only 17 investment projects (in Category C¹⁶⁵ and Category F1-3¹⁶⁶) are considered. Advisory services and completed projects are excluded. Out of these 17 projects, only 15 are active (the remaining are either on hold or pending approval/signing).¹⁶⁷ The investments are in the form of loan, guarantee, equity or risk management.

FIGURE 26: IFC GREEN FINANCE

Country	Amount (US\$ million)
Cambodia (6 active)	60
Indonesia (2 active)	20.9
Myanmar (4 active)	25.4
Philippines (1 active)	22.03
Singapore (2 active)	50
Total	178.33

Source: IFC

ASIAN DEVELOPMENT BANK (ADB)

Total ADB operations in 2016 in South-East Asia were US\$3.36 billion (in the form of loans, grants and technical assistance, with co-financing excluded).¹⁶⁸ Out of this, 34% is assumed to be green, which translates to a total of US\$1.14 billion.¹⁶⁹

DEVELOPMENT BANK OF THE PHILIPPINES (DBP)¹⁷⁰

The Green Financing Program is the umbrella program that supports the Bank's strategic thrust on environmental protection and the country's green growth strategy. In 2015, DBP approved a total loan of more than US\$234 million specifically for projects related to industrial pollution prevention and control, solid waste management, and new and renewable energy generation.¹⁷¹

GREEN CLIMATE FUND (GCF)

Through the GCF, only Viet Nam has so far received an amount of US\$29.5 million in the form of a grant.¹⁷²

CLIMATE INVESTMENT FUNDS (CIF)

Through the CIF, six ASEAN members (Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam) have received a total of US\$146 million in 2016 as grants and concessional loans.¹⁷³ The approved projects cover all four infrastructure and cross-cutting sectors discussed in this report.

The total green finance from the MDBs considered individually arrives at an estimate of US\$3.1 billion. This is similar to the total climate finance reported jointly by the MDBs for ASEAN. Both have limitations in scope or coverage as outlined below. Therefore, it is assumed that the total green finance in 2016 and from all MDBs would be around US\$3 billion. Some of this finance could possibly overlap with government expenditure as most MDBs provide support directly to the government.

Although the Asian Infrastructure Investment Bank (AIIB) is a major multilateral development bank in the region, only US\$237 million was approved for ASEAN as of January 2017. The green component is assumed to be negligible, hence it is not considered in this report. AIIB's growing importance in the region is however acknowledged as it is foreseen that AIIB's lending programme will grow to US\$1.5-2.5 billion in 2017 and US\$2.5-3.5 billion in 2018.¹⁷⁴ Similarly, the New Development Bank (NDB), another multilateral development bank established by the BRICS states (Brazil, Russia, India, China and South Africa) has no approved projects for ASEAN as of October 2017, so it is not included in this report.

F. OTHER INVESTMENTS (2016)

The estimates for other financing sources are based on best available information that is not always complete or specific to ASEAN. It excludes equity investment (e.g., directly into solar power companies). Most ASEAN countries are also recipients of international aid (Development Finance Institutions (DFIs) and bilateral donor agencies combined) consisting of both grants and loans, some of which could be green or climate-aligned. Some DFIs have already been included under MDBs above. A portion of bilateral finance is assumed to have been represented by public expenditure as many bilateral agencies provide support directly to national governments, and such support is often reflected in government budget, and hence in government expenditure.

Recognizing the above exclusion and uncertainties, the overall additional finance opportunity is estimated to be **US\$3 billion. US\$1 billion out of this is assumed to have come from the private sector.**

G. PUBLIC FINANCE – FUTURE INVESTMENT

The final estimate of 43% of **future investment opportunities coming from public finance is derived as follows:**

FIGURE 27: FUTURE INVESTMENT OPPORTUNITIES FROM PUBLIC FINANCE

	Investment Need	Global Estimate of Public Finance Proportion*	Adjusted ASEAN Estimate
Infrastructure	1,800	46%	60%
Renewable Energy	400	15%	15%
Energy Efficiency	400	20%	16%
Food, Agriculture and Forestry	400	NA	20%
Total	3,000		
Weighted Average			43%

*46% infrastructure estimate is for Asia Pacific

Source: Authors

G.1 INFRASTRUCTURE

While vast differences exist in the patterns of financing between countries, infrastructure financing in Asia and the Pacific region in general is broadly estimated to be split along the following lines: 70% from public funds (government budgets and national development banks), 20% from private funds, and 10% from multilateral development banks, official development assistance, and other sources.¹⁷⁵ The public share was estimated at about 90% in Indonesia (average of 2013-2020), and 45% in India in the first three years of its 11th plan (2007-2012).¹⁷⁶

ADB analysis of financing issues for a selected set of developing member countries of Asia and the Pacific over the 2016-2020 period shows that public sector reforms on both tax revenues and expenditures – while ensuring new borrowing maintains public debt sustainability – can meet around 46% of the gap (US\$121 billion out of US\$262 billion) between current and needed investments based on baseline estimates. This leaves 54% of the gap (or US\$141 billion) for private sector finance (absent new avenues for generating additional public sector resources for infrastructure). Factoring in the climate change cost, public financing will be only 39% of the US\$308 billion gap. This means 61% of the remaining gap will have to be financed by the private sector. Expanding private finance by the required level is, without a doubt, a major challenge.¹⁷⁷

It is observed that the current proportion of public finance in Indonesia (90%) is significantly higher than the average (70%) estimated. Of the total infrastructure investment opportunity of US\$1,800 billion (see Section 3.4), US\$650 billion comes from Indonesia, making it a significant part of the overall investment opportunities. In addition, many assets in other emerging markets like the Philippines, Thailand and Viet Nam are government-owned. This suggests that the estimate for ASEAN should be higher than the 46% for Asia and the Pacific. The report conservatively uses an estimate of 60% in this report.

G.2 RENEWABLE ENERGY

The amount of public finance is expected to differ by country and by type of renewable energy. Our baseline derives from analysis suggesting that 15% of all renewable energy will be financed by public finance.¹⁷⁸ It is expected that this pattern is more or less replicated fully in ASEAN and, based on conversations with subject matter experts, no specific adjustments were made in the context of ASEAN.

G.3 ENERGY EFFICIENCY

Consultations with subject matter experts in and beyond the ASEAN region, combined with secondary research, suggest that public finance will amount to 20% for energy efficiency investments globally.¹⁷⁹ No estimate is available for ASEAN. The global estimates are broadly applied to ASEAN. For electric vehicles (EVs), it is assumed that public finance will be required to meet at least 5% of the investment opportunities in the form of Research and Development (R&D) expenditure.

FIGURE 28: PUBLIC FINANCE BY TYPE OF ENERGY EFFICIENCY SUBSECTOR

	Public Finance Portion (%)		ASEAN Investment Opportunities	
	Global Estimate	Adjusted ASEAN	US\$ billion	%
Building	20%	20%	152	38%
Transport	20%	20%	91	23%
Industry	20%	20%	57	14%
Electric vehicles	NA	5%	100	25%
Total			400	100%
Weighted Average				16%

Source: Authors

On this basis, the report uses an estimate of 17% of public finance in ASEAN energy efficiency transactions.

G.4 FOOD, AGRICULTURE AND LAND USE

As outlined in Section 3.4, agriculture and food production represent about half the green investment opportunities, with food distribution and management making up another 40%. Indonesia represents 40% of the total opportunities.

Private companies and farmers will make much of the investment as they improve efficiency and adopt sustainable principles of manufacturing. There may be elements of agriculture that require public finance such as large-scale irrigation systems.

The report uses an estimate of 20% of public finance in agriculture transactions. A 2012 FAO study on agricultural investment in East Asia and the Pacific (excluding China) shows a 17% public/83% private split, supporting the assumption.¹⁸⁰

CALCULATION OF AVERAGE LOAN TENOR OF GREEN INVESTMENTS

Using an average loan tenor of 15 years for infrastructure projects, 8 years for renewable energy projects, 5 years for energy efficiency projects and 3 years for food, agriculture and forestry projects, this report arrives at an average loan tenor of 12 years for all sectors, using the weighted average method (see below).

FIGURE 29: AVERAGE LOAN TENOR FOR GREEN INVESTMENTS

	Investment Opportunity (US\$ billion)	Average loan tenor (years)	Basis
Infrastructure ¹⁸¹	1,800	15	Commercial banks usually provide infrastructure financing with tenor between 10 and 15 years (the higher end considered here). Only multilateral agencies provide financing with development perspectives and in long tenors, typically 20-30 years (sometimes even 35-40 years).
Renewable energy ¹⁸²	400	8	Typical lending terms for renewable energy infrastructure projects in Indonesia today are 7-8 year tenors.
Energy efficiency ¹⁸³	400	5	Average tenor of loans for the purchase of energy efficient equipments is considered to be around 5 years (Indonesia).
Food, agriculture and land use ¹⁸⁴	400	3	Loan tenors range from one to seven years. 3 years assumed to be an average.
Total	3,000		
Weighted Average			11.13 (12 years used for the report)

APPENDIX C – GREEN FINANCE ACTORS AND INSTRUMENTS

This appendix contains a brief explanation of some of the actors and instruments relevant to green finance. For each actor or instrument is provided a brief description as well as perspectives on the current size and characteristics in Asia, ASEAN and in the leading countries in the world.

MULTILATERAL DEVELOPMENT BANK (MDB)

What is it?

MDBs are financial institutions, created by a group of countries, set up to support development objectives. Financing can take multiple forms and is often highly structured to meet the specific needs of the borrower as well as of partnering private investors. Some MDBs have mandates that allow them to earn a lower return on their investments and take a higher exposure to risk, helping to make green assets more bankable. Such investments can take the form of equity, subordinated debt, guarantees, grants or permutations of these forms. The term “blended finance” is used to describe the strategic use of different sources of finance for the mobilization of additional commercial finance towards the SDGs in developing countries, and often involves MDBs.¹⁸⁵

<p>Global Perspective</p>	<p>Among the global MDBs, two related institutions stand out as having capacity – financially and in expertise – for substantial investments in emerging markets:</p> <ul style="list-style-type: none"> (i) IFC, with a commitment in Asia of more than US\$5 billion as of 2016. (ii) The World Bank, which in 2016 approved US\$7.5 billion for 41 projects in East Asia and Pacific, including US\$5.2 billion in International Bank for Reconstruction and Development (IBRD) loans and US\$2.3 billion in International Development Association (IDA) commitments. Of this, 26% is invested in projects related to Environment and Natural Resource Management.¹⁸⁶
<p>Asian Perspective</p>	<p>The Asian Development Bank (ADB) has taken a leading role in financing development projects in Asia. With committed loans of over US\$130 billion as of June 2017, a substantial portion is invested in climate change-related projects.¹⁸⁷</p> <p>The China-led AIIB supports infrastructure development in the Asia-Pacific region, with US\$100 billion in capital, which is two-thirds that of the ADB, and half that of the World Bank.¹⁸⁸</p>
<p>ASEAN Perspective</p>	<p>In ASEAN, only the Philippines has a national development bank (Development Bank of the Philippines) with a charter that includes both the environment and infrastructure.¹⁸⁹</p>

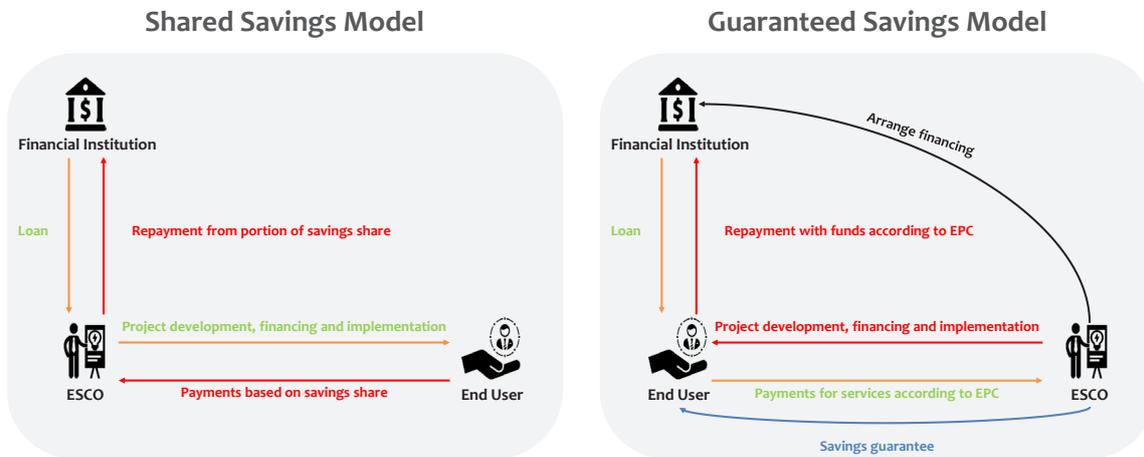
ENERGY SERVICE COMPANY (ESCO)

What is it?

An ESCO is a company providing a broad range of energy solutions including the design and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

ESCOs are important actors in providing both technical and financial solutions for energy efficiency implementation. An energy performance contract undertaken by an ESCO could include guarantees of energy savings or the provision of the same level of energy service at a lower cost with its remuneration directly linked to the energy savings achieved. The ESCO can either finance or assist in arranging financing under a shared savings or guaranteed savings model.

FIGURE 30: ESCO MODELS



Source: The World Bank (2008). *Financing Energy Efficiency – Lessons from Brazil, China, India and Beyond*. <https://openknowledge.worldbank.org/handle/10986/6349>

Global Perspective	ESCO markets in US and Europe are deep. The US ESCO market is expected to grow from US\$6.3 billion in 2015 to US\$11.5 billion in 2024, while ESCO revenue in Europe is projected to grow from US\$2.7 billion to US\$3.1 billion for the same period. ¹⁹⁰
Asian Perspective	The Asian market is diversified but well established. As an indication, China had already by 2012 more than 4,000 active ESCOs and the market size in India by the same time exceeded US\$140 million. ¹⁹¹
ASEAN Perspective	<p>ESCOs have become well adopted in ASEAN. The pace of adoption has partly been driven by national agendas for energy efficiency, with Malaysia, Singapore and Thailand being the top three countries that have actively implemented financial incentives to drive energy efficiency efforts in partnership with ESCOs.</p> <p>FIGURE 31: ESCO DEVELOPMENT</p> <p>Source: ACE (2017). <i>ASEAN ESCO Report</i>. ASEAN Centre for Energy (ACE), Jakarta. Available at: www.aseanenergy.org/publications</p>

GREEN BOND

What is it?

Green bonds are debt instruments issued by a corporation, financial institution or municipality to serve as dedicated financing of identified and specified assets with discernible, positive environmental impact. Issuers of green bonds are required to provide certain disclosures initially and periodically related to the assets funded. The rationale of issuing green bonds varies among issuers but generally include the ability to access new investors – e.g. those with a mandate to only invest in green assets – and corporate commitment to sustainable operations and the related corporate branding effect.¹⁹²

<p>Global Perspective</p>	<p>The global green bond market stood at approximately US\$81 billion in 2016 and is projected to hit US\$120 billion in 2017.¹⁹³ While this is still a fraction of the global bond market (US\$100 trillion),¹⁹⁴ the rapid growth of the market is encouraging.</p> <p>China has emerged as the world’s largest issuer of green bonds, making up about 39% of the new green bond issuances in 2016.¹⁹⁵ Investors for green bonds are anecdotally known to have a higher proportion of European and US investors,¹⁹⁶ including dedicated responsible investors such as Mirova¹⁹⁷ and ACTIAM.¹⁹⁸</p>
<p>Asian Perspective</p>	<p>Aside from China, green bond issuances have occurred in economies such as the Republic of Korea, India, and Taiwan.¹⁹⁹ In 2016, China issued approximately 32% of the global total, with the rest of Asia accounting for 7%. Some criticism has been raised over the quality of the issuances including the “greenness” of the assets financed.²⁰⁰ This is an important debate that will be ongoing for a while as this nascent market develops and reporting frameworks start to solidify.</p>
<p>ASEAN Perspective</p>	<p>The ASEAN market is in its infancy. 2017 saw the inaugural issuance of two green bonds in Singapore.²⁰¹ A corporate issuer in Malaysia issued its first green bonds under a Sukuk framework, thus making it available to investors following Sharia Investment Principles.²⁰²</p>

YIELDCO

What is it?

YieldCos are used for companies building and operating assets that upon completion have relatively stable contracts. The YieldCo is a dividend growth-oriented company, created by a parent company that bundles renewable or conventional long-term contracted operating assets in order to generate predictable cash flows. The parent company (e.g., a solar company) will upon the completion of a solar power plant enter into long-term offtake contracts for the plant – preferably at fixed prices by kilowatt-hours (kWh) – and would transfer the plant and contract into the YieldCo. In doing so investors in the YieldCo would be exposed to no completion risk on the asset and instead would be left with only the credit risk (of the offtaker) and depending on the structure with rollover/replacement risk.

Global Perspective	YieldCos were the favoured financing vehicles for US solar companies where the structures were also tax incentivized. In 2015, the market capitalization of YieldCo investments was estimated at US\$30 billion. ²⁰³ The structures suffered a subsequent dramatic drop in issuance after a single US solar company defaulted, causing losses to the YieldCo investors. ²⁰⁴ YieldCos have to date been primarily concentrated in North America. ²⁰⁵
Asian Perspective	YieldCos have yet to be introduced as a green finance instrument in Asia outside Japan. In Japan, three solar real estate investment trusts (REITs) are already listed and Canadian Solar received approval in September 2017 for their future listing. ²⁰⁶
ASEAN Perspective	No YieldCos have been observed in ASEAN.

EXCHANGE-TRADED FUND (ETF)

What is it?

ETFs are publicly traded investment funds that aim to replicate the composition and performance of a common index. They involve little or no active management. “Green ETFs”, which cover green assets, typically have various criteria to determine the asset eligibility to be classified as green. Such criteria allow investors to select ETFs according to their own view of sustainability.

Global Perspective	<p>The global ETF industry has, as of May 2017, hit over US\$4 trillion in assets under management (AUM), across almost 7,000 ETFs.²⁰⁷ Of this, global green ETF AUM is at US\$3.6 billion, which is 0.09% of total ETF market capitalization.²⁰⁸ By another estimate, US\$22.9 trillion of global AUM in 2016 were reported as invested in a “sustainable” way.²⁰⁹ In the US, ETFs are beginning to gain prominence for future fund flows due to their lower costs and ability to allow investors to focus on various ESG and socially responsible investing (SRI) trends or belief structures.²¹⁰</p> <p>The largest funds typically have global investment mandates and may focus on a sector such as clean energy or have a broader mandate. Most such listings today are in the US.</p> <p>As the trend of socially responsible investing grows, so has the supply of ETFs that proclaim to have a “green” or “social” investment mandate. In Europe, this has partly originated from requirements of pension funds, which need to ensure that its funds are invested responsibly. In both the US and Europe, the trend is broad-based and arises from the demands of individual savers and investors.</p>
Asian Perspective	Asia has yet to see a “green ETF” listed on any exchange in the region. However, ETFs listed in the US with global mandates may have investments in Asian companies, although the portfolio invested is limited. ²¹¹ These included companies in China, Hong Kong, Taiwan, the Republic of Korea, Japan and Thailand, with solar companies in China dominating the portfolio.
ASEAN Perspective	No ETFs launched.

MICROFINANCE

What is it?

Microfinance involves small-scale lending. This type of financing is often used to fund sustainable start-up companies in emerging markets. While traditional commercial banks may engage in this type

of financing, traditionally this is often undertaken by dedicated microfinance institutions. Such funds can also be raised via dedicated portals and websites where private individuals invest in small amounts, which in turn channels funds into microfinance investments (see “Crowdfunding”).

Global Perspective	With an estimated 10,000 microfinance institutions (MFI) globally, this industry has experienced significant growth since its early beginnings in the 1970s. The current global market for commercial microfinance is estimated at about US\$11.6 billion. ²¹² The total volume of microfinance loans worldwide is estimated at US\$60-100 billion. ²¹³
Asian Perspective	The modern microfinance movement originated in Asia. Grameen Bank in Bangladesh was an early pioneer. ²¹⁴ The highest growth rate (25-30%) in the sector globally is expected to be in the Asia-Pacific region, relative to the global growth forecast of 10-15%. ²¹⁵
ASEAN Perspective	The Philippines is the prominent microfinance country in ASEAN ²¹⁶ with an estimated lending portfolio of US\$9.5 billion as of the end of 2015. ²¹⁷ The country has set up a microfinance Council to promote microfinance. ²¹⁸ Cambodia is the number two micro, small and medium enterprise (MSME) finance market globally, and is expected to grow by 7.6% in both 2016 and 2017.

GREEN INSURANCE

What is it?

Green or sustainable insurance covers a wide range of products including those tailored for renewable energy providers (e.g., insurance against cost from lawsuits, resource insurance for costs suffered linked to adverse weather, replacement cost due to technology risk). It also includes catastrophe insurance for farmers covering damage to harvests, or to building owners covering damage from extreme weather. It also includes microinsurance, covering people in low-income classes (often those living below the poverty line) against disruption to their income.

Global Perspective	Over 100 insurance companies and stakeholder organizations today are signatory to the UN’s Principles for Sustainable Insurance (PSI), representing 20% of the global premium volume and US\$14 trillion in AUM. ²¹⁹ Many global insurance companies today offer many types of green insurance and the volume of natural catastrophe insured losses globally during 2016 was US\$50 billion. ²²⁰
Asian Perspective	The Asian insurance market does offer green insurance mainly through global insurance providers. Japan and Taiwan are sector leaders within this area. ²²¹ Among the 57 insurance signatories to the PSI, eight are from Asia. ²²² In China, environmental pollution liability insurance is mandatory in environmentally high-risk areas under their guidelines on green finance, ²²³ while in India, the Weather Based Crop Insurance Scheme (WBCIS) by the government exists to provide protection to farmers against adverse weather conditions. ²²⁴
ASEAN Perspective	Munich Re and JLT Asia have launched “One Storm Philippines”, an innovative insurance plan that insures the cost of having to prepare for extreme weather rather than the actual cost of the damage. ²²⁵ This encourages proactive enhancement of infrastructure to protect against damages. Specific to crop insurance, Thailand, the Philippines, and Viet Nam have government-subsidized schemes, while other ASEAN nations such as Indonesia, Cambodia and Myanmar show indications of embarking on similar schemes. ²²⁶

CROWDFUNDING

What is it?

Crowdfunding is a model that aggregates financial contributions from multiple sources, often individuals, typically involving the use of an online platform. For this report, crowdfunding refers to financing models for social entrepreneurs, particularly those with a green business model (for instance, developers of renewable energy solutions).

<p>Global Perspective</p>	<p>Today, a sprawling universe of crowdfunding platforms exist,²²⁷ with an estimated worldwide volume of US\$34.4 billion in 2015,²²⁸ which included US\$25.1 billion in lending. Better known consumer examples include <i>IndieGoGo</i> and <i>Kickstarter</i>, but multiple other platforms exist – mainly in US and Europe.²²⁹</p>
<p>Asian Perspective</p>	<p>While Asia is home to multiple crowdfunding platforms, none are known to be dedicated to the financing of green assets. With the diverse variety of projects being funded on any single platform, it seems plausible that green projects should be part of the offerings. Currently, crowdfunding for donations (e.g. <i>GiveAsia</i>), equity (e.g. <i>CrowdPlus.asia</i>) and debt coexist, offering a variety of sources for crowdfunding, with China responsible for the largest volume.²³⁰ For crowdlending within Asia-Pacific, China similarly remains dominant in terms of loan origination volume.²³¹</p>
<p>ASEAN Perspective</p>	<p>Singapore-based IIX promotes a debt-based crowdfunding platform to SMEs, which represent 96% of all enterprises in South-East Asia, and many SMEs are active within the renewable energy, agriculture and water sanitation sectors.²³²</p> <p>In the equity crowdfunding space, Malaysia, Thailand, Singapore and Indonesia are the most advanced, with increasing regulatory involvement.²³³</p> <p>Accion invests around the globe in micro-entrepreneurs. Its 2016 Annual Report describes a microfinance loan to a teashop owner in Myanmar to buy local milk and avoid having to pay local money lenders 10% interest a month.²³⁴</p>

APPENDIX D – ASEAN GREEN GROWTH AGENDA

The OECD in 2014 undertook an analysis to determine which of the ASEAN countries had set targets for different aspects of “green growth”. OECD’s conclusions are outlined in the figure below. It is likely that some targets have changed since the preparation of the report. Nevertheless, the report serves to show that all countries have set some targets in many areas of green growth.

FIGURE 32: GREEN GROWTH TARGETS - ASEAN COUNTRY

	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam
Resilience to natural disasters/ adaptation to climate change	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sustainable forest and land management	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Renewable energy	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Air pollution, water pollution and waste	Water only	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Energy security	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Food security	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Sustainable fossil fuel and minerals extraction	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Green technology	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Energy efficiency	No	Marginal	Marginal	Yes	No	Yes	Yes	Yes	Yes
Climate change mitigation	No	Yes	No	Yes	No	No	No	No	Yes

Notes: A “no” indicates that the objective did not appear in the plan – although it may have been listed as a challenge (but with no details on how to address it) – or may appear in a stand alone sectoral strategy. A “yes” indicates that the objective appeared in the plans and is thus considered mainstreamed.

While other documents in Singapore consider climate change mitigation as a key priority, Singapore’s Sustainable Development Blueprint (reviewed here) includes no specific objectives or strategies for reducing greenhouse gas emissions.

Source: OECD (2014). Towards Green Growth in Southeast Asia. Available at: <https://www.oecd.org/dac/environment-development/Final%20SE%20Asia%20Brochure%20low%20res.pdf>

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