Green Growth Potential Assessment

Myanmar Country Report

December 2017

Global Green Growth Institute

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Executive Summary

Myanmar is often described as undergoing a triple transition – to democracy, a market economy and peace. In that process the country is attempting to balance rapid economic growth with a commitment to sustainable development. Myanmar is one of the fastest growing economies in the world, with a GDP growing by than of 7% per year on average over the past five years and projected to continue for the coming five years (IMF 2017). This rapid increase in economic output are due to rising investment following Myanmar's transition to democracy and increasing levels of peace. Much of the growth in the recent past has been led by investment and development of the country's natural resources in the energy, mining, agriculture and forestry sectors. As investment and development intensify, so too do the challenges in ensuring that Myanmar's growth is sustainable. The government has committed to meeting these challenges, with mainstreaming green growth in its development policy. After re-joining the international community in 2012, Myanmar has commanded high levels of interest from donor agencies and development partners, which has led to a frenetic level and activity amongst government departments and between sectors. This report provides a timely prioritisation of issues in the country that can inform key interventions related to green growth.

The Global Green Growth Institute (GGGI) has developed a process to assess a country's potential for green growth. This Green Growth Potential Assessment (GGPA) is a diagnostic tool that combines data analysis with stakeholder consultation to identify and prioritize interventions where green growth offers the greatest potential for supporting a country's development. In four chapters, this report presents the results of the assessment process, including the underlying analysis and key recommendations.

In chapter 1, the GGPA methodology is explained. The results of the data analysis and benchmarking of Myanmar's green growth performance compared to its regional peers, together with the results of the stakeholder consultation are presented in chapter 2. Data analysis and stakeholder identified a broad range of sectors as necessary for a development following the principle of green growth. In many aspects, these sectors are highly interconnected, with changes and reforms in one sector directly impacting other sectors. Chapter 3 reviews in detail the challenges and opportunities across a number of sectors relevant for efforts towards sustainable development. Expert interviews, existing policy frameworks and existing evidence drawn from a wide range of literature have informed the analysis and the development of recommendations. Chapter 4 provides a summary of the main findings of this report.

Analysis has been conducted and recommendations were developed for the following sectors: agriculture, land use and forestry; energy; mining; industry, commerce and tourism; urban development and infrastructure, as well as cross-cutting sectors including public administration and education.

In the agriculture, forestry and land use sector, issues raised through the GGPA process include management of forest resources, activities threatening existing forest cover and increasing agricultural productivity. Recommendations include:

- Develop an implementation plan for achieving government forest protection goals and activities to support this plan, such as national land use emissions commitments, improve capacity around community foresting and prioritise biodiversity assets for guiding interventions to protect these assets.

- Address economic incentives, lack of governance and lack of enforcement that enable the continued illegal trade in timber as well as development of technical capacities for tracing timber.
- Promote diversification of crops and implement sustainable agriculture practices and marketing strategies to improve agriculture productivity.
- Develop ecotourism assets by conducting market studies to prioritise investment in ecotourism sites and inform fiscal policies that link recreational use to conservation funding in protected areas.

Analysis covering the energy sector focuses on the provision of electricity from renewable sources and the potential of off-grid electricity for rural electrification. Recommendations include:

- To improve access to electricity in rural areas, consider off-grid electricity from renewable sources as a viable long-term solution. Suitable pilot projects should be identified to demonstrate the viability of the approach.
- Build knowledge around options to finance off-grid renewable energy solutions. Develop public private partnerships to provide electricity from renewable sources based on international experience on necessary conditions to attract investments for infrastructure, power purchasing agreements, fiscal incentives and technology-specific financial support mechanisms such as feed-in-tariffs, etc. Deploy a pilot project to demonstrate these approaches.
- Undertake studies around energy efficiency standards and technologies, including lessons learned in other countries that are relevant to Myanmar's development context.
- Launch an electricity tariff reform to introduce tariffs that reflect the costs of providing electricity, while offering assistance for low income customers. This will generate revenue to allow for investments to improve the quality of the electricity infrastructure and reduce electricity losses.

The mining sector in Myanmar is characterized with illegal trade and underreporting of extractions, which undermines the country's sustainable development. Recommendations include:

- To improve transparency in the mining sector, develop best practices specific to each market that Myanmar supplies from its mining activities, advocate for an independent regulator to oversee mining activities and convene a dialogue amongst development partners to coordinate efforts on transparency in mining.
- Reform the distribution of mining revenues. Consult with regions and states to develop a model for revenue sharing with local areas and develop a strategy for investing revues from the extractive industry on education and conservation of natural assets.

The industrial sector is a key element of Myanmar's economic development plans. However, in its current state, the sector is not operating sustainably. Pollution, insufficient waste management and mass tourism contribute to significant environmental degradation. Recommendations include:

- Establish a pollution monitoring and control system. Survey existing pollution standards and data collection procedures for gaps. Based on the results, develop an implementation plan for pollution monitoring and capacity building. Develop a database for tracking and reporting pollution levels.

- To improve industrial waste management, pilot a catchment level approach to wastewater management planning and demonstrate wastewater treatment technologies in the pilot catchment.
- To foster sustainable practices in the tourism sector, build knowledge around financial models for sustainable tourism and the construction of the required infrastructure.

On the policy level, urban development in Myanmar suffers from conflicting planning activities and low capacity in implementing development plans. Concerning specific infrastructure, waste management poses a considerable challenge. Recommendations include:

- Plans for urban development should be aligned at both local and national levels. For that purpose, capacity for urban planning needs to be strengthened in city governments and stakeholders should convene to coordinate development plans.
- Promote city-level analysis of infrastructure needs and build knowledge on sustainable infrastructure, public transport, district cooling and waste management as solutions to address these needs. Develop a financing roadmap for infrastructure in urban areas which includes strengthening tax collection systems, creating an enabling environment for the private sector, and introduce innovative finance solutions for sustainable infrastructure projects.
- Pilot an urban "green zone district" demonstrating sustainable infrastructure and planning concepts as well as energy efficiency measures, and advocate for wider adoption of successful practices.

Delivering green growth in Myanmar will require significant capacity building as well as coordination throughout the government and wider community. Therefore, education and public administration are regarded as critical enablers for progress. Recommendations include:

- Align green growth objectives with national development goals through a national green growth policy. Develop best practices for investing local revenues in assets allowing for sustainable economic growth.
- Develop material on topics relevant for green growth for inclusion in general education curricula, promote vocational training programmes for skills and professions needed to deliver sustainable economic growth, and develop green growth-specific modules for the new Civil Service Academy launched in 2017.

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List of Abbreviations

ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
ALARM	Advancing Life and Regenerating Motherland
ASEAN	Association of Southeast Asian Nations
BANCA	Biodiversity and Nature Conservation Association
BNI	Burma News International
BRG	Badan Restorasi Gambut
CDEC	Comprehensive Development Education Centre
CPF	GGGI's country planning framework
CPI	Corruption Perception Index
DoM	Department of Mines
ECCDI	Ecosystem Conservation and Community Development Initiative
ECD	Environmental Conservation Department
ECODEV	Ecologically Progressive Ecosystem Development
EITI	Extractive Industries Transparency Initiative
EMP	environmental management plans
EU	European Union
FLEGT	Forest Law Enforcement, Governance and Trade
FREDA	Forest Resources Environment Development and Conservation Association
GDP	gross domestic product
GEGG	Green Economy Green Growth
GGGI	Global Green Growth Institute
GGKP	Green Growth Knowledge Platform
GGPA	Green Growth Potential Assessment
GHG	Greenhouse gas
GII	Gender Inequality Index
GIS	Geographic Information System
GNI	gross national income
GoC	Greening of Cities
GoM	Government of Myanmar
gW	gigawatt
IEA	International Energy Agency

IFC	International Finance Corporation
IGC	International Growth Centre
IGES	Institute for Global Environment Strategy
IMF	International Monetary Fund
INDCs	Intended Nationally Determined Contributions
IRD	Internal Revenue Department
IRENA	International Renewable Energy Agency
JICA	Japanese International Cooperation Agency
KOICA	Korea International Cooperation Agency
kW	kilowatt
kWh	kilowatt hour
Lao PDR	Lao People's Democratic Republic
LMIC	Lower Middle Income Countries
MCCA	Myanmar Climate Change Alliance
MCRB	Myanmar Centre for Responsible Business
MDI	Myanmar Development Institute
MDRI	Myanmar Development and Research Institute
MEI	Myanmar Environment Institute
MEITI	Myanmar Extractive Industries Transparency Initiative
MES	Myanmar Engineers Society
MGE	Myanmar Gems Enterprise
MGEF	Myanmar Green Economy Framework
MGMA	Myanmar Garment Manufacturers Association
MJ	megajoules
MOALI	Ministry of Agriculture, Livestock and Irrigation
MoC	Ministry of Construction
MOECAF	Ministry of Environmental Conservation and Forestry
MoEE	Ministry of Electricity and Energy
MONREC	Ministry for Natural Resources and Environmental Conservation
MOU	Memorandum of Understanding
mW	megawatt
NCDP	National Comprehensive Development Plan
ND-Gain	Notre Dame Global Adaptation Initiative
NEMC	National Energy Management Committee
NEMP	National Electricity Master Plan

NEP	National Electrification Plan
NGO	Non-governmental organization
NLD	National League for Democracy
OECD	Organization for Economic Co-Operation and Development
PES	Costa Rica's payment for ecosystems services
PM	particulate matter
PPP	Public private partnerships
PV	Photovoltaic
REAM	Renewable Energy Association Myanmar
SBI	Sustainable Budget Index
SDGs	Sustainable Development Goals
SDKN	Sustainable Development Knowledge Network
SEA	Strategic Environmental Assessment
SMART	SMEs for Environmental Accountability, Responsibility and Transparency
SMEs	Small and Medium sized Enterprises
SOE	State-owned enterprises
TFC	Total Final Consumption
TOU	Time-of-Use
TPES	Total Primary Energy Supply
tWh	terawatt hour
UN	United Nations
UNEP	United Nations Environment Programme
WB	World Bank
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

Acknowledgements

1 Introduction to Green Growth Performance Assessment

1.1   The Global Green Growth Institute (GGGI) in Myanmar

The Global Green Growth Institute (GGGI) is a treaty-based international, inter-governmental organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies. Established in 2012, at the Rio+20 United Nations Conference on Sustainable Development, GGGI is accelerating the transition toward a new model of economic growth – green growth – founded on principles of social inclusivity and environmental sustainability. In contrast to conventional development models that rely on the unsustainable depletion and destruction of natural resources, green growth is a coordinated advancement of economic growth, environmental sustainability, poverty reduction and social inclusion driven by the sustainable development and use of global resources.

GGGI and the Government of Myanmar recently signed a Memorandum of Understanding (MOU) confirming their commitments to collaborate in the development of national green growth strategies. The implementation of GGGI's Green Growth Performance Assessment (GGPA) represents a critical first step in GGGI's consultation with key national stakeholders for defining priority areas of engagement and will contribute to the elaboration of GGGI's country planning framework (CPF).

1.2   The Green Growth Potential Assessment

Green growth priorities and recommendations for Myanmar were identified using GGGI's Green Growth Potential Assessment (GGPA) tool. The GGPA is a diagnostic tool that combines data analysis with stakeholder consultation to identify areas where green growth offers the greatest potential for supporting a country's development (See 0). The methodology was developed by the Global Green Growth Institute for two purposes: First, to provide evidence-based policy advice to governments to determine in which sectors and areas green growth policies can have the greatest impact. Second, to help GGGI identify areas in which it will focus its work and establish projects and programs.

Figure 1.   Conceptual schematic of the GGPA process

Concept of the GGPA

Combination of data analysis and stakeholder consultation to identify green growth priorities

Data Analysis

- 33 indicators to examine a **country's performance in key green growth areas**
- Comparison to peer countries to **identify areas for improvements**
- Underperforming areas = **opportunities for high-impact interventions**

Stakeholder Consultation

- **Stakeholder consultation** to validate/revise data analysis
- **Consensus** on green growth priorities across government, private sector, civil society
- Ensures that GGPA results based on stakeholder priorities

- **Agreed green growth priorities** for further analysis

Source: Global Green Growth Institute

The GGPA process consists of three stages (as shown in Figure 2)**:**

1) preliminary assessment based on quantitative analysis;
2) validation of the preliminary assessment and consultation with stakeholders; and
3) sector analysis and the development of recommendations, laid out in this report.

This design aims to ensure that the assessment process is systematic, objective, and participatory.

Figure 2. Overview of the GGPA Process

[Phase 1] Preliminary Assessment

Desktop Research based on Indicators

33 indicators to identify areas of improvement
Detailed data analysis of identified areas

Green Growth Priority **Areas and Sectors**
(according to available data)

[Phase 2] Validation & Consultation

Stakeholder Consultation based on Survey

Delphi survey to identify and prioritize of areas and sectors of improvement

Participants: government ministries, private sector, academia, civil society

Priority Green Growth **Areas and Sectors**
(consensus)

[Phase 3] Sector Analysis & Recommendations

Expert Consultation

Identify causes and interventions for priority areas/sectors

Country Report

Comprehensive analysis of priorities, causes and recommendations

Recommendations on Green Growth Interventions

Source: Global Green Growth Institute

The GGPA engages stakeholders from government, academic institutions, the private sector and development partners to identify priority areas that offer the highest potential for green growth interventions and develop recommendations informed by national priorities. The rationale behind employing such an inclusive process is to build a country's green growth agenda through giving the government and other stakeholders the leading role in the process, in contrast to a tradition of externally imposed solutions. In Myanmar, green growth efforts are being led by the Ministry for Natural Resources and Environmental Conservation (MONREC), which is working closely with GGGI and other partners.

The GGPA is a diagnostic method to identify priorities for green growth and develop relevant recommendations. Throughout the assessment, a number of terms are used, referring to this standardized approach.

– Indicators: 33 indicators have been selected by GGGI for comparing a country's performance to selected peers on a range of green growth aspects. These indicators, covering the economic, environmental and social dimensions of green growth, are derived from a number of sources providing national data on a global level.
– Areas: Each indicator represents a topic relevant to green growth that includes more than the corresponding data point captured by an individual GGPA indicator. In the consultation workshop, votes for a specific indicator are interpreted as recognition that the related area is of high concern in a country. For example, votes for the indicator electricity losses are assumed to translate to a concern about the reliability of the energy system overall as a barrier to development and well-being.
– Sectors: Sectors represent the domestic economy within a country and identifying relevant sectors for individual priority areas help to target the final analysis.[1] Many areas are affected by more than one sector. Identifying the sectors most connected to individual areas can help to guide policies, projects and investments aiming at promoting green growth in a country.

1.2.1 Preliminary Assessment

The GGPA process starts with a quantitative assessment based on a set of indicators relevant for green growth. The GGPA draws on a set of 33 comparative indicators covering the economic, environmental and social dimensions of green growth to identify priority areas. These indicators are meant to identify areas of underperformance, which can be seen as opportunities for high-impact green growth interventions at modest costs. For that purpose, the performance of Myanmar in each of the indicators is compared with peer countries as well as Lower Middle Income Countries (LMIC) as per the World Bank classification.

The GGPA uses a set of indicators, presented in the form of country scorecards, to benchmark country performance. This serves as a starting point for identifying the priority areas for green growth, causes for low performance in these areas, and possible remedies. It is a "static" assessment based on historical data to investigate a country's current state. The indicators are grouped into four themes (themes and specific indicator scorecards are provided in Appendix A.4):[2]

- **Resource-Efficient Growth**: Increasing the efficiency of production and consumption activities
- **Eco-Friendly Growth**: Preserving and enhancing the quality and quantity of natural assets

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[1] For the purposes of this GGPA, the term *sector* is utilized as it is by the OECD to denote thematic areas that may have several ministries and/or entities involved with policy implementation.

[2] In order to measure green growth, the Green Growth Knowledge Platform (2016) proposed to look at indicators reflecting the following five dimensions: (1) natural assets (eco-friendliness); (2) resource efficiency; (3) (climate) risk and resilience; (4) economic growth and innovation; and (5) social inclusion. The GGPA is largely following this approach in its selected indicators. To the extent possible, indicators reflecting the dimension of economic growth and innovation have been included in other dimensions due to the limited availability of relevant data.

- **Climate Resilient Growth**: Mitigating the impacts from and adapting to climate change
- **Socially Inclusive Growth**: Ensuring that the green growth maximizes benefits for, and minimize costs to, the poor and the most vulnerable

Figure 3.   Conceptual Framework for GGPA Indicators
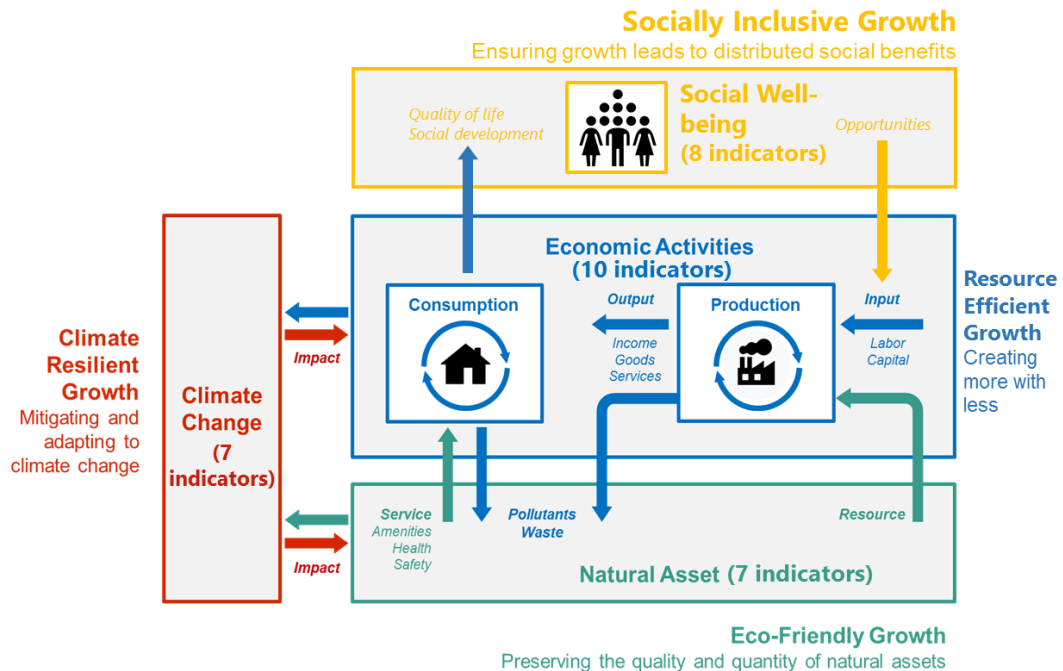
Source: Global Green Growth Institute

1.2.2   Validation and Consultation

An essential part of the GGPA is to gather input from a broad range of stakeholders through an interactive workshop. This workshop brings together stakeholders from stakeholders from government, academic institutions, the private sector and development partners. It serves to select priority areas for green growth, and to identify the relevant sectors related to each of the priority areas. For that purpose, a Delphi process is used to gather feedback and build consensus, via an electronic voting system which allows participants to anonymously identify and prioritize areas for green growth and corresponding sectors to manage interventions. Preliminary data analysis is shared with the workshop participants to validate and/or revise the initial findings and inform the discussion. The consultation process also serves to compensate for any lack of relevant data and ensures the alignment of GGPA results with existing policies.

1.2.3   Sector Assessments and Recommendations

Building on priorities identified in the consultation workshop, specific opportunities and barriers to green growth in are identified through a qualitative analysis. As part of this process, the linkages between priority areas and sectors are analysed. Furthermore, existing gaps and inconsistencies in a country's policy framework and the governance structure are identified. A crucial input to this analysis of challenges and opportunities is a series of expert interviews covering the identified priority areas and sectors. This approach helps to identify specific

interventions that could support green growth, including sectoral strategies, potential interventions as well as specific pilot projects. In the case of Myanmar, the recommendations are aligned with Myanmar's National Comprehensive Development Plan in order to achieve the country's goals as set out in the plan. The output of this analysis is given in Section 3 of this report.

The Green Growth Potential Assessment also serves as an input to GGGI's Country Planning Framework. Going forward, the successful conclusion of the GGPA represents a critical first step in GGGI's consultation with key national stakeholders for defining priority areas of engagement and will contribute to the elaboration of GGGI's Country Planning Framework (CPF). This follows GGGI's overarching philosophy to support countries all along the way from identifying relevant issues and setting the agenda to formulating policies and implementing them to the development of bankable projects and facilitating access to international finance, as show in Figure 4.

Figure 4.   The six steps in which GGGI supports national administrations

1. Issue Identification

2. Agenda Setting

3. Policy Formulation

4. Policy Implementation

5. Development of bankable projects

6. Facilitation of access to international finance
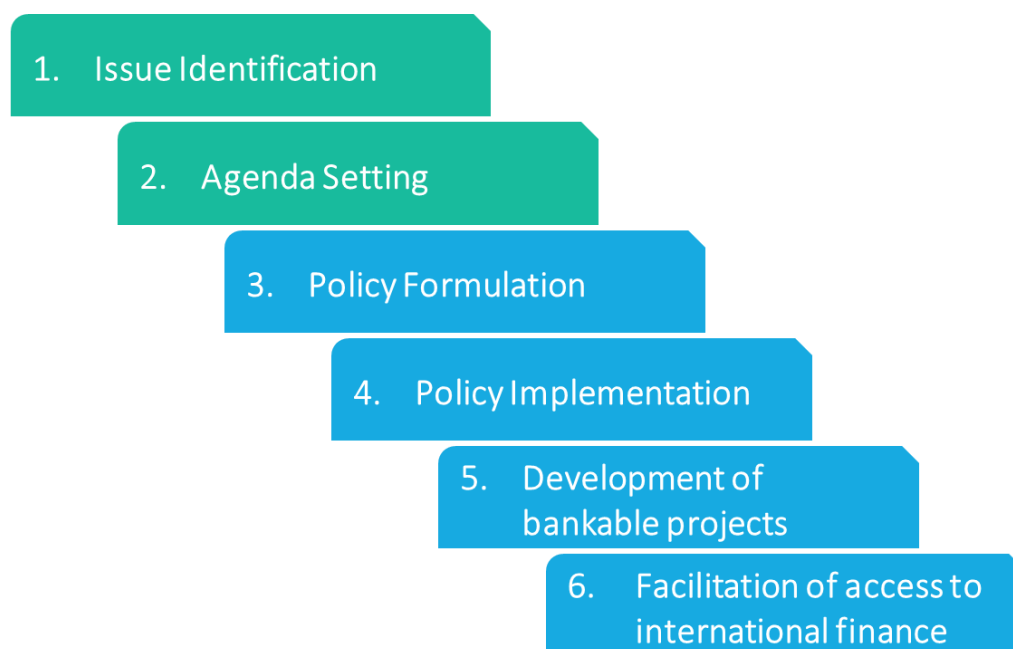
Source: Global Green Growth Institute

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2 Myanmar's Green Growth Story

2.1   Country context

Myanmar is often described as undergoing a triple transition – to democracy, a market economy and peace. In that process the country is attempting to balance rapid economic growth with a commitment to sustainable development. Myanmar is one of the fastest growing economies in the world, with a GDP growing by than of 7% per year on average over the past five years and projected to continue for the coming five years (IMF 2017). This rapid increase in economic output is due to rising investment following Myanmar's transition to democracy. Future growth is expected to be driven mainly by rising manufacturing and construction output, and increasing demand for services. Much of the growth in the recent past has been linked to investment in the country's energy, mining, agriculture and forestry sectors targeting the development of the country's non-renewable resources. As investment and development intensify, so too do the challenges and opportunities for ensuring environmental protection, the sustainable development of natural resources and social license to operate in some of the sectors. So, while a transition towards peace and democracy have enabled rapid economic growth, this is placing pressure on the environment. This, in turn, threatens peace and democratic legitimacy, given the importance of agriculture to the majority of households' income and increased expectations on the fair distribution of natural resource wealth.

Myanmar is bestowed with a large wealth in the form of natural resource and the government has committed to inclusive and sustainable development, including protection of the country's natural assets. Myanmar's ambitious economic development plans strive to balance the preservation of its natural assets as it works to foster economic growth and alleviate poverty throughout the country, especially in agriculturally-oriented communities in rural areas. This approach is in line with the Sustainable Development Goals set by the international community, which aim to improve the welfare of the current generation without exploiting the needs of future populations.

Myanmar has an opportunity to leapfrog traditional development hurdles. This has been particularly demonstrated by the country's telecommunications sector, and offers a model example for how change can occur when innovative thinking, modern technology and investment into infrastructure come together. A market with 7% internet access in 2011 is enjoying 90% internet access in 2017, with 65% of users utilising data, not just basic communications, only 3 years after new carrier entry. Yet, a host of challenges related to poverty remain, including lack of education, capacity of public institutions and infrastructure. These challenges confront the 2015 elected National League for Democracy government after many years of military rule and a period of dramatic transition and reform. Additionally, the country's enormous ethnic diversity is a cultural asset of great heritage, however, active conflict and lack of peace in ethnic states tempers optimism and presents constraints for progress across all sectors.

The sheer scope and extent of reform underway is both exhilarating and daunting. Youth policy development, education reform, agricultural reform, national energy planning, the decentralization of power and the peace process, are all among the new administration's highest priorities, with active policy programs currently ongoing. These overlay long-term priorities such as public financial management reform, economic development and employment.

The long list of challenges Myanmar is faced with creates the potential for leapfrogging in some areas, instead of merely following past development trajectories. As international momentum and available support on climate change and the sustainable development goals build more solutions to the country's development challenges become available.

2.1.1 Myanmar's Green Growth Performance

Myanmar's historical green growth performance is assessed relative to the average performance for lower middle income countries. As described in Section 0, the first stage of a GGPA is to conduct a data-driven assessment of green growth so as to provide a preliminary assessment of Myanmar's performance. This section includes comparisons for indicators of each of the green growth pathways presented in Figure 5, Figure 6, Figure 7 and Figure 9. These are resource efficient growth, eco-friendly growth, climate resilient growth, and socially inclusive growth. Details on all indicators, including a description of the indicator, are provided in Appendix A.4 GGPA performance indicators for Myanmar. Green growth indicators are placed in context of the broader literature in Box 2.

Box 2. Defining Green Growth

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. Through the green growth model, countries seek opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, and maintain healthy and productive ecosystems, as well as create green jobs, reduce poverty and enhance social inclusion.

Green growth balances economic growth, environmental sustainability and social inclusion. Several definitions and concepts of green growth exist from development entities, such as World Bank, OECD, and UNEP. Common to all of these definitions they identify three pillars of green growth, i.e. economic growth, environmental sustainability and social inclusion. GGGI's definition recognizes the importance of all three pillars without emphasizing one over the other.

The methodological framework and indicators for measuring green growth in the GGPA is in line with the theoretical work undertaken by other institutions in this area. In order to measure green growth, the Green Growth Knowledge Platform proposed to look at indicators reflecting the following five dimensions (GGKP 2013, GGKP 2016): natural assets (eco-friendliness), resource efficiency, (climate) risk and resilience, economic growth and innovation, and social inclusion. The GGPA is largely following this approach in its selected indicators. To the extent possible, indicators reflecting the dimension of economic growth and innovation have been included in other dimensions due to the limited availability of relevant data.

2.1.1.1 Resource Efficient Growth

Figure 5.   Resource Efficient Growth
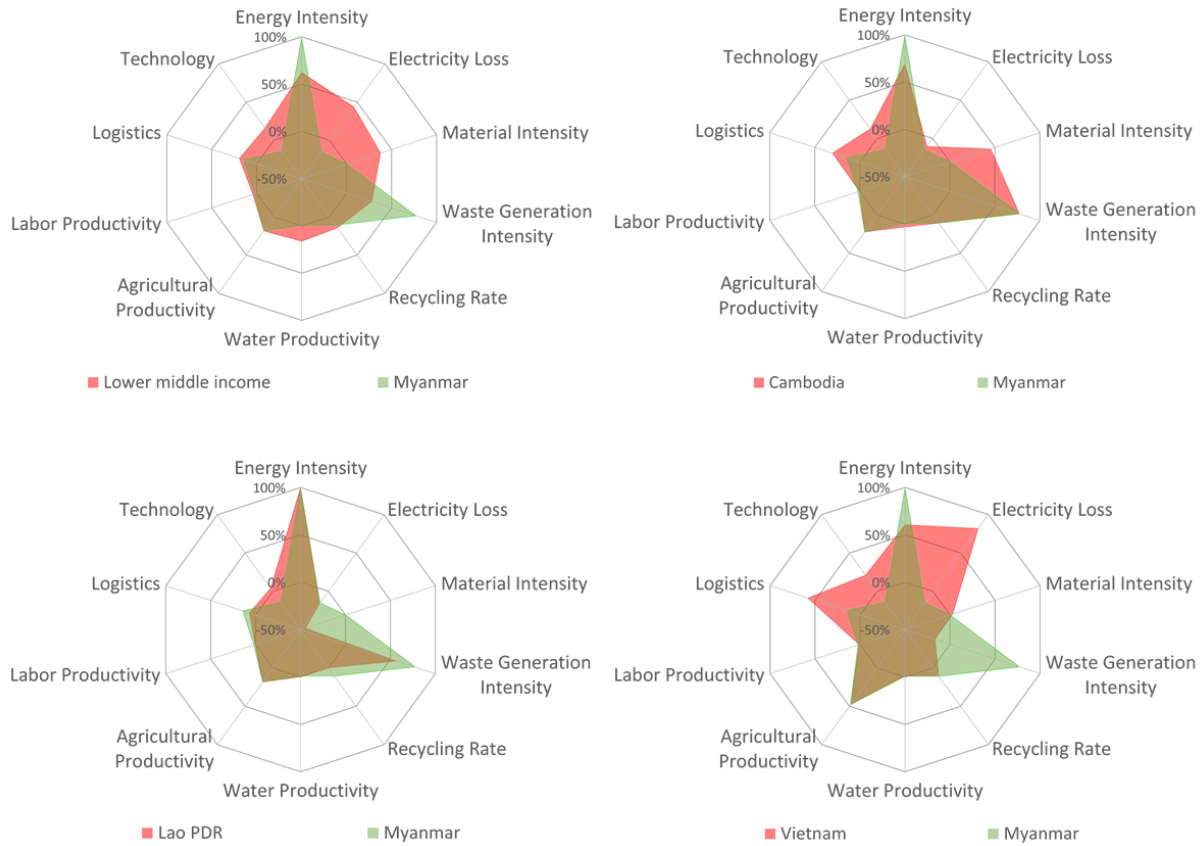
Note: *No comparable data available for agricultural productivity in Myanmar*

Source: *Global Green Growth Institute*

Table 1.   Summary of Country Comparisons for Resource Efficient Growth

	Indicators	LMIC	Cambodia	Lao PDR	Vietnam
Resource Efficient Growth	Electricity Loss	X		N/A	X
	Material Intensity	X	X		
	Water Productivity	X			
	Agricultural Productivity	N/A	N/A	N/A	N/A
	Technology	X	X	X	X

Compared to Lower Middle Income countries, Myanmar's scores are relatively low for the Resource Efficient growth dimension, with the exception of *Energy Intensity* and *Waste Generation Intensity*. On both of these scores, Myanmar performs significantly better than its peers. That is to say that Myanmar uses less energy and generates less waste per unit of GDP than peer countries. However, Myanmar's income is low relative to the lower middle income group, and energy and waste generation intensity tend to increase with higher incomes.

Agricultural productivity is measured as the value of agricultural production per total area of agricultural land. The relationship between agricultural productivity and rural wages is especially important in Myanmar, where over 70 per cent of the population lives in rural areas. No comparative data on agricultural income per km^2 is available for Myanmar, but a recent World Bank study finds that "agricultural productivity in Myanmar is low, irrespective of what indicators are used" (World Bank, 2016). Countries tend to increase productivity with irrigation, fertiliser or machinery, which can cause environmental stress and reduce rural jobs, so raising agricultural productivity can come with trade-offs if not carefully managed.

Technological readiness is measured by the World Economic Forum's Technological Readiness Index, which ranges from 0 to 7, with higher scores indicating more preparedness. The index includes aspects regarding the internet and mobile phone use as well as availability of the latest technologies. Myanmar has a relatively low level of technological readiness, but this is in line with its development stage.

Myanmar has a high level of electricity losses, currently close to 30%, three times the levels in peer countries. Electricity losses include both technical and non-technical losses. Technical losses refer to transmission and distribution losses. They are caused by physical characteristics of the grid and the electricity-generating system. The amount of losses is mainly dependent on the size of the country (length of power lines), voltage of transmission and distribution, and quality of network. Transmission and distribution losses comprise all losses due to transport and distribution of electrical energy, including losses in overhead transmission lines and distribution networks as well as losses in transformers which are not considered as integral parts of the power plants. Non-technical losses mainly refer to electricity theft. Low levels of electricity losses mean that a country's electricity distribution system is efficient, which supports economic growth.

2.1.1.2 Eco-Friendly Growth

Figure 6. Eco-Friendly Growth

Source: *Global Green Growth Institute*

Table 2. Summary of Country Comparisons for Eco-Friendly Growth

	Indicators	LMIC	Cambodia	Lao PDR	Vietnam
Climate Resilient Growth	Renewable Energy	X			
	Carbon Sink	X	X	X	X
	CC Exposure	X	X	X	X
	Adaptive Capacity	X			X

Myanmar performs well in several areas included in the Eco-Friendly growth dimension, namely indicators representing aspects such as *Fishing Pressure, Water Stress, Natural Resources Depletion* and *Endangered Species,* when compared against Lower Middle Income countries. However, the country scores significantly lower than its peers assessing the quality of natural

assets captured by measures such as *Air Quality, Soil Health, Water Quality* and *Change in Forest Cover*.

High rates of forest cover reduction mean that a country is unsustainably consuming its forests (for timber, land, fuel wood, etc.). Change in forest cover is measured as an annual percentage change in forest area. In Myanmar, the rate of forest cover change is uncertain, but appears to be accelerating.

2.1.1.3 Climate Resilient Growth

Figure 7. Climate Resilient Growth Comparator
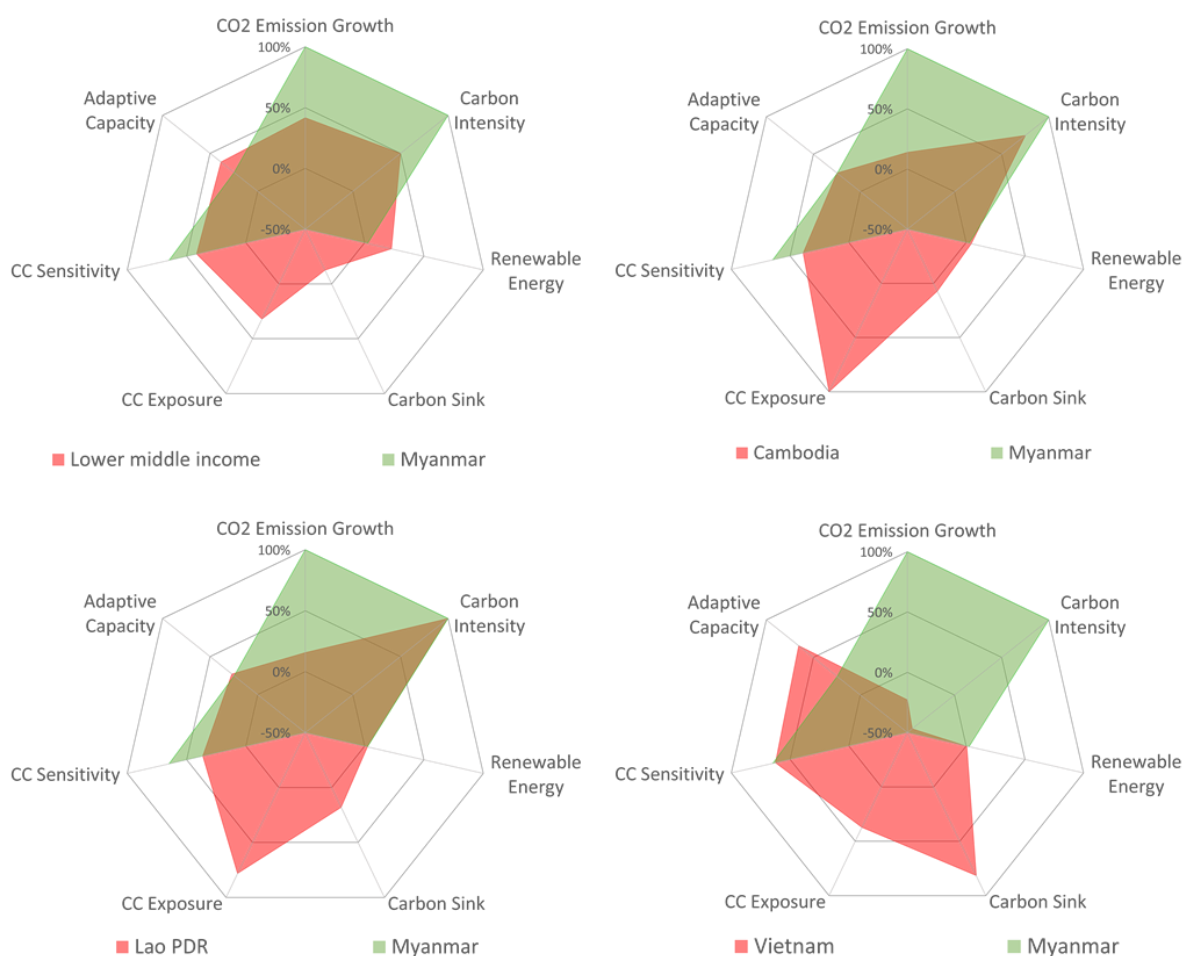
Source: Global Green Growth Institute

Table 3. Smarmy of Country Comparisons for Climate Resilient Growth

	Indicators	LMIC	Cambodia	Lao PDR	Vietnam
Climate Resilient Growth	Renewable Energy	X		N/A	
	Carbon Sink	X	X	X	X
	CC Exposure	X	X	X	X
	Adaptive Capacity	X			X

Regarding Climate Resilient Growth, Myanmar performs well on measures of *Carbon Intensity*, *CO$_2$ Emission Growth* and *Climate Change Sensitivity*. Myanmar is one of the countries in the world with the highest *Climate Change Exposure* scores and the country shows considerable losses of *Carbon Stock* in forests. *Adaptive Capacity* and *Renewable Energy* are also underperforming areas.

Climate change indicators are presented as a disaggregation of climate vulnerability. A country is *exposed* to climate change when it will be subject to major changes in extreme climate events and weather patterns. It is *sensitive* to this exposure when the economy relies on sectors where output depends on the climate, such as agriculture. A country also has *adaptive capacity*, which is its ability to reduce the impacts of climate change, despite its level of exposure and sensitivity. Exposure and sensitivity increase a country's overall vulnerability to climate change, while adaptive capacity reduces overall vulnerability.

Figure 8.   Climate change vulnerability exhibit
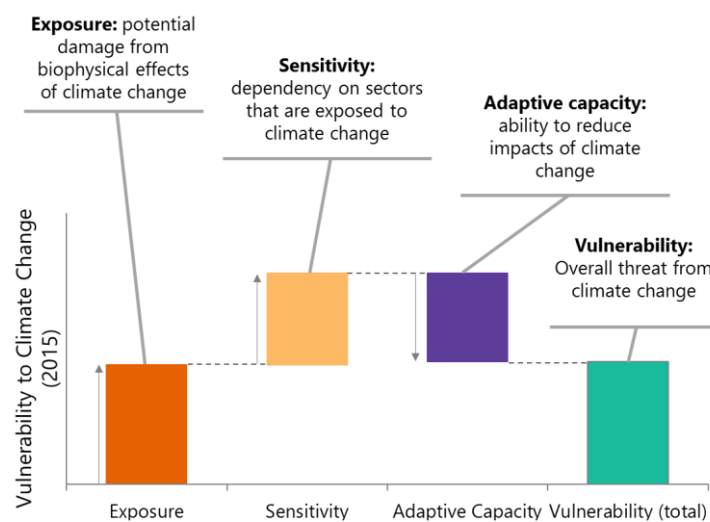
Note: *Adaptive capacity and climate sensitivity are measured independently and represent different values; however, in Myanmar, both effects are of similar magnitude (Climate Sensitivity index of 0.37 and Adaptive Capacity index of 0.36). In the case of Myanmar, sensitivity to climate impacts is largely balanced by adaptive capacity. Climate vulnerability is the residual value of climate exposure after accounting for sensitivity to impacts and adaptive capacity.*

Source: *Vivid Economics, based on data from ND-Gain and Germanwatch*

Myanmar is highly exposed to climate change. Myanmar is exposed to climate change, in particular because the intensity and frequency of extreme climate events is expected to increase. Myanmar also has an economy that is sensitive to climate change, although this has reduced in recent years as the economy has diversified somewhat from agriculture.

Renewable energy is defined in GGPA analysis as the share of electricity sourced from non-hydroelectric renewable sources.[3] Generating electricity from renewable sources provides access to energy for households and businesses with very low carbon emissions and other air pollution that is emitted by fossil fuel-based electricity generation. Energy supply in Myanmar is dominated by the use of biomass for cooking fuel, particularly in rural areas. The amount of electricity generated from non-hydro renewable sources is minimal.

2.1.1.4   Socially Inclusive Growth

Figure 9.   Socially Inclusive Growth
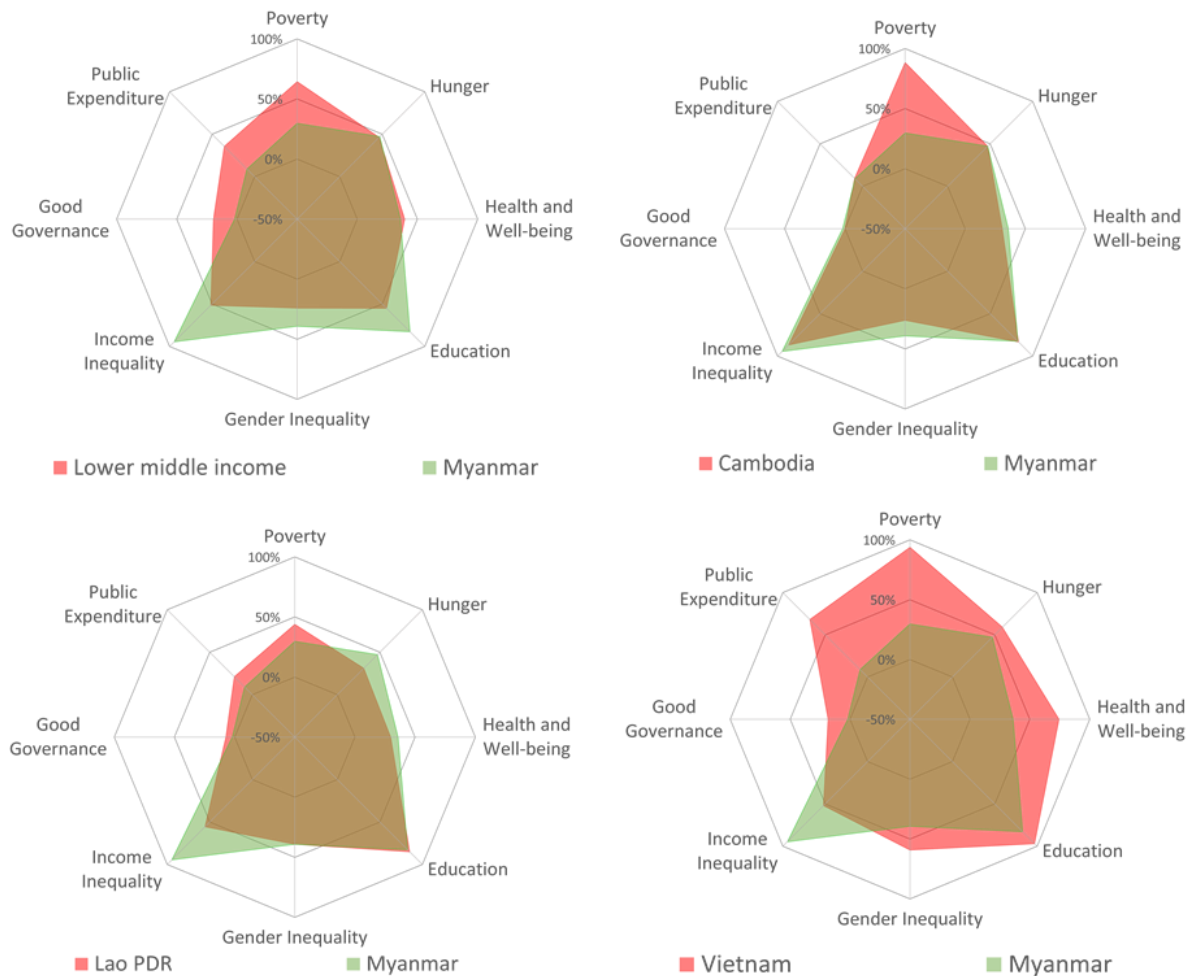
Source: Global Green Growth Institute

Measured on Socially Inclusive Growth indicators, Myanmar appears to outperform its peers in measures of *Education, Gender Inequality* and *Income Inequality*. The country scores lower than

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[3] Although hydroelectricity is a renewable source of energy, the construction of large scale hydroelectric facilities can have significant and unavoidable negative environmental and social impacts. The most important of which are generally related to the flooding of land in the impoundment zone upstream of a dam, and changes to water flows and water levels downstream of a dam. For instance, forced land acquisition and population displacement; changes in river regimens (which can affect fish, plants and wildlife); and flooding of land and wildlife habitats (through the creation of reservoirs). While the nature and severity of such impacts are highly site specific and tend to vary in scale according to the size and type of the project, due to its generally environmentally disruptive impact, large scale hydropower is counted separate from other renewable energy sources.

peers on *Corruption*, *Public Expenditure* and *Poverty*, and equivalent to Lower Middle Income countries on *Hunger*.

Poverty is a key constraint to human development. Poverty is represented by the Poverty Headcount Ratio, defined by the percentage of population living under $1.90 per day, in 2011 PPP terms. Myanmar's poverty headcount ratio is high relative to peer countries. Poverty tends to decline with economic growth, as long as the gains are distributed equally.

Income inequality is measured via the GINI index, which assesses how income is distributed across the population. A GINI index score of 0 represents perfect income equality, with a score of 100 representing full inequality. Myanmar is currently more equal than many other countries globally, with a GINI index of 29 relative to a global average of 38. However, maintaining income quality during economic growth can prove difficult and often requires a focus in policy.

High perceptions of corruption are problematic as they represent a lack of trust in the public administration and may indicate significant burdens for conducting business. Analysis on country-level corruption is based on the Corruption Perception Index, developed by Transparency International. Index scores range from 0 to 100, with higher scores indicating lower levels of perceived corruption. Myanmar has a high level of perceived corruption compared to its peers, but the country experienced significant improvements in this area, with its score having doubled over the past decade. Myanmar also receives low scores for other indicators of good governance such as the World Bank's Easy of Doing Business Index which measures regulatory environment for local firms.[4] In its latest iteration, the index ranks Myanmar 171st out of 190 countries (World Bank, 2017)

2.2   Stakeholder Consultation

As described in Section 1.2.2, the second stage of a GGPA is to hold a consultation workshop to validate the results of the preliminary assessment and to identify green growth priorities within Myanmar. The GGPA workshop was held in Naypitaw on 9 February 2017, with 57 participants and staff from institutions representing government ministries, government departments, the private sector, civil society and academia. The full list of invited participants is included in the Appendix A.1.

Out of 33 indicators representing relevant areas of green growth, participants were asked to select eight that they viewed as highest priority, over a total of three rounds of voting. Participants identified five priority areas for green growth in Myanmar. These are education, natural resource depletion, poverty, changes in forest cover, and agricultural productivity. The results of three rounds of voting are shown in Figure 10. The chart on the right-hand side provides the percent of votes in the final round of voting. The chart on the left-hand side illustrates the development of participants' preferences for each area across the three rounds.

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[4] The Ease of Doing Business Index includes quantitative indicators measuring regulation for starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts and resolving insolvency.

Areas receiving a high number of votes are considered priority areas for GGGI to focus on in the subsequent stages of the GGPA, as discussed further in Section 3.

Figure 10. Top 20 green growth areas, as ranked by votes from GGPA workshop participants
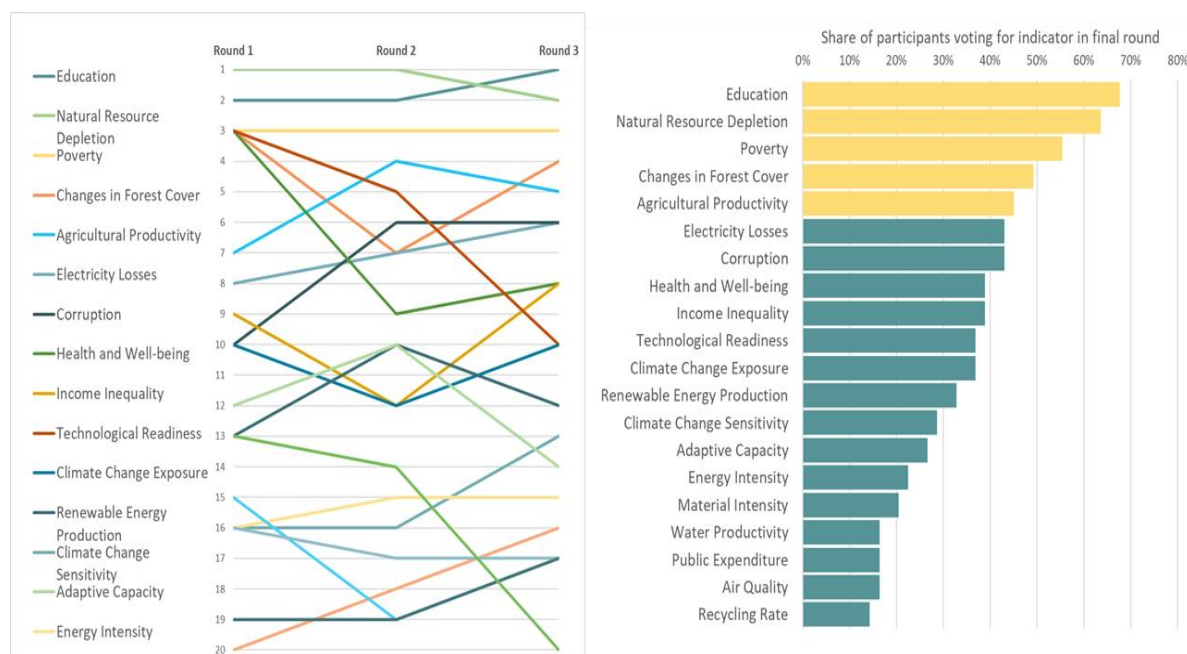
Note: Participants were asked to vote for their top eight choices, from a list of 33

Source: GGGI

Participants were also asked to priorities the sectors that would need to be engaged to implement green growth initiatives in order to address the priority areas. Votes were cast only for the top five areas, which do not include any of the three *Climate Change* indicators, or *Electricity Losses*, which was the 6th priority area.

Table 4. Sector priority votes, share of votes cast

Priority Area/Sector	Forestry and Land Use	Education	Agriculture and Fisheries	Public Administration	Energy and Mines	Commerce	Urban Development
Education	4%	**17%**	8%	**24%**	2%	9%	8%
Natural Resource Depletion	**27%**	5%	**12%**	5%	**25%**	3%	6%
Poverty	**28%**	3%	**13%**	**10%**	**15%**	4%	**16%**
Changes in Forest Cover	**21%**	3%	**13%**	**10%**	**15%**	4%	**16%**
Agricultural Productivity	**13%**	**10%**	**26%**	3%	0%	**11%**	3%

Note: The top five areas were presented for sectoral votes; sectors receiving at least 10 per cent of votes for an area are highlighted.

Source: GGGI

The results show that some sectors are considered important across multiple priority areas, suggesting a degree of interrelatedness between some sectors. Therefore, the detailed analysis concentrates (Section 3) on the sectors that appear most influential across green growth priority areas. Figure 11 maps sectors across the three dimensions related to green growth, i.e. natural capital, human capital and economic growth. The categorization of sectors across these three dimensions provided a basic framework for considering how different sectors impact green growth areas and where the best opportunities for reforms exist.

Given the presence of a substantial extractive resource sector in Myanmar, energy and mines were considered as two separate sectors in the final analysis. Energy includes the generation, transmission and distribution of energy to communities and businesses throughout Myanmar. Electricity in Myanmar is currently primarily generated from hydropower and natural gas (with minimal renewables, coal and oil use). Mining in Myanmar includes extraction of jade and other precious stones.

Figure 11. Venn diagram showing the mapping of relevant sectors into themes
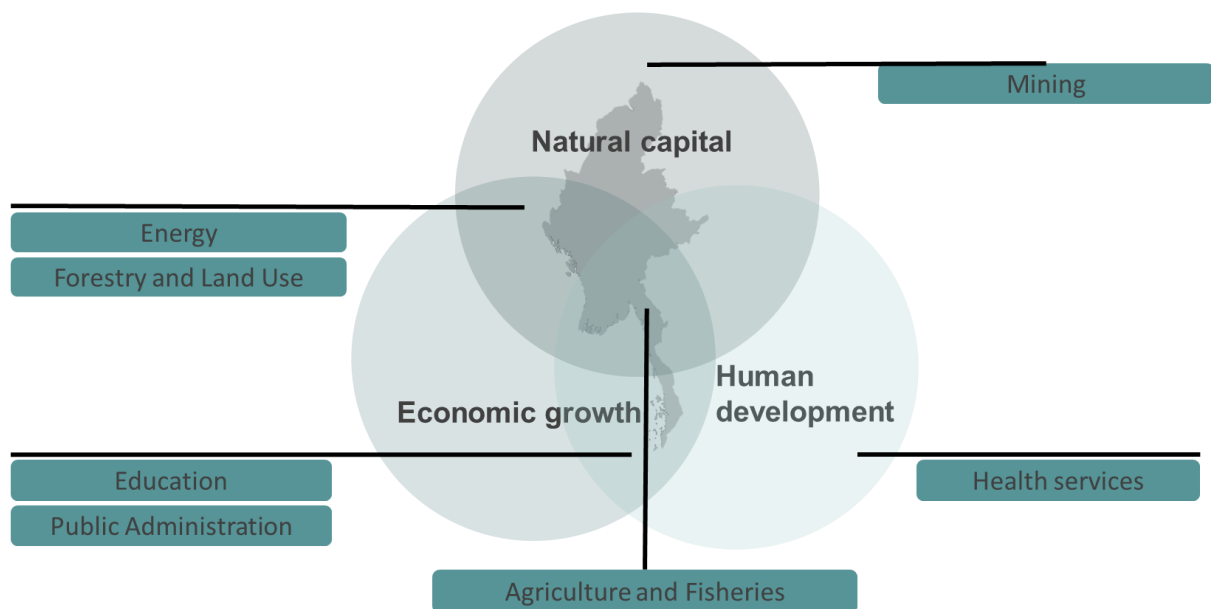
Figure 12 illustrates a way of assessing the *perceived* importance of sectors and their interconnectedness. It shows a network diagram where the nodes are the sectors and the lines show connections between sectors. The interconnectedness is quantified according to the number of votes the pair of sectors has in common across the top five areas. The figure shows all interconnections with more than 30 per cent of the maximum number of shared votes (i.e. the most interconnected pair of sectors). This demonstrates that agriculture and fisheries is the most interconnected sector, followed by public administration, education as well as forestry and land-use. It also shows that there are strong interconnections between agricultural and fisheries, forestry and land-use as well as energy and mines, and between public administration, education, commerce as well as agricultural and fisheries. These two constellations of interconnections suggest that many priority areas can be targeted via a small number of sectors, as long as the relationships between them are taken into account. The consequence of this is twofold. First,

interventions in one sector should consider the consequences on interconnected sectors, for example a solution to commercial issues may reside in public administration. Second, solving an issue in an interconnected sector may be cost-effective as it may solve problems in other sectors.

Figure 12. Interconnections between sectors, for all interconnections with more than 30 per cent of the maximum number of shared votes
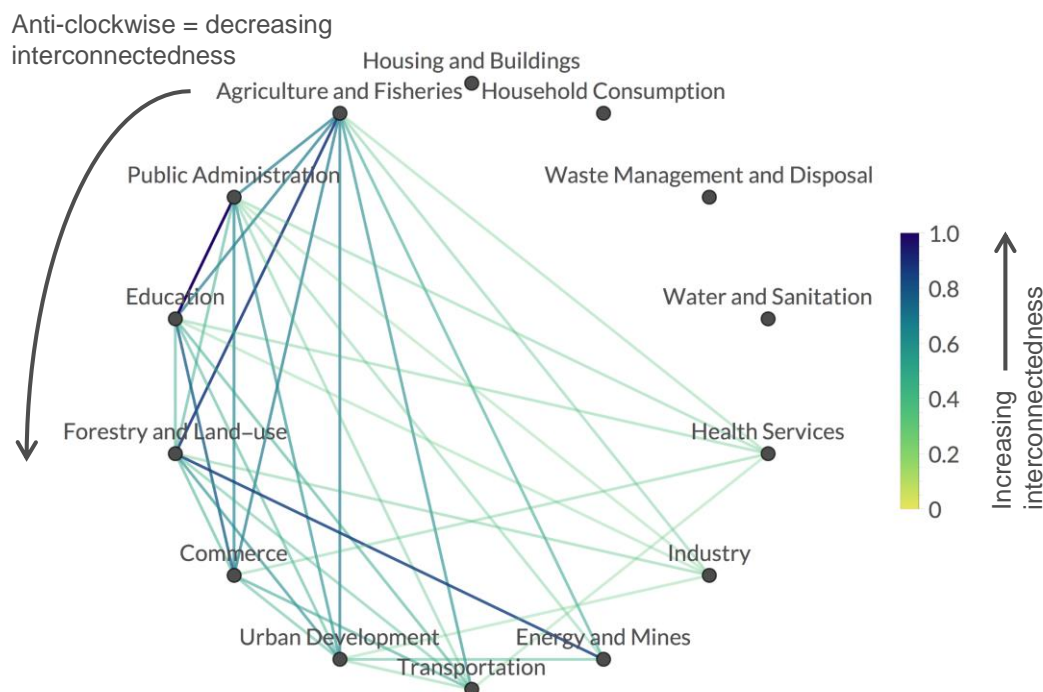
Source: Vivid Economics

Issues that span across these sectors are discussed in Section 3.6. These include opportunities to shape green growth in Myanmar, such as through education and building public capacity, as well as barriers to green growth, such as conflict and corruption.

Table 5.   Priority sectors and related green growth areas

Sector	Related Priority Areas	Interlinkages with other sectors
Forestry and Land-use	Natural Resource Depletion, Changes in Forest Cover, Agricultural Productivity	Energy and Mines, Agricultural Productivity
Education	Poverty, Education, Agricultural Productivity	Public Administration, Commerce
Agriculture and Fisheries	Agricultural Productivity, Natural Resources Depletion	Forestry and Land-use
Public Administration	Education, Poverty, *Health and Well-being*	Education
Energy and Mines	Natural Resource Depletion, Changes in Forest Cover, *Electricity Losses*	Forestry and Land-Use
Commerce	Poverty, Agricultural Productivity, Education	Education
Urban Development	Changes in Forest Cover, Education	
Transportation	Agricultural Productivity, Education	
Industry	Natural Resource Depletion	
Health Services	Education, Poverty	

Note: Italicized priority areas are additional to those identified by workshop participants, drawn from analysis of breakout group discussions
Source: GGGI

2.3   Green Growth Policies in Myanmar

Based on the selected priorities, the GGPA identified specific opportunities and barriers to green growth. For that purpose, relevant policies in each of the priority sectors were identified and interviews were held in Myanmar with sector experts.

Economic and development policies in Myanmar form an important context for the analysis and recommendations provided in this report. These policies provide a record of government activity around green growth to date and form important context for further interventions. Table 17 in Appendix A.5 sets out related policies for priority green growth sectors identified in Table 5.

Myanmar has developed cross-cutting as well as sectoral policies. Cross-cutting policies address national development goals and include the National Comprehensive Development Plan and the Myanmar Climate Change Strategy and Action Plan. Myanmar's National Comprehensive Development Plan sets out an overarching goal to transform the country into 'a developed nation integrated into the global economy' by 2030. The objectives of the NCDP are set in the context of *safeguarding the environment and resource base*.

Further policies are currently under development. These include the Green Economy Policy Framework and a National Urban and Regional Development Planning Law.

The policy landscape in Myanmar is developing rapidly. As explained in Section 2.1, Myanmar is undergoing multiple transitions, in particular the recent transition to democracy. As a consequence, reform is being undertaken across the functions of government. This has resulted in a large number of policies, which can often overlap and are not always consistent with each other. The key policies are explored in Section 3.

2.4   Expert Interviews

In-country interviews built upon workshop results to support the analysis and develop sector-based recommendations for green growth interventions. Following the GGPA workshop, interviews were carried out in Myanmar to understand the selected priority areas and the related sectors. Interviews focussed on identifying underlying causes for low performance in these areas, understanding actors and processes able to contribute to improvement in these areas, and developing potential interventions. This section lays out the interview programme. A set of standard interview questions which was used to guide interviews is included. Key findings from the interviews are integrated into the sector analysis and recommendations, presented in Section 3.

Interviews were structured around a standard framework. First, for each sector included in the interview program, **questions were posed to understand the *causes* of poor performance in priority areas related to green growth.** The relevant sectors and priority areas for each sector include those identified in Table 5.

Second, **questions aimed to identify specific *interventions* in each sector** that address the causes of poor performance for each priority area. These interventions could include investments and efforts to improve access to finance, capacity-building programs and policy mechanisms.

Other areas explored in each sector interview program include:

  –   Sector development goals, strengths and challenges

- Known green growth opportunities, especially where collaboration with other sectors is required
- Policies in place related to green growth and perceived effectiveness
- Threats to sustainable development from economic growth in and between sectors
- Pressure from climate change and strategies to adapt to climate threats
- Areas of interrelation between sectors

A list of all in-country experts interviewed for the GGPA can be found in Appendix A.3.

3 Analysis of green growth sectors and recommendations

This section provides context and recommendations for sectors identified as priorities for green growth in Myanmar. It draws on the results of the GGPA workshop, government policies in Myanmar, and sector expert interviews. The sectors are:

- Agriculture, forestry and other land use have been combined into one sector. Ecotourism is also included in this sector
- Energy has been separated from Energy and Mines
- Mines has been separated from Energy and Mines
- Industry, commerce and tourism have been combined into one sector, which includes pollution from industry and the management of natural resources affected by industrial pollution
- Urban development and infrastructure have been combined into one sector which includes transport
- Cross-cutting support areas have been formed from combined sectors Education and Public Administration

Each sector has a background section providing analysis on which the suggested interventions are based and a recommendations section. Recommendations are summarized in grey boxes.

Policy development in Myanmar is complex and fluid, and so recommendations are made for the sector, rather than linked to particular initiatives and documents. Myanmar has experienced a profusion of policies in recent years, and responsibilities have often shifted between ministries and personnel. As a result, it can be unclear which policy document is currently most relevant, or will be most relevant in the future. As the recommendations provided here focus on the underlying issues that policies seek to address, the recommendations are not linked to particular initiatives to emphasize that they retain their relevance even if individual policy and strategy documents change in the future.

3.1 Agriculture, Forestry and Other Land Use (AFOLU)

'Myanmar is a country relying on land, so if we don't use land well, we'll suffer'[5]

Land use in Myanmar is defined by the intersection of demands on land and environmental resources for 1) agricultural activities, 2) mining and extraction of non-renewable natural resources, 3) preservation of forests and the goods and services they support and 4) promotion of cultural heritage and eco-tourism markets. This section reviews the trends and pressures around agriculture and forestry activities. It provides recommendations for joint management

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[5] Quote from in-country interviews conducted by Spectrum and GGGI April and May 2017

that is compatible with green growth. Mining activities will be discussed separately in Section 3.3.

Myanmar's natural resource ministry (the Ministry of Natural Resources and Environmental Conservation (MONREC), including the Department of Forestry) and agriculture ministry (Ministry of Agriculture, Livestock and Irrigation (MOALI)) have primary oversight of issues related to green growth in the land use sector, while the Ministry of Hotels and Tourism oversees eco-tourism, which is also discussed in this section. Other important actors include the Myanmar Agricultural Development Bank, which was taken over by the Ministry of Planning and Finance in 2017, and the Myanmar Timber Enterprise, which operates under the oversight MONREC. Table 6 lists relevant national policies associated with agriculture, forestry and other forms of land use in Myanmar.

Table 6.   Key policies and ministries for the AFOLU sector in Myanmar

Policies	Ministries responsible
– National Environment Strategy Plan – National Agriculture Policy 2012 – Myanmar Forestry Policy 1995 – Agricultural Development Strategy 2016 – National Biodiversity Strategy and Action Plan 2016 – National Land Use Policy 2016 – Land Acquisition Act 1894 – Vacant Fallow, Virgin Lands Management Law 2012 – Farmland Law 2012 – Protected area ecotourism plans – Various individual plans and management plans developed – National Action Plan for Food and Nutrition Security (draft) – Conservation of Water Resources and Rivers Law 2006 – Rural Development Strategy for Poverty Reduction Concept Note (5th) draft – Seed Law 2012 – Pesticide Law 2016 – Fertilizer Law 2002 – Law Relating to Aquaculture 1989 – Freshwater Fisheries Law 1991 – Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law 1994 – New Generation of Plants (Seedling) Protection Law 2016 – Myanmar Ecotourism Policy and Management Strategy – Destination Management Plan for Inya Lake Region 2014-2019 – Cross-cutting strategies as presented in in Table 17	– Ministry of Agriculture, Livestock and Irrigation – Ministry of Natural Resources and Environmental Conservation (including Department of Forestry and Myanmar Timber Enterprise) – Ministry of Tourism (Eco-tourism) – Ministry of Planning and Finance (Myanmar Agricultural Development Bank) – National Land Committee – State and regional governments – Myanmar Climate Change Alliance

Source: Vivid Economics and Spectrum SDKN

3.1.1 Background

Myanmar has a large endowment of natural resource wealth, including environmental assets which support agriculture, timber and hydroelectric sectors and play an important role in the global ecosystem. Myanmar has declared a commitment in economic development plans to preserve its environmental assets as it works to alleviate poverty throughout the country, including in agriculturally-oriented communities in rural areas, which are home to 70 per cent of the population. In its high-level policy frameworks such as the 2012-2015 *Framework for Economic and Social Reforms* the government has expressed interest in balancing the reduction of rural poverty through increased agricultural productivity and protection of environmental resources including forest cover (Republic of the Union of Myanmar, 2012). These shared targets are in line with donor agendas, including the World Bank (Myint, Badiani-Magnusson, Woodhouse, & Zorya, 2016).

With high levels of rural poverty, Myanmar is seeking ways to raise incomes amongst rural populations. Agricultural productivity is measured as the value of agricultural production per total area of agricultural land. The relationship between agricultural productivity and rural wages is especially important given Myanmar's high rural population. No recent data on agricultural income per square kilometre is available for Myanmar, but a recent World Bank study finds that 'agricultural productivity in Myanmar is low, irrespective of what indicators are used' (World Bank, 2016). Strategies to increase levels of agricultural productivity can have significant environmental impacts.

Increasing Myanmar's agricultural productivity from its current low level highlights the country's challenge to balance economic development with the protection of environmental resources. Efforts to increasing rural incomes can follow one, or a combination, of three paths:

1. Increase income from agricultural activities by improving productivity of current activities,

2. Increase the quantity and diversity of agricultural activities, or

3. Shift the population away from agricultural activities to alternative sources of income.

The extent to which each of these is pursued has important implications for natural resources and the loss of forest area to agriculture. For example, increasing income from land currently used for agriculture through the use of fertilisers, irrigation systems and/or fossil-fuelled farming machinery can create significant costs in related to water use, greenhouse gas emissions and rural jobs being replaced. In the absence of substantial gains in agricultural development, rural farmers are likely to seek additional land for farming and may convert forested land (in both protected areas and unmanaged forested areas) to agricultural area (Chomitz, Buys, De Luca, Thomas, & Wertz-Kanounnikoff, 2007).

Forests

Myanmar has significant forest resources, which have been threatened by illegal logging and land use changes. Data on forest cover is unreliable and forest cover loss is a politically sensitive topic. However, as discussed in Section 2, Myanmar leads the region in forest cover, but has experienced steady decreases related to mining, conflict and agricultural development. While 63 per cent of land cover in Myanmar was forested in 2014, only 38 per cent has canopy cover greater than 80 per cent, the threshold to be considered intact. Although data is uncertain,

credible sources suggest the he share of land covered by intact forests has decreased by nearly 1 per cent per year from 2002 to 2014 (Bhagwat et al., 2017).

Interviews with forestry sector stakeholders identified a need for long-term targets to raise finance, develop skills and inform policies for the protection of forest assets in Myanmar. Civil servants and sector experts cited the lack of a long-term strategy for forest management as a barrier to international finance and inter-governmental cooperation for forest projects. [6] Government officials estimate $600 million is needed to support a reforestation plan throughout the country. Green growth-compatible initiatives such as community foresting and ecotourism have not yet reached an effective level of support within government or from the donor community due to a lack of strategic direction for the sector.

Myanmar has institutions in place for protecting forest resources, but regulations are not enforced systematically. The 1995 *Myanmar Forest Policy* aims to preserve 30 per cent of total land as Permanent Forest Estate[7], but there appears to be little organized support to implement this policy (Htun, 2009). Exports of round logs have been banned since 2014 and in 2016 the new government instituted a one-year national logging ban and a 10-year logging ban for the Pegu Yoma region. These actions follow the exposure of illegal flows of nearly 1 million cubic meters of logs a year from Kachin State to China, accompanied by systematic evidence of overlogging (Environmental Investigation Agency, 2015). Myanmar is a preferred supply source for illegal exporters due to its high-value teak and rosewood forests, the strict enforcement of forest laws in surrounding countries and its extensive land border with China, the largest recipient of illegally logged timber in the world.

Capacity for enforcing forest laws is outmatched by the size and complexity of Myanmar's timber industry. The Department of Forestry is charged with enforcing all of Myanmar's forest policies and laws, but interviews indicate that its workforce of 8,000 is not sufficient for enforcing concessions over the country's 40 million hectares of forest. [8] The department's commercial counterpart, the Myanmar Timber Enterprise, is responsible for generating income from forest resources, but relies on subcontractors to carry out the physical logging of forest concessions, with limited oversight of their compliance with quotas and rules. Regional civil conflicts, especially in the northern provinces, prevent safe enforcement of forest rules, opening up forest resources in the area to even greater exploitation, and revenues from illegal logging activities have played a significant role in financing violence in these areas (Environmental Investigation Agency, 2015).

International experience can provide evidence for reforms for conserving forest resources in Myanmar. Costa Rica's payment for ecosystems services (PES) scheme represents one option for creating value from forest resources other than through deforestation, by providing cash or in-kind compensation to users that would otherwise convert forest area to agricultural land. This type of intervention is credited with increasing the country's forested land cover from 20 per cent in the 1980s to over 50 per cent today by protecting 1 million acres through payments to would-be users (Porras, Barton, Miranda, & Chacón-Cascante, 2013). Criticisms of PES

[6] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[7] Myanmar's 1992 Forest Law set up a Permanent Forest Estate covering 31% of the country's total land area, which includes reserved forests (18% of total land area), protested areas (7% of total land area) and protected public forests (6% of total land area). Forestry activities and use in these areas are regulated by MONREC. The Minister of Forestry can expand areas in the 'public protected forest' classification for the purpose of 'conservation for sustainable production' (Htun, 2009).

[8] In-country interviews conducted by Spectrum and GGGI in April and May 2017

approaches include the risk of deforestation leakage, which occurs in areas lacking an effective high level of sustainable forest resource management policy and entails users converting a neighbouring forest area outside of the PES coverage for agriculture or other use, eliminating the benefits from conserving protected areas (Fripp, 2014). Leakage can be reduced by policies which extend PES schemes over larger areas, including national land use emission agreements, such as Peru's Joint Declaration with Norway and Germany. Peru's Joint Declaration includes a commitment to achieve net zero emissions from land use change and forestry by 2021 in return for $300 million of results-based payments (Government of Peru, 2017).

China and Vietnam were identified by interviewees as positive examples for engaging rural households in reforestation efforts. China's Green for Grain programme, the world's largest reforestation effort was launched in 1999 to combat deforestation and rural poverty. The scheme covered 124 million people and resulted in 8.2 million hectares of cropland being converted to forest (Liu & Wu, 2010). Vietnam assigned rural households one to three hectares of forest for local management, and has seen recovery in the national stock of forests to peak levels (Tatarski & Johnson, 2016). Interviewees point to Thailand's practice of reinvesting tourism revenue in forest conservation as a sustainable option for future protection of forest resources in Myanmar.[9]

In each example, the entire supply chains and alternative income sources have to be considered in designing effective policies. It is important to look at the entire supply chain, so that locally produced timber is not merely replaces by imports, leading to increased deforestation in other countries. Past experience shows that reforestation successes in some countries were made possible to a significant degree by increased imports of raw logs. For example, Vietnam successful domestic reforestation has been correlated with a proportionate expansion of licit and illicit timber imports from neighboring Laos and Cambodia that continue to feed the country's furniture production industry (Barney & Canby, 2011) (Environmental Investigation Agency, 2011) (Russell et al., 2013) (Robichaud, Sinclair, Lanquaye & Klinkenberg, 2009).

Improving energy access amongst rural populations can relieve pressure on forest resources. Years of uncontrolled logging and gathering of wood for indoor cook stoves have contributed to forest depletion in Myanmar. Sustainable energy sources deployed for greater rural electrification can deliver improved local management of forest areas.

Agriculture

Agriculture is a significant economic activity in Myanmar, representing over a third of GDP. Agriculture also accounts for a large share of exports (up to 30 per cent) and labor (70 per cent), indicating a large opportunity area for economic development.[10] Due to its scale in the national economy, agricultural policies have a large impact on green growth. The 2016 Agricultural Development Strategy includes goals to increase water efficiency by 40% in five years, land productivity by 50% and labour productivity by 50%.

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[9] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[10] http://www.fao.org/myanmar/fao-in-myanmar/myanmar/en/

Rice production dominates agricultural activity in Myanmar and features prominently in export goals. In 2011, rice production accounted for 32 million metric tons, or 64 per cent of the total agricultural output in the country (JICA, 2013). Myanmar currently exports 1.3 million tons of rice annually, with goals to reach exports of 4 million tons by 2020 (The World Bank, 2014).

Myanmar's rice market faces systemic challenges, but these may provide opportunities to transition farmers to more climate-resilient, less water-intensive crops. Constraints in Myanmar's rice output include low productivity of rice paddies, insufficient seed supply and inefficient use of nitrogen fertilizers (Myint et al., 2016). Rice requires high levels of water and fertilizer inputs, which create pressures on resources in rural areas through high demand for water in water-scarce areas and the production of nutrient runoff and emissions from fertilizer use, which are linked to poor water quality and climate change, respectively. Alternatives to rice include beans and pulses, which are grown in the Central Dry Zones in summer and sell for higher profits than rice.

Crop diversification can be pursued in tandem with increasing the productivity of rice paddies. Given the central role of rice in rural diets, farmers are unlikely to adopt more profitable crops until they can be sure of producing enough rice to feed their families (The World Bank, 2014). Subsistence remains a key focus of farming activities in Myanmar, where most farming is done on small family farms (average small farm size 5 acres).

Climate change has already impacted the region and is projected to cause significant physical and economic damages in the coming decades. Observed changes in the region include a significant increase in the incidence of extreme weather events, increase in average temperatures and sea levels, and a decrease in rainfall levels. These trends are expected to continue and become more pronounced Mean temperatures in the region are expected to increase by 4.8 degrees Celsius on 1990 levels by the end of the current century and sea levels are projected to rise 70 cm over the same period (Asian Development Bank, 2009). These impacts have traditionally been modelled to cost the region up to 6.3 per cent of future annual GDP, but state-of-the-art modelling adjusted to reflect a non-linear relationship between economic costs and steep changes in temperature suggest that economic costs of climate change in Southeast Asia could be as high as 50 per cent of per capita GDP by 2050 (Burke, Hsiang, & Miguel, 2015).

Agricultural land and rural communities in Myanmar are vulnerable to impacts from climate change. Myanmar is exposed to significant impacts from climate change, particularly in its Central Dry Zone, which is primarily used for agriculture (Horton et al., 2017). Extreme weather events in Myanmar will continue to exert a heavy toll on human livelihoods, particularly in the country's rural areas. The country witnessed an average 14 deaths per 100,000 inhabitants in a study of hazards from 1994 to 2013, the highest hazard death rate in the world (Sönke, Eckstein, Dorsch, & Fischer, 2015). In 2015, floods stemming from Cyclone Komen affected 1.4 million acres of farmland, in addition to destroying 21,000 homes and causing over 100 deaths. In the Central Dry Zone, drought conditions have reduced agricultural output. Climate change is expected to reduce the average productivity of current agricultural crops, lead to more frequent sudden destructions of cultivations by severe hazards and droughts and erode soils over the long-term. Rice paddy production is projected to decline by up to 50% of 1990 levels and woodland areas may be replaced by tropical savanna and shrub land cover by the end of the century (Asian Development Bank, 2009).

Country-level analysis of climate impacts in Myanmar have been piloted, but further modelling including economic impacts of climate change is necessary to inform policy and investment decisions. Global climate models, such as those cited in the Intergovernmental Panel on Climate Change reports, generate high-level projections for Southeast Asia which can inform country-level impacts, including assessments of physical and economic damages to be expected from climate change. Technical support for climate modelling was included in the program of work delivered by the Myanmar Climate Change Alliance. However, detailed analysis of climate impacts and their potential economic consequences has yet to be developed. As discussed in recommendations for cross cutting support sectors in this report, further work on climate modelling could include improving the understanding of economic impacts from climate change at a sector level.

Agricultural strategies for adapting to climate change include *climate smart agriculture* interventions such as changing crop mix, introducing new cultivation technologies and accessing new markets. Myanmar's current reliance on low-quality rice production requires high levels of water and fertilizer for limited returns. Shifting to higher quality, less water-intensive crops can help rural farmers in Myanmar adapt to impacts from climate change while increasing their incomes. Adapting technologies for better management of agricultural inputs, such as drip irrigation systems being piloted by the Japanese International Cooperation Agency (JICA) in Myanmar's Central Dry Zone, can also improve adaptive capacity and agricultural output together. Reducing pesticide use and adopting organic farming standards allow farmers to produce sustainable agricultural products, which can be sold to ecotourism markets and hotels catering to environmentally-oriented tourists.[11]

Ecotourism

In addition to agriculture, land use related to tourism can impact forest resources and must be managed to deliver economic benefits while preserving Myanmar's environmental assets. Mass tourism around cities and heritage sites can bring environmental damages that threaten sustainable development. Strategies to minimize the environmental impacts of mass tourism are discussed in the Industry, Commerce and Tourism sector of this report. Ecotourism relates to tourism-related activities around protected ecosystems and is included in the discussion of activities that primarily affect forest resources in this section. Stakeholders in Myanmar regard ecotourism as an important opportunity in the country, pointing to Thailand's model of funding forest conservation through income from national park entry fees.[12]

Ecotourism offers an opportunity to sustainably monetize ecosystem services provided by Myanmar's forest areas without threatening biodiversity or carbon sequestration benefits. Ecotourism activities in Myanmar offer the following benefits (Government of the Republic of Myanmar, 2015):

- biodiversity and ecosystem conservation;
- education and learning related to management practices compatible with conservation of natural and cultural assets; and

[11]In-country interviews conducted by Spectrum and GGGI in April and May 2017

[12] In-country interviews conducted by Spectrum and GGGI in April and May 2017

– economic and social benefits to communities surrounding protected areas that 1) support reduced damage of natural assets and 2) engage them in collaborative approaches to managing protected areas.

The Myanmar ecotourism strategy identifies 21 ecotourism sites for development, around 10 protected areas. Together, protected areas near these sites received 170,000 international and 2.2 million domestic visitors in 2014, as shown in Table 7. Over half of the sites included in the strategy lack sufficient transportation infrastructure, which poses a barrier to realizing the economic and conservation benefits around these sites. The ecotourism strategy includes a program of work budgeted at $15 million between 2015 and 2020 to develop infrastructure to promote access to ecotourism sites. The Government of Myanmar's policy towards ecotourism includes a commitment to 'establish a diversity of quality ecotourism products and services' by 2020, implemented through an Ecotourism Partnerships Framework (Government of the Republic of Myanmar, 2015).

Table 7.   Visitors to protected areas near identified ecotourism sites in Myanmar, 2014

Protected area	Domestic visitors	International visitors
Alungdaw Kathapa	230,000	30
Chattin	160	0
Hkakaborazi	18	5
Hlawga	230,000	1,000
Hponkanrazi	150	<150
Hukuang Valley	0	0
Indawgyi	200,000	<50
Inlay	200,000	100,000
Kyiakhtiyo	1,000,000	30,000
Lampi	0	1,000
Lawkanandar	26,000	30,000
Meinmahla Kyun	9	20
Moeyungyi	7,000	300
Myaing Hay Wun	0	0
Natmataung	730	430
Panlaung and Pyadalin Cave	<100	<10
Phokyar	340	680
Popa Mountain	4,200	6,200
Shwesettaw	200,000	<10
Thamihla Kyun	0	0
Wetthikan	60,000	<10

Source: Government of the Republic of Myanmar (2015)

In order to deliver effective conservation, Myanmar's ecotourism products must be informed by market demand and reflect local capabilities. Guiding principles outlined in the national ecotourism strategy include standards to limit impacts of visits on protected areas, but market interest is also necessary for successful investment. Success factors from international experience include good transport links, demand amongst tourists for ecotourism products,

available accommodation and guiding skills amongst local residents.[13] The ecotourism strategy includes 10 sites as 'first priority' which should be developed considering these factors.

Implementing the national ecotourism strategy will require collaboration across ministries and levels of government. Ecotourism in Myanmar is administered by the Department of Forestry, with input from Myanmar Timber Enterprise and the Ministry of Planning and Statistics (Government of the Republic of Myanmar, 2015). The national strategy was developed with input from across government ministries, but interviewees flagged that cooperation on this topic is lacking.[14] Implementing the existing strategy and identifying other ways in which ecotourism can contribute to green growth (e.g. through reinvesting ecotourism income in enforcing protected areas) will require close collaboration across ministries and with local communities in and around protected areas. Furthering the peace process in conflicted areas is necessary for expansion of the ecotourism market to all regions of the country.

3.1.2   Recommendations

Sustainable management of environmental resources in Myanmar requires long-term targets to align finance, education and capacity-building in the AFOLU sector. Myanmar's goal to conserve 30 per cent of land cover in a forest estate provides a long-range end-point, but further strategic direction is required to develop programmes and policies to achieve this goal. Box 3 presents recommendations for how GGGI could support this. By identifying a comprehensive strategy to protect forest resources, the Government of Myanmar (GoM) will be well-placed to increase ambition from its 30 per cent goal in order to retain the maximum amount of forest cover in the country, and achieve gains from reforestation efforts in the Central Dry Zone and degraded forest areas.

[13] Interview with Professor David Harrison, ecotourism expert in London 3 August 2016

[14] In-country interviews conducted by Spectrum and GGGI in April and May 2017

Designing, implementing and enforcing effective land use policies requires cooperation across a wide range of policy areas. In-country interviews suggest that coordination between agriculture and forestry ministries is lacking.[15] Integrating these functions, along with tourism, at all levels of government is an important area in which GGGI can add value. Box 4 provides a recommendation on how this could be done. Opportunities to promote collaboration include establishing reporting requirements on national strategies that relate to all three ministries (such as a long-term land use strategy), cross-ministry working groups and collaboration processes around the annual budget-making process which require approval of multiple ministries for plans that impact interdisciplinary assets. Quasi-governmental and civil society organizations with responsibilities in the AFOLU sector should be included in consultative activities and policy development processes, as suggested in Box 5, with respect to traceability in logging activities. Education and training required in these areas is discussed in the recommendations section discussing cross-cutting support sectors.

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[15] In-country interviews conducted by Spectrum and GGGI in April and May 2017

– To reduce illegal logging, address economic incentives, lack of governance and lack of enforcement that enable the continued illegal trade in timber. Seek third-party assistance to develop the technical capacity of tracing timber, such as a Voluntary Partnership Agreement with the European Union's Forest Law Enforcement Governance and Trade framework.

Improving agricultural productivity is a priority for the GoM and development partners. Access to finance for machinery, high-quality seeds, and agricultural technologies can all drive advances in productivity for rural populations. The GoM and donors should be careful to reflect climate change impacts and social safeguards in initiatives and investment plans to foster rural development. GGGI can facilitate the dissemination of *climate smart agriculture* as a route to improving agricultural productivity.

Climate change and green growth goals necessitate reforms in Myanmar's agricultural sector. Traditional markets, dominated by rice production, are not compatible with sustainable land and water management, they are vulnerable to the adverse impacts of climate change, and offer limited potential for generating income when selling products on international markets. Reforms related to green growth in this sector include aligning the country's agricultural exports, production practices and technologies with sustainable agriculture management practices. Recommendations on these areas as presented in Box 6.

Box 6. Recommendations: Align agriculture policy and interventions with green growth objectives

– Promote diversification of agricultural production and export goals away from rice and towards climate resilient crops including hybrid seeds and organic horticulture.
– Disseminate lessons learned from existing climate-smart agriculture technology to local and regional governments and civil society.
– Promote inclusion of climate smart agriculture technology such as drip irrigation in the government's engagement plans with donors and international finance sources.
– Identify pathways for sustainable agricultural products to enter domestic markets, including ecotourism sites and the national hospitality industry.
– Educate farmers and agricultural extension service providers on sustainable farming compatible with organic produce labels.
– Reduce the use of pesticides and chemical fertilizers, including through education of alternative technologies and phased targets for eliminating chemical use from the agricultural sector.

Developing an ecotourism sector in Myanmar requires implementation of existing plans with consideration of the demand for tourism and the infrastructure required to support tourist activity. The national ecotourism strategy identifies two priority categories of sites for the development of infrastructure to improve access to these sites. Projects could be further categorised on a project-by-project basis to weigh 1) protection benefits for biodiversity assets identified in long-term land use strategy, 2) demand for tourism at the proposed site and 3) skills

and resources in existing area to support ecotourism traffic, including accommodation, transport and guides available. Recommendations are summarized in Box 7. Education and training programs needed to build the ecotourism sector are listed in the section on cross-cutting support sectors.

Box 7. Recommendations: Develop an ecotourism sector based on conservation needs and tourist demand

- At the project-level, prioritize proposed ecotourism sites, according to the biodiversity conservation benefits delivered from each site, demand from tourists and resources available to support ecotourism traffic.
- Imclude legal forest product markets in ecotourism management plans to provide sustainable income for residents of protected areas.
- Reinvest income from tourism activities dependent on protected areas into forest conservation and enforcement efforts.
- Conduct a case study on Thailand and other ASEAN countries to determine best practices on tourism-support forest conservation for application in Myanmar.

3.2 Energy

'Renewable energy is needed to feed our Green Economy'[16]

This section reviews the trends and pressures around energy and electricity supply in Myanmar and provides recommendations for expanding access to energy in a manner that is compatible with green growth. Recommendations focus primarily on expanding access to electricity and different electricity generation technologies are discussed. Energy efficiency is also discussed in this section, but recommendations related to energy demand and consumption are included in further detail in the Urban Development and Infrastructure section of this report.

Myanmar's energy policy is overseen by the Ministry of Electricity and Energy (MoEE) and in rural areas by the Ministry of Agriculture, Livestock and Irrigation (MOALI). At the time of this report, the Ministry of Construction also plays an influential role in energy policy and infrastructure investment. Other important actors include the Myanmar Electric Power Enterprise, which develops the national transmission network, the Electricity Supply Enterprise, which provides electricity to areas outside of Yangon and the Yangon Electricity Supply Corporation, which is responsible for power in Yangon. Government committees tasked with overseeing energy development in Myanmar include the National Energy Management Committee and the Energy Development Committee. Table 8 lists relevant national policies associated with the energy sector in Myanmar.

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[16] Quote from in-country interviews conducted by Spectrum and GGGI April and May 2017

Table 8.   Key policies and ministries for the energy sector in Myanmar

Policies	Ministries Responsible
– Petroleum Law 1937 – Electricity Law 2014 – Electricity Rules 2015 – Electricity Regulations (being drafted by ADB) – Grid Code 2017 (being drafted by MOEE) – National Electrification Plan 2014 (WB) – National Electricity Plan 2014 (JICA) – National Electricity Plan redraft 2017 (JICA) – Myanmar Electricity Vision 2015 (WWF) – National Energy Policy (NEMC) – National Energy Master Plan 2016 (ADB) (and 2017 update) – National Energy Efficiency and Conservation Policy	– Ministry of Agriculture, Livestock and Irrigation (Rural electrification) – Ministry of Electrical Power and Energy – Ministry of Construction – Ministry of Industry – National Energy Management Committee – State and regional governments

Source: Vivid Economics and Spectrum SDKN

3.2.1   Background

Myanmar's energy supply is dominated by biomass in terms of both primary energy supply and final consumption. Figure 13 offers a picture of the energy sector in Myanmar in 2015. Total Primary Energy Supply (TPES) is dominated by biofuels accounting for more than half of TPES, followed by domestically produced crude oil and imported petroleum products accounting for about a quarter, and natural gas (15%). Total Final Consumption (TFC) is similarly dominated by biofuels (57%) and oil products (31%). Electricity accounts for only 6 per cent of TFC, reflecting low electrification rates, particularly in rural areas. Electricity is generated primarily from hydro power and natural gas, with less than 1 per cent from solar or wind power. While Myanmar has significant natural gas reserves, about four fifth of the produced amounts are exported and only one firth being used domestically.

Figure 13. TPES, TFC and Electricity Mix, 2015
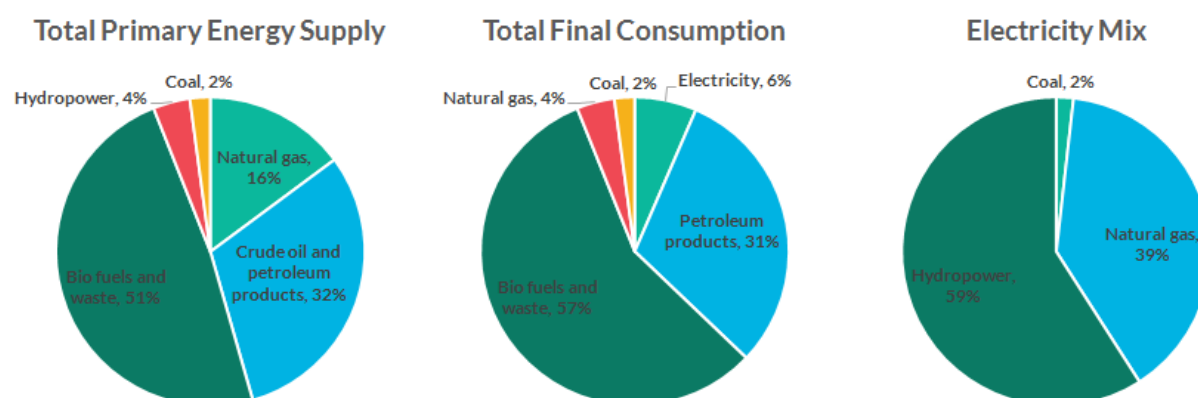
Source: IEA 2017

Most energy is consumed in homes, with residential consumption accounting for more than half of total final consumption (Figure 14). The vast majority (97 per cent) of residential sector energy is derived from biomass. Transport and industry also account for a significant share of energy consumption, at 20 and 15 per cent of final consumption, respectively.

Figure 14. Total final consumption by sector, 2015
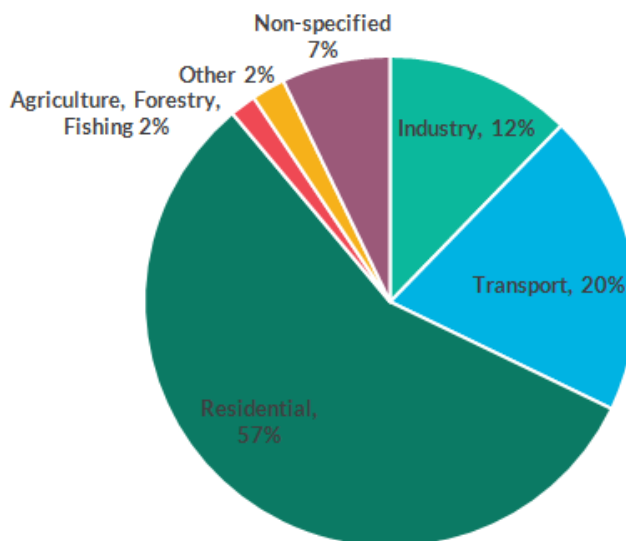
Source: IEA 2017

Access to electricity is essential for economic growth, and a major barrier in Myanmar. Measures of the share of population with access to electricity in Myanmar vary between sources, but 2013 estimates range from 32 per cent (18 per cent in rural areas)(Nam, Cham, & Halili, 2015) to 51 per cent (45 per cent in rural areas),(Myanmar National Energy Management Committee, 2014) placing the country at the bottom of electricity access distributions in Asia (Wang, 2016). Increasing access to electricity is at the top of energy sector priorities in Myanmar.

The government is currently debating 1) the right mix of electricity generation technologies (renewables vs fossil fuels vs hydroelectricity) and 2) which business models to pursue in the power sector (grid vs off-grid systems). The National Energy Policy and National Electrification Plan provide a road map for the sector. The Ministry of Energy and Electricity has also developed a National Electricity Master Plan, with the support of JICA, which is currently being extensively reworked. These are discussed below.

Myanmar's National Energy Policy advocates for a diverse energy mix delivering sustainable growth, efficient pricing and security of supply. Adopted by the National Energy Management Committee (NEMC), the policy sets out the principles of diversity, security and sustainability to guide development in the energy sector. Diversity is applied to energy sources, both in terms of fuel and providers. Security is prioritized by requiring multiple supply routes. Sustainability is introduced by committing to the principle of decoupling economic growth from *excessive*

increases in energy demand,[17] efficient management of infrastructure to reduce electricity losses and optimal pricing regimes that reflect costs and benefits over the long term (Myanmar National Energy Management Committee, 2014).

A National Electrification Plan (NEP) has been developed to address electricity access shortfalls in Myanmar. This plan charts a path to full grid integration for the country by 2030. The original NEP was developed by the World Bank in 2014 and JICA redrafted the plan in 2017. The NEP adopts a least-cost approach to deploying grid connections, prioritizing relatively easier connections covering 50 per cent of households by 2020, with two additional phases deploying an additional 25 per cent of grid coverage each through 2030. Off-grid renewable electricity technologies are treated as short term solutions for distant villages, until they can be connected to the national electricity grid (Dobermann, 2016).

The NEMC issued a National Electricity Master Plan (NEMP) in 2015, that projects energy demand and fuel mix to 2030 across sectors, with low expectations for renewable technologies; this plan is currently being revisited. Projections in the 2015 NEMP estimate that solar and wind energy will provide around 5 per cent of the national electricity supply in 2030 and that coal will increase from 1.6 per cent of the power sector in 2015 to 30 per cent by 2030. These forecasts assume renewables remain relatively expensive and that no carbon price is in place in 2030.[18] In August 2017, the Myanmar government announced the resignation of its MoEE Minister, turning over responsibility for the MoEE portfolio to the Minister for Construction. As a part of this leadership change, the NEMP is being reviewed and may include a revised view on the role of renewables in Myanmar's electricity system.

The electricity access challenge in Myanmar is recognized as a top priority in development plans. The government has adopted electricity access as a key priority and its National Electrification Plan calls for 100 per cent access to electricity supplied by the national grid by 2030, a goal that is widely known, but not universally accepted as desirable.[19] The World Bank is currently delivering an off-grid electricity project in rural areas, offering solar home systems and microgrid electricity systems in cooperation with the Ministry of Agriculture, Livestock and Irrigation (MOALI) that is complementary to NEP goals.

Electrification via a central grid

Grid expansion goals set out in the National Electricity Plan are likely to come with a steep price tag. High costs related to grid expansion stem from the infrastructure costs of extending electricity grid connections to distant communities over challenging terrain. The World Bank has

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[17] The document states: "Reducing energy intensity by means of energy efficiency and conservation measures so that excessive energy requirement is decoupled from GDP growth." Reducing energy intensity of GDP is notable given the low energy intensity per unit of GDP in the country at present. Limiting growth in energy intensity of GDP through energy efficiency and conservation measures is likely are more realistic goal.

[18] Assumptions applied in the electricity master plan for renewable energy costs assume capital costs of around $1800/kW in 2013 for both solar and wind generation technologies, with a cost reduction of 5 per cent every five years. In contrast, IRENA projects costs will fall as much as 12 per cent by 2025 for these technologies, and that with advances in operations and maintenance, the levelized costs of energy from renewable energy could fall twice as steeply for wind and as much as 57 per cent for solar. Recent cost data show that capital costs for wind in 2015 are lower than those included in the master plan at $1560/kW (Inernational Renewable Energy Agency, 2016).

[19] In-country interviews conducted by Spectrum and GGGI in April and May 2017. Arguments against grid extension mainly centered around the financial costs associated with extending the grid, particularly given Myanmar's topography, and the need for investment in large-scale power plants and their considerable environmental impacts.

calculated that Myanmar's current tariff structures, which are heavily subsidized, leave a funding gap of over $2 billion for grid expansion (Myanmar Department of Rural Development, 2016). Costs for grid infrastructure alone may be as high as $10 billion, with an additional $20 billion for increasing power generation capacity required by 2030 (Rieffel, 2016). Other projections estimated even higher amounts of investment required, with $28-45 billion of investment needs identified across different scenarios in the 2015 National Electricity Master Plan. Investments outlined in the current NEMP (under review as discussed above) include $11-17 billion in gas power plants alone by 2030 (Government of Myanmar, 2015a).

Planned expansion of the national electricity grid relies heavily on additional generation capacity based on fossil fuels. Under the current NEMP, new generation assets to fed into the national grid will include high emission thermoelectric plants which have long lifetimes. Projections included in the plan estimate that 30% of the electricity system will be sourced from coal by 2030, increasing emissions from electricity generation significantly.[20]

However, decarbonization of the electricity grid can help Myanmar align with a green growth development pathway. Urban areas especially are likely to remain dependent on grid-supplied electricity. While past policy documents have identified coal and hydroelectricity as main sources of electricity for future populations, Myanmar's solar and wind resources could meet demand for electricity in areas connected to the electricity grid. Where renewable energy capacity can be constructed near urban areas, it can avoid the transmission losses currently experienced from transmitting electricity for hydroelectric dams in the north to urban areas in the south.

A new report on the stability of Myanmar's electricity grid disproves objections that on-grid renewable electricity capacity would destabilise the national system. A study conducted by Tractebel and Delphos International for the U.S. Trade and Development Agency found that the existing electricity grid in Myanmar could support at least 19% of supply from on-grid renewable sources (Depierreux, Shumway, & Sparavier, 2017). This finding clears an important hurdle in reforming Myanmar's grid code policy, which currently is not compatible with renewable electricity generation technologies due to uncertainty around grid stability. The MoEE is currently revising the grid code as part of its review of the NEMP.

As the grid code is modernised, opportunities for design that is compatible with renewable technologies and smart grids (i.e. smart metering) offer potential for low carbon wins. Smart grid technologies allow the utility to track energy consumption and direct resources across the electricity system.

Smart grids would become of particular importance of the government were to move away from expensive large-scale fossil fuel based power plants to increasing the share of renewable energy in the electricity mix. Smart grids allow to better manage load, reducing curtailment and losses when higher amounts of variable renewable generation is added to the mix. Smart grids are important for connecting distributed, renewable energy to the grid at a future point and may be relevant in Myanmar's urban areas (Government of Myanmar, 2015a). The International Energy Agency recommends the deployment of smart grids in a developing country context given that they can enhance the operability of the power grid to connect to remote systems (Moreno & Bareisaite, 2015).

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[20] This assumes technologies such as carbon capture use and storage are not economically feasible by this point.

When modernizing and expanding the country's electricity grid, two essential obstacles have to be addressed, the high amount of electricity losses and the lack of a tariff system that allows maintaining the system and fund investment. **Myanmar has a high level of electricity losses, currently close to 30%, three times the levels in peer countries.** Electricity losses include both technical and non-technical losses. Technical losses refer to transmission and distribution losses. They are caused by physical, technical and institutional characteristics of the grid such as the length of power lines, voltage of transmission and distribution, load balancing capabilities and systems in place to manage the network. Grid expansion may increase these losses, especially in latter phases that cover greater distances. Therefore, while grid expansions to connect major consumer areas appear justified, connecting small and remote communities might be economically unsustainable. Non-technical losses appear to be linked to inefficient tariff structures throughout the grid according to the World Bank (World Bank Group, 2017a). Non-technical losses also include theft, but no detailed information or systematic analysis is available on the causes of non-technical losses throughout the country's system.

Technical electricity losses are a function of low levels of maintenance and investment in the electricity system by grid operators. In Myanmar, electricity tariffs are low, due to government subsidies (at 2.8 cents/kWh they are 20 per cent of the ASEAN average). Without subsidies, cost-reflective tariffs provide grid operators with capital to upgrade and maintain transmission infrastructure, keeping technical losses to a minimum. Current tariff levels represent a $200 million annual subsidy to electricity prices (Vagliasindi, 2013). GoM has included moving towards a cost-effective electricity tariff in sector plans, but no action has been taken due to political pressure (Energy Sector Management Assistance Program, 2014).

Electricity tariff regimes can balance policy needs to cover the costs of generation and system maintenance with promoting access to electricity for low-income customers. An efficient, targeted support scheme for low-income households would allow electricity providers to supply power to households priced out of the market by a cost-reflective tariff. Indonesia successfully implemented an energy assistance program for low-income groups when it removed energy subsidies from its domestic fuel supply in 2005, targeting the bottom 40 per cent of its population with quarterly cash transfers for energy bills (Dobermann, 2016).

Electrification via off-grid options

Off-grid electricity from renewable technologies may be a more effective and economically viable route to provide electricity to rural communities than waiting for grid connections to reach every village. Solar home systems, mini-grids and biomass/biogas projects can be effective in rural areas where land and agricultural waste are plentiful. MOALI is implementing a World Bank-supported project to develop mini-grids and solar home systems for 500,000 households over the next five years, meant to complement grid-expansion efforts. At the end of FY2016, one third of rural villages had received electrification support from these efforts (Asian Development Bank, 2016a).

The case of mobile phone deployment in Myanmar provides an illustration of the rapid pace at which technology can spread, and the challenges of dependence on centralised infrastructure. In three years, Myanmar moved from nearly zero mobile phone penetration to 84 per cent, with 45 million mobile phone subscriptions on record in 2016 (First Solar, 2014). However, limited

capacity for infrastructure, sparse electricity supply and low internet bandwidth capacities all pose constraints on mobile phone usage in Myanmar. Box 8 shows high levels of mobile phone use in rural areas. Similarly high levels of take up of batteries for storage, wind and solar energy indicate an appetite in rural areas for off-grid electricity from renewable sources.

The figure below, based on data from the 2014 census, shows that in the North East, a high percentage of households at the township level use solar PV or small hydro for power, while households in the centre and West of Myanmar own batteries. These figures show a lack of overlap between lighting services and mobile phone ownership, which represents a significant opportunity for off-grid renewable energy to meet demand for electricity in rural
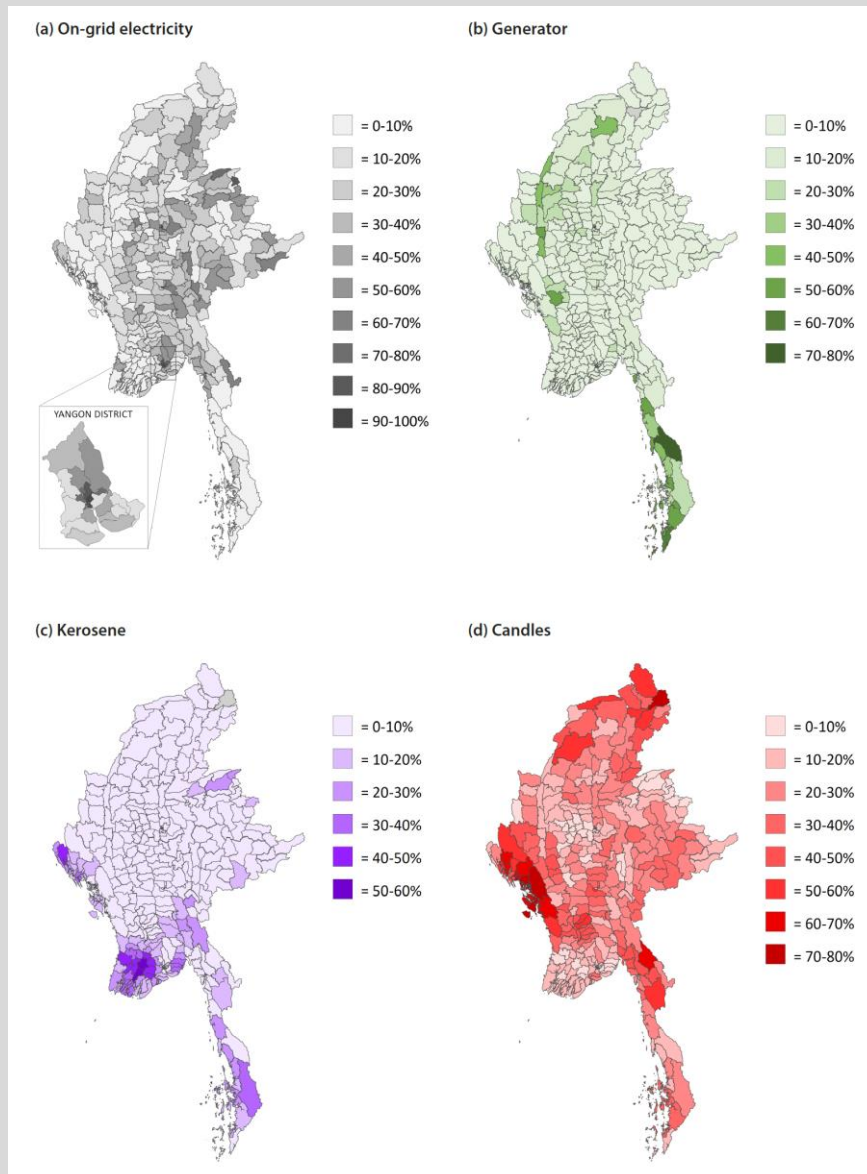
areas that currently lack access to the electricity grid.

(e) Solar PV

- = 0-10%
- = 10-20%
- = 20-30%
- = 30-40%
- = 40-50%
- = 50-60%

(f) Small hydro

- = 0-10%
- = 10-20%
- = 20-30%
- = 30-40%
- = 40-50%

(g) Battery

- = 0-10%
- = 10-20%
- = 20-30%
- = 30-40%
- = 40-50%

(h) Mobile phone ownership

- = 0-10%
- = 10-20%
- = 20-30%
- = 30-40%
- = 40-50%
- = 50-60%
- = 60-70%
- = 70-80%
- = 80-90%
- = 90-100%
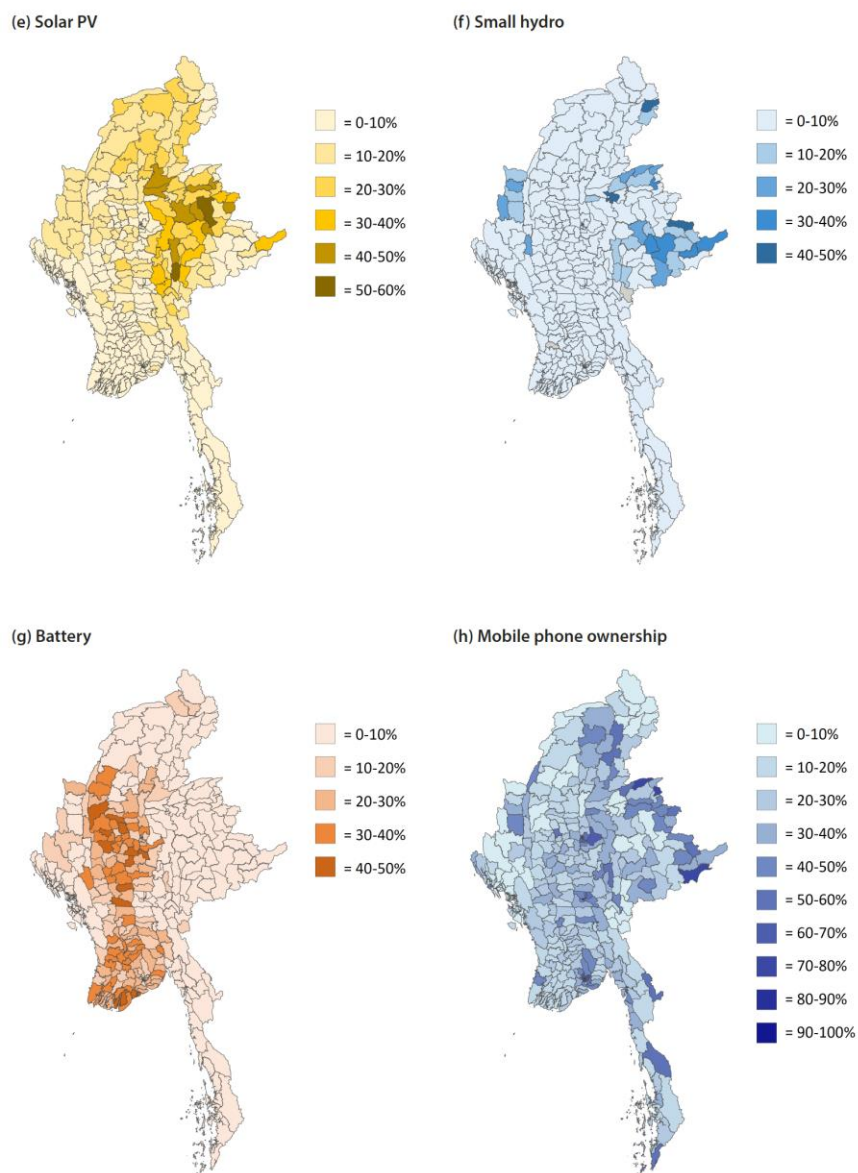
Source: (Spectrum SDKN, 2017a) *based on data from 2014 census*

A major barrier to take-up for existing off-grid electrification schemes is a lack of access to credit for local communities, who are responsible for 10-20 per cent of system costs.[21] Financial arrangements for solar home and mini-grid systems supported by the Department for Rural Development in MOALI include support from project developers (20 per cent), central government (60 per cent, including pass through from international donors) and 10-20 per cent from local communities. There are no examples of loan programs, microfinance schemes or other routes to finance for local communities to meet their share of project costs. Private sector participation in these schemes is also variable, as no specific plans are in place to connect off-grid communities to the national grid and dialogue between MOALI and MoEE on this topic is non-existent.

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[21] In-country interviews conducted by Spectrum and GGGI in April and May 2017

Private sector interest in Myanmar's power sector appears significant, with over 80 per cent of all foreign investment going into the power sector in 2013. 60 MOUs have been signed between private project developers and the GoM as of December 2016, with support of the Asian Development Bank (ADB) on a public-private partnership framework for hydropower, thermal and solar projects (Chern, 2017). Opportunities for development of small-scale projects providing off-grid electricity are also abundant. Myanmar's electricity laws currently allow states and regions to permit electricity generation projects of less than 30MW. This represents an important opportunity for building micro-hydro, solar, wind and biogas generation capacity in areas which lack access to the electricity grid.

Additional legal and economic structures including strong purchasing power agreements, common law guarantees, competitive bidding for generating capacity projects and feed-in-tariffs for renewable energy technologies were flagged in interviews as necessary interventions for renewable energy development.[22]

Microgrids offer a promising solution to places with low electricity access and high traditional grid infrastructure costs. Kenya has deployed solar-powered microgrids to provide renewable electricity in remote villages without subsidies using centralized cloud-based monitoring, smart meters and mobile payment systems (Dobermann, 2016). Power grid company ABB Limited was recently quoted in support of mini-grid deployment in Myanmar (Government of Myanmar, 2015a):

'Myanmar can actually leapfrog the conventional grid by embracing new technologies like the microgrid…which we now can build and install much more cheaply compared to ten years ago.' – Chaiyot Piyawannarat, ABB Limited

Renewable energy

Renewable energy is defined in the GGPA as electricity sourced from non-large scale hydroelectric renewable, though mini-hydroelectric generation is considered in the following analysis.[23] Electricity from renewable sources provides access to energy for households and businesses without the GHG emissions and local air pollution associated with fossil fuel-based

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[22] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[23] Although hydroelectricity is a renewable source of energy, the construction of large scale hydroelectric facilities can have significant and unavoidable negative environmental and social impacts. The most important of which are generally related to the flooding of land in the impoundment zone upstream of a dam, and changes to water flows and water levels downstream from a dam. For instance, forced land acquisition and population displacement; changes in river regimens (which can affect fish, plants and wildlife); and flooding of land and wildlife habitats (through the creation of reservoirs). While the nature and severity of such impacts are highly site specific and tend to vary in scale according to the size and type of the project, due to its generally environmentally disruptive impact, large scale hydropower is counted separate from other renewable energy sources. Myanmar is engaged in a Strategic Environmental Assessment process which provides additional information regarding hydropower and holistic assessment of benefits and impacts.

electricity generation. Power from renewable sources other than hydroelectricity play a negligible role in Myanmar's electricity mix.

The amount of electricity generated in Myanmar from solar and wind energy is minimal, but the potential is large. The potential is described in the following paragraphs.

Myanmar's estimated potential for generating electricity from solar power far exceeds the country's current electricity demand, at more than 52,000 TWh per year (Asian Development Bank, 2015). Total electricity demand was 14 TWh in 2014 and is anticipated to grow to 57.6 TWh in 2030 (Asian Development Bank, 2012). Much of this potential is located in the Central Dry Zone, where rural poverty is being further stressed by climate change impacts on agriculture, so solar power could provide a welcome source of additional investment and income.

Wind energy potential in Myanmar is estimated at 80 TWh per year (Asian Development Bank, 2015). Potential capacity of electricity generation from on-shore wind power in Myanmar's Chan and Shin states is estimated at 7 TWh/year, which would generate half of the country's current electricity demand alone.[24] Excess wind power generated in the north of the country would need to be transmitted elsewhere in the country or exported to neighbouring countries, requiring grid infrastructure. Coastal wind energy potential has been estimated to be as high as 365 TWh (Asian Development Bank, 2012).

Potential for producing cooking fuel from biogas may be high, given Myanmar's significant livestock industry, but further study is required to understand the economic and technical barriers. The theoretical potential for biogas production may be as high as 20 million cubic meters per day, but this production is limited given that livestock populations tend to be small and free-ranging, presenting barriers for collecting animal waste for use in biogas digesters. Biogas appears to be of broad interest from interviews, but the case for supporting it as a low cost energy source has yet to be made amongst the donor community.[25] Past experience with biogas in Myanmar has met with mixed success, with 80 per cent of family-sized facilities installed since the 1980s no longer in operation, but more recent fixed-dome biogas plants have been successful in providing electricity at the village level, especially in the Mandalay region (Hunter, 2017).

Hydropower is an important source of electricity generation in Myanmar, but can have significant impacts on the environment. Installed capacity in Myanmar is estimated to be more than 100 GW, providing over 60 per cent of electricity in 2014 (Asian Development Bank, 2016a). Hydropower projects including 47 GW of planned capacity in Myanmar's Ayeyarwady basin (representing 61 per cent of land cover in Myanmar) have been paused for a review of their social and environmental impacts (Seebregts, 2010). Small-scale micro-hydro projects may present a viable option for local electricity generation without the social and environmental impacts of large-scale hydroelectricity, though these facilities may be especially vulnerable to climate change as increased variability in water levels are amongst observed impacts.[26]

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[24] Modern on-shore wind turbines in the UK have an estimated load factor of 21-25 per cent, accounting for plant availability (International Renewable Energy Agency, 2014). If 4 GW of wind turbines ran for 24 hours/day for 365 days/year, they would produce 7.1 TWh of electricity under the assumption of a 20 per cent load factor.

[25] Specifically, China's experience with biogas digesters suggests that they may have lower social returns than generally claimed (Zuzhang, 2013).

[26] In-country interviews conducted by Spectrum and GGGI in April and May 2017

The future of hydropower in Myanmar is currently being reviewed through a Strategic Environmental Assessment (SEA) process led by the IFC and Australia Aid. The focus of this ongoing study is to identify how Myanmar can leverage its enormous hydropower potential to power economic growth without endangering economic and social well-being. The SEA is focussed on development over the next 20 years and will result in a *Sustainable Hydropower Development Pathway*. At the time of writing, the process was entering its 'sustainable development pathway setting and assessment' phase, which includes development of multicriteria analysis to rank individual projects on impact and sustainability. A 'mitigation and recommendations' section will follow.

Other issues

Policy commitments around electricity generation technologies are still being developed, indicating an opportunity for change from the pathways identified in the electricity master plan. The ADB is engaged in a capacity-building project to help develop energy policy, strategy and planning. The ADB has chosen to focus on the development of the power sector in recognition of strong private interest in the oil and gas sector. Further planned work includes a Power Network Development Plan in 2018, with a goal to achieve a 47 per cent electrification rate in 2020 (compared to a 34 per cent baseline) in line with the National Electrification Plan target of 50% electrification of households by 2020 (World Bank Group, 2017b).

Innovative tools for electricity system planning are providing new ways to determine which technologies are best fit for specific geographies, market structures and policy goals. The best fit off-grid electricity solution for an area can be difficult to identify due to uncertainties in local energy needs, geography, market structures and local access to finance. Innovations in electricity planning, such as the use of GIS data to conduct spatial analysis, allow for high-resolution technical analysis to be conducted at low cost from satellite imagery. However, these do not yet appear to be being used in Myanmar.

Technology choices for electricity generation in Myanmar are often influenced by supply-side offerings, based on what donors are willing to support. Other country experience demonstrates donors may misallocate funds to drive a proven technology at scale, without consideration of local geography or context, for example the deployment of solar in highly shaded rainforest. Investments and energy sector reports to date suggest that donor preferences have had a heavy influence on policies and strategic decisions in Myanmar's energy sector. Support for grid electrification (JICA and ADB), coal (Japan and China), large-scale hydroelectric power (China) and liquefied petroleum gas (USA) have all been pushed by national actors with export and technology interests.[27]

Natural gas is currently a significant source of export earnings and grid-based electricity in Myanmar. Natural gas accounted for over half of export earnings in 2013 and used as an important fuel source for electricity generation, constituting 35 per cent of total electricity generation in 2014. Natural gas will remain an important source of grid electricity for at least the

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[27] In-country interviews conducted by Spectrum and GGGI in April and May 2017

lifetime of generating plants currently installed, which have an average lifetime of 30 years (OECD/IEA, 2017).

Additional reserves of natural gas in Myanmar have recently been discovered. These include offshore reserves discovered by Woodside Energy, an Australian extractor. Natural gas reserves typically have a long timeframe for exploration and production, with the average field yielding fuel within 8-15 years of discovery. These resources remain important, but immediately deployable technologies such as wind and solar power will be more immediately useful to meeting Myanmar's existing electricity deficit.

Data available indicate that decoupling economic growth and energy consumption will remain a challenge for Myanmar, at least in the short term, given current levels of energy access. Energy intensity of GDP is a key measure of the environmental impacts of economic development, depending on the sources of energy and electricity provision. Myanmar's energy intensity fell from $6.4/MJ in 2004 to $3.2/MJ in 2014, a period of 220% growth in GDP (World Bank Group, 2017b). These trends show that the country is using more energy per economic output. The country's low electrification rate and high share of population engaged in rural agriculture is likely to contribute to increases in energy intensity from a transition to greater industrial production.

Energy efficiency standards for buildings, industry, transport and appliances play an important role in supporting growth with lower energy requirements and GHG emissions. Myanmar's National Energy Efficiency and Conservation Policy calls for 12 per cent reduction in 2012 levels of energy consumption by 2020, 16 per cent by 2025 and 20 per cent by 2030. Implementation of energy efficiency targets will require specific technical and performance requirements for different sectors. Limited technical information and capacity for systematic regulation of energy use is available to date in Myanmar. Therefore, this area should be a focus for further study and development. International experience has shown that more efficient use of energy can best be achieved through a phased approach to building, industrial and transport standards. Efficiency in specific sectors is discussed further in the sections on urban development and industry in this report.

3.2.2   *Recommendations*

Myanmar has a high endowment of renewable resources, but its current plans are reliant on electricity generated from coal. The National Electricity Master Plan projects the share of electricity from coal to increase from 2 per cent in 2015 to 30 per cent in 2030, while solar power is expected to generate only 5 per cent of electricity in 2030 (Piyasil, 2015). Coal has been favored in policy documents due to ease of power supply to the grid (and influence from donors with national interest in coal), but lacks public acceptance and is incompatible with a green growth approach to development.[28]

Renewables can be deployed as an increasingly low cost alternative to grid expansion. Solar and hydroelectric technologies are currently deployed at modest levels in rural areas as off-grid generation options, but can be scaled up and used to power off-grid communities. Wind energy also offers increasingly low cost generation potential for both microgrid and off-grid electricity generation. GGGI can work with members of the National Energy Management Committee to

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[28] In-country interviews conducted by Spectrum and GGGI in April and May 2017

update the electricity master plan and National Electrification Plan to support the scaling up of renewable energy technologies for both off-grid and grid-connected systems, rather than generate electricity from fossil fuels.

Renewable, off-grid technologies are likely better suited to achieving access to electricity across rural Myanmar than grid expansion, at least in the short to medium term. The UN's Sustainable Energy for All initiative has adopted the global goal of providing *100 per cent access to modern energy*, which may be a more suitable goal for Myanmar than its current target of 100 per cent grid connection. The long term national energy strategy informs foreign aid and investment, which can be more effective if directed to modern energy expansion across the country, rather than focussing on grid infrastructure investments with much higher costs than off-grid technologies. Implementation options for off-grid renewables are discussed further below.

Box 9. Recommendations: Allow for diverse soltuions to achieve access to electricity for all

- Engage with development partners to inform a long-term national electricity generation policy that takes advantage of Myanmar's abundant solar and wind resources and provides off-grid and microgrid technologies alongside grid investments to rapidly deploy electricity throughout the country.
- Update or adapt the National Electrification Plan to target 100 per cent access to electricity by 2030, via grid or off-grid solutions, rather than full grid expansion.
- Develop a knowledge base from international experience on legal and economic policies and tools required to develop successful public private partnerships to provide electricity from renewable sources. Include evidence on successful elements of Power Purchasing Agreements, investment environments for infrastructure, fiscal incentives and technology-specific financial support mechanisms such as feed-in-tariffs.
- Coordinate and align efforts towards access to sustainable electricity across government ministries and throughout development plans affecting the energy sector (i.e. align electricity access agenda across MOALI, MoEE and MoC).
- Undertake studies around energy efficiency standards and technologies, including lessons learned in other countries that are relevant to Myanmar's development context.

Off-grid electricity from renewable sources including solar home systems and mini-grids are currently being deployed in rural areas of Myanmar by the World Bank. Electricity generation from micro-hydropower may be appropriate for forested areas, with high rates of shade cover. Wind and solar power may be cost-efficient electricity supply sources for areas in Myanmar with suitable topography and weather conditions. A location- and technology-specific evidence base would help to identify which technologies are best fit in specific areas in order to support rapid improvements in electricity access nationwide. GGGI can support decision making processes amongst funders and policymakers, by providing a toolkit that identifies best fit *electricity solutions* (generation technologies and financing structures) and up to date information for specific geographies and contexts.

Scaling up deployment for off-grid electricity generation in rural Myanmar requires improved access to finance for scalable technical solutions. The World Bank's off-grid solar project that is currently active in rural areas requires 20 per cent local financing to support the installation of local solar power, which has been a challenge in many communities, according to interview responses. Innovative finance models which have been successful in increasing access to electricity in other developing countries include: climate bonds, microfinance schemes[29] and blended finance packages (including private sector funds). Innovation in payment methods can also help to attract investment. Collecting payment for energy use via mobile phones or implementing pay-as-you-go plans lowers transaction costs for consumers and increases rates of payment (Moreno & Bareisaite, 2015). GGGI can disseminate knowledge on financial innovations through workshops for donors and government officials, pilot projects or publications. It can also provide access to finance by connecting donors, intermediary financial institutions and communities.

> *Box 10.*   Recommendations: Expand off-grid electricity generation from renewable sources
>
> – Develop a decision support tool for evaluating best fit energy solutions for specific locations that is compatible with rapid deployment of electricity generation technology and green growth.
> – Build knowledge on financial models for off-grid electricity development to donors, civil servants and rural communities to scale renewable technologies and connect communities to finance flows.
> – Pilot microgrid systems with private sector partners in rural communities without access to grid electricity. This could include piloting innovative local finance strategies and renewable energy technologies.

Tariff structures designed to lower system costs can also provide high social benefits. Thailand has incorporated a Time-of-Use (TOU) tariff, which allows households to pay a lower rate if they do not use electricity during peak hours (Global Witness, 2015). This approach requires first a centralised network operator to shift electricity supplies between areas of demand and, second, meters equipped to register and communicate time of use to billing systems. Phased implementation of subsidy-free tariffs will allow for ac careful evaluation of the impacts of cost-reflective tariffs on communities of interest. GGGI can demonstrate the economic benefits of an efficient tariff structure through modelling policy reforms and disseminating knowledge around successful cases. Public acceptance of cost-reflective electricity pricing can be aided by developing educational material and curricula around energy systems, emissions from different electricity generation technologies and energy efficiency practices. These are discussed further in the section on cross-cutting support sectors.

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[29] As deployed in Haiti, Kenya, India, Nepal and Uganda (REN 21, 2017)

3.3   Mining

'A historic transition in natural resource governance is underway in Myanmar' [Global Witness, 2015]

This section reviews opportunities, practices and problems in Myanmar's mining sector and provides recommendations for ending illegal mining activities and implementing sustainable practices compatible with green growth. Recommendations include bringing the full activity of the mining sector under transparent government oversight, aligning incentives between concession holders and regional governments, and investing rents from the sector in core economic infrastructure such as human and natural capital. Most of the analysis is focused on the jade trade, which dominates the extractive industry in Myanmar, but gems and other minerals are also significant markets in the sector.

Myanmar's mining sector is overseen by the Department of Mines (DoM) under the Ministry of Natural Resources and Environmental Conservation (MONREC). For the jade and gemstone trade, the Myanmar Gems Enterprise is an important actor, as the state-owned enterprise that runs the gem emporium. A group of state-owned mining companies are responsible for other minerals: Mining Enterprise No 1, Mining Enterprise No 2, Mining Enterprise No 3 and the Myanmar Gems Enterprise. The Extractive Industries Transparency Initiative is working in Myanmar to improve capacity and develop transparency in the sector. Table 9 lists relevant national policies associated with the mining sector in Myanmar.

Table 9.   Key policies and ministries for the mining sector in Myanmar

Policies	Ministries Responsible
— Salt Enterprise Law 1992 — Pearl Law 1992 — Gemstone Law 1995 — Gems Law Second Amendment 2016 — Mining Law 1995 — Mining Rules 1996 — Mining Law 2014 (Draft) — EITI Report & Recommendations 2013-2014 FY	— Ministry of Natural Resources and Environmental Conservation (Department of Mines) — Ministry of Planning and Finance (oversees revenue collection and distribution)

Source: *Vivid Economics and Spectrum SDKN*

3.3.1 Background

Myanmar's mining sector represents a massive opportunity to support the country's economic growth, but is currently focused on moving economic rents out of the country at the expense of environmental and social well-being. The country's largest mineral export, jade, could yield as much $6 billion in annual government revenue, equivalent to 3 per cent of GDP (Global Witness, 2015). Compared to actual state revenues from jade exports of $370 million in 2013-2014, effective oversight and taxation of jade trade from Myanmar would provide significant resources to support the country's development and green growth agenda. In its current state, the mining sector thwarts development objectives, contributing to conflict, corruption and environmental degradation.

Measuring mining output in Myanmar

Estimating the value of trade in Myanmar's mineral wealth is a challenge, with official processes ignored and cheated. Illegal trade in jade is as high as nine times the reported value of jade exports. Myanmar is the largest producer of jade in the world, with over 70 per cent of known global reserves. The country's jade trade is operated through a gem emporium system facilitated by Myanmar Gem Enterprise, a state-owned enterprise, which in 2013-2014 reported $3.5 million in revenue from jade sales, via auction and sales of low-value lots. Analysis of China's imports of jade, and characteristics of jade in the global market, reveal that much of the jade extracted from Myanmar is smuggled out of the country, disguised as lower quality gems or underreported through official channels, with the true annual value of jade exports estimated to be as high as $31 billion, as shown in Figure 15 (Walker, 2015).

Figure 15. Jade export revenue, 2014, official vs estimated production
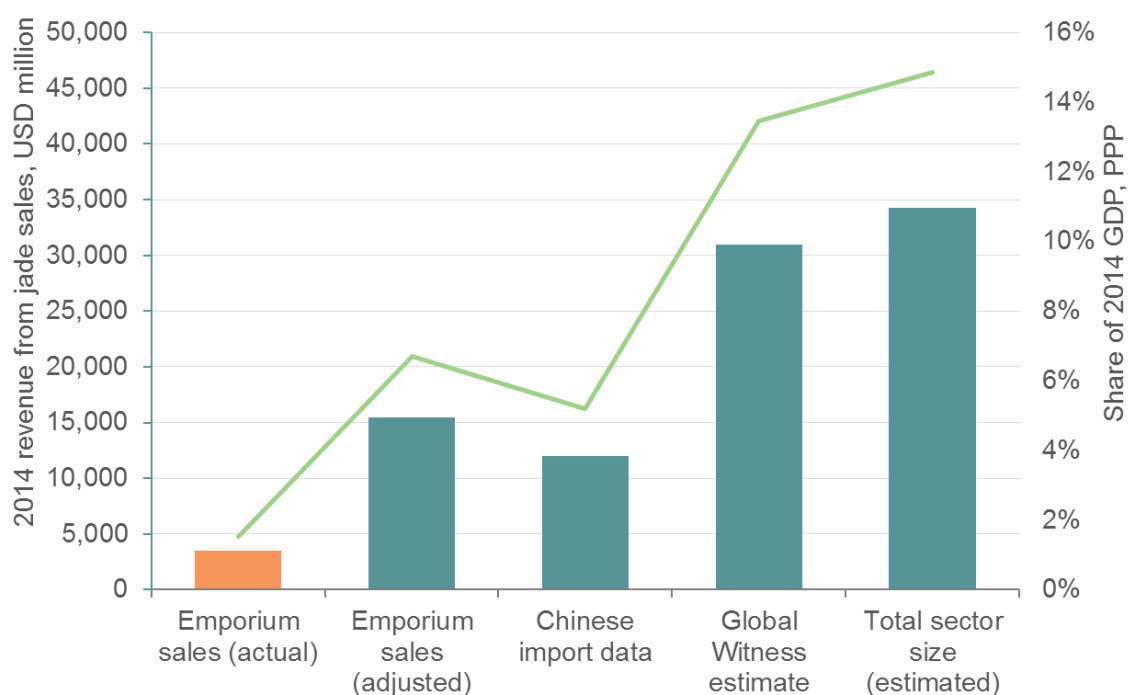
Note:	*Emporium sales (actual) are official numbers provided by GoM, Emporium sales (adjusted) represent official volumes of jade sold at emporium but with estimates of actual shares of high-quality jade, Chinese import data represents the official imports into China for products in sector codes including jade in 2014, Total sector size (estimate) adjusts import numbers (reported by China) by the adjusted price profile applied to emporium sales and Global Witness estimate corrects the sector size for the estimated share of imports that are jade (99.3 per cent)*	
Source:	*Vivid Economics based on data from* (Bauer et al., 2016))	

While resource rents from mining products can facilitate sustainable development in Myanmar, informal trade and other losses in the sector prevent productive investment of extracted revenues. Disparity between official and estimated levels of revenue from the country's jade trade undermines trust in government institutions and encourages illegal behavior amongst mining concession holders. In addition to missed revenues, low levels of enforcement in the mining sector offer an attractive source of finance for militant groups involved in regional conflicts throughout Myanmar, enabling violence in Northern regions. Areas engaged in jade mining are also associated with HIV/AIDS, a result of drug use and prostitution stemming from illicit flows of gems (EITI International Secretariat, 2017b).

Government efforts to reform the mining sector include participation with the Extractive Industries Transparency Initiative (EITI) and a ban on jade mining. The GoM froze permits for jade mining in 2016, pending the development of a new mining law.[30] However, it continues to support expanded mining of copper, nickel and chromite (EITI International Secretariat, 2017a). In 2014, Myanmar was approved for candidacy in the EITI, an international organization that coordinates transparency and reporting efforts in mining and extractive activities. Myanmar's

[30] http://www.mmtimes.com/business/21593-jade-mining-permit-extensions-suspended.html

candidacy was expected to result in full membership in January 2017, but the national EITI organization requested an extension to petition for membership in March 2017 (Myanmar Extractive Industries Transparency Initiative (MEITI), 2015). The Myanmar EITI first report covers the oil, gas and mining sectors, but relies on official records, which vastly underreport revenues from the jade trade. Two additional reports are expected in March 2018.

Reforms in the mining sector and international engagement are necessary to attract sustainable business and donor interest. Successful engagement with the EITI requires support of civil society and government departments committed to enforcement of rules and transparency. As an example of an unsuccessful engagement, Azerbaijan was suspended from the EITI Board earlier this year due to a lack of progress engaging civil society around reporting and transparency requirements (Natural Resource Governance Institute, 2016). In Myanmar, the US Embassy is currently supporting work on a gems and jade policy, the UN Development Programme is working with BRG on regulation and monitoring while Japan and Korea have capacity building programs in place in the sector.[31] Private sector interest could represent a large investment flow for the country, including from multinational companies with sustainability concerns and from China's Belt and Road Initiative.

Environmental management plans (EMP) offer one route to documenting and mitigating local impacts of mining operations. Studies such as a September 2017 EMP conducted for jade mining in Lone Khin, Kachin State[32] can ensure that plans are in place to avoid environmental disasters and that local residents and other stakeholders are engaged in the approval process.

Revenue sharing from extractive industries

Though a fraction of its potential, mining provides significant funding to GoM, but it is not sustainably reinvested. Mineral revenues accounted for 7 per cent of national government revenues in 2013/2014. Official numbers cited in the first EITI report show $460 million of mineral taxes and fees in 2013/2014, with 88 per cent from gems and jade (Bauer et al., 2016). As shown in Figure 16 and Figure 17, 45 per cent of revenues from jade, gem and mineral sales are passed through state-owned enterprises to fund national government. The remaining 55 per cent of revenues are retained by state-owned enterprises. A small amount of funding from salt and timber returns to state and regional governments via development fund contributions from mining companies.

[31] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[32] https://www.mmtimes.com/news/kachin-state-jade-mining-area-get-environment-plan.html

Figure 16. Collection of revenues from Myanmar's extractive industry (Jade and Gemstones)
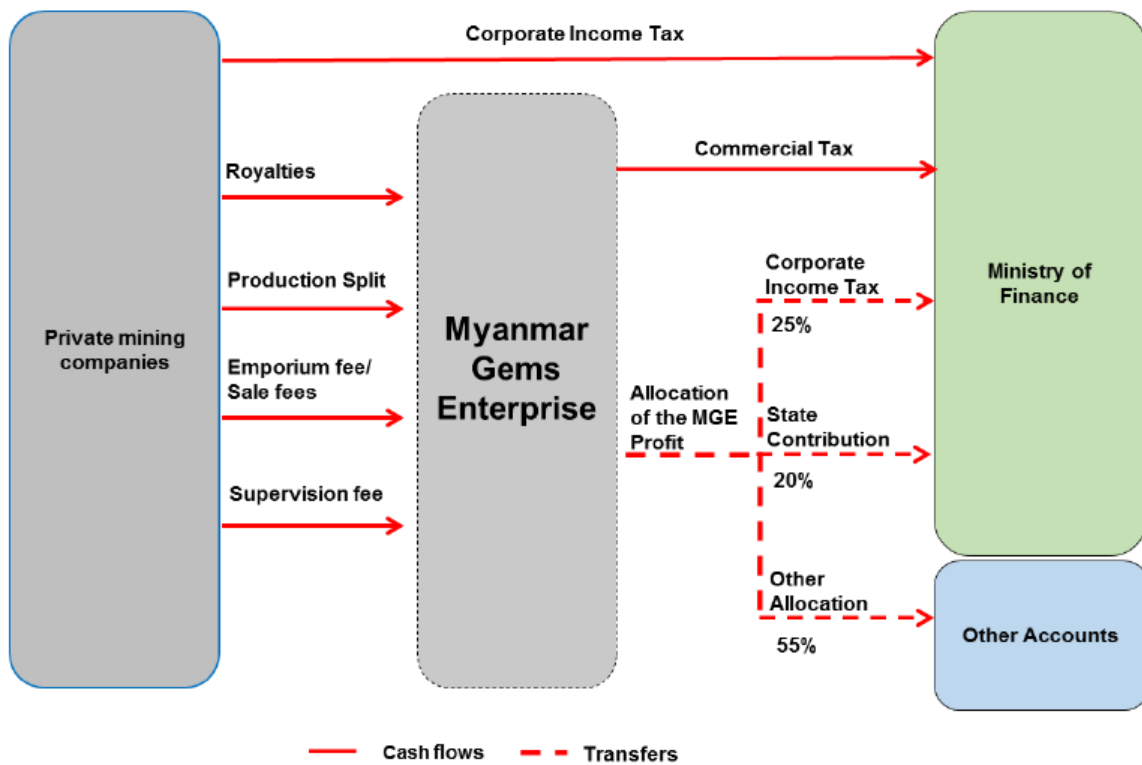
Source: EITI, 2015

Figure 17. Collection of revenues from Myanmar's extractive industry (other minerals)
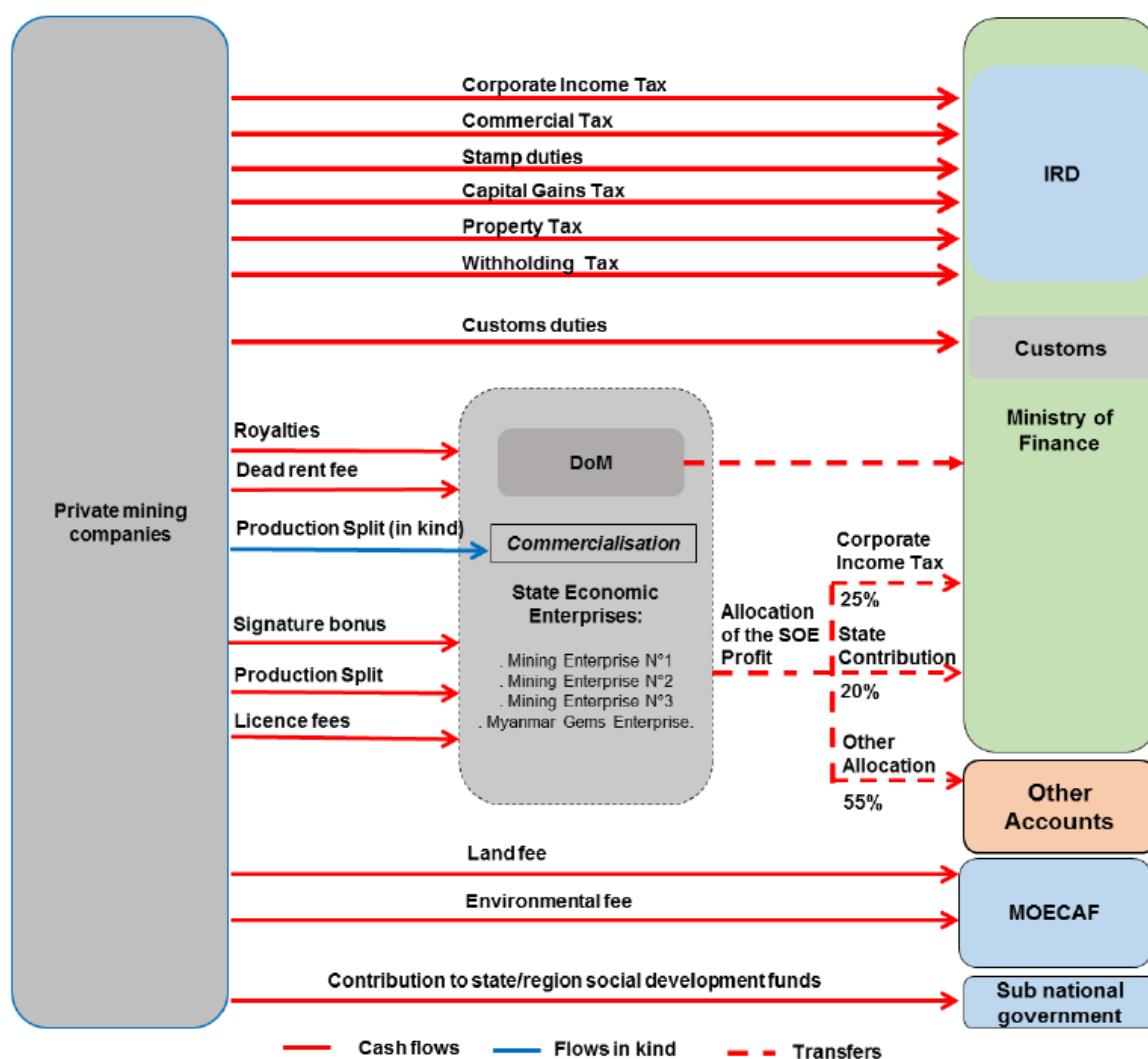
Source: EITI, 2015

Myanmar's existing revenue sharing system benefits state-owned enterprises and holding companies, while local governments depend on modest funding allocations. A group of state-owned enterprises coordinated through the Department of Mines in MONREC is conducting all mining activities in Myanmar, including the Myanmar Gems Enterprise mining gem stones. State-owned enterprises typically enter a production sharing contract with private companies, where private companies assume 100 per cent of investment costs and profits are split between public and private partners. A recent report from the National Resource Governance Institute recommends reforms to Myanmar's state-owned enterprises including improved financial reporting, investment advice and formal rules for financial assets in their control (Bauer et al., 2016).

Military holding companies also hold significant positions in the energy, mining and gems sectors. Two companies directly or indirectly tied to the armed forces, the Union of Myanmar Economic Holdings Company and Myanmar Economic Corporation, own subsidiaries with mining

operations and benefit from existing structures and revenue flows. Close ties between former military leaders and the mining sector pose a political challenge to reforms.

National allocations to states and regions have been increasing but from low levels. Contributions from the national government to regional and state governments amounted to 3.4 per cent of the national budget in 2013/14 and 8.7 per cent of the budget in 2015/16. These transfers represent 64 per cent of state and regional revenues in 2015/16. Very little money is saved or invested at lower levels of government, and 80 per cent of spending is on capital projects. In the absence of a standard revenue sharing formula, there is significant disparity in allocations between regions and states. For example, in 2015-2016, Chin state received $195/per capita while Ayeyarwady received $18/per capita (Bauer et al., 2016).

Systematic revenue sharing schemes between national and lower level governments can promote enforcement against illegal mining, return investment to regions impacted by mining activities and aid development efforts. Specifically, redistribution of mining revenue can take the following forms:

- compensate local communities for the negative impacts of extractions;
- mitigate or prevent violent conflict;
- respond to local claims for benefits, based on ideas of local ownership; and
- promote regional income equality between resource and non-resource rich regions (for example, a formula weighted for population, literacy weights, share of households without electricity for lighting and per cent of individuals without access to 'improved' drinking water.

Achieving consensus on the objective for resource revenue sharing schemes is necessary in order to implement a scheme successfully. Further decisions include at what level to split revenues; which revenue streams to share (e.g. royalties, taxes and license fees); and how to incentivize efficient spending (tied to development outcomes), improve transparency, and how to involve stakeholders in the approach (African Natural Resources Center, 2016).

Mongolia offers a recent example of successful resource sharing of mining revenues across levels of government. In 2016, a new mining law was adopted that will assign 5 per cent of mining royalties to General Local Development Funds for distribution according to a population-weighted formula, 30 per cent to regions producing mining resources (known as aimags), of which one third is reallocated to local governments (soums). Fifty per cent of mining license fees will go directly to regional development funds in mining areas, of which half of the distribution is earmarked for localities (Bauer et al., 2016).

Investing resource rents

Proper enforcement and regulation throughout the mining sector, as well as reform of state-owned enterprises could yield substantial government revenues and support green growth in Myanmar. The estimated $6 billion annual government revenue possible from full enforcement of taxes and royalties in the jade trade alone would represent a significant source of income for GoM. Combined with a consensus-driven revenue sharing system for distribution of resource rents throughout the country, these financial revenues have huge potential to drive GoM's

sustainable development and green growth agenda, including through investment in human and natural capital.

Myanmar can invest resource rents from the mining sector in developing its natural and human capital, while decoupling revenue to government ministries charged with regulating extractive industries. Due to variable commodity prices and finite reserves, resource rents from mining cannot be relied upon for annual operational costs of government, in particular those overseeing mining activities. Using revenues from the extractive industry for investments in long-term schemes to strengthen institutions in Myanmar in areas such as education, protect natural assets and develop infrastructure development can support sustainable growth. Government functions currently dependent on mining revenue should be financed through reliable sources of state income instead of being dependent on volatile commodity prices.

Botswana stands as an example of good practice in investing resource rents into long-term drivers of growth to break the 'resource curse' (Government of Myanmar, 2015b)**.** Botswana's Sustainable Budget Index (SBI) measures the sustainability of resource rent investment in the public sector national budget. Based on the principle that rents from non-renewable (mined) resources should be invested in renewable resources to promote sustained growth, the SBI is given as the ratio of non-investment spending to non-renewable resource revenue, with the general condition that operational budgets should not be dependent on resource rents for annual support. Instead, resource rents are invested in improving education, health and access to water and energy, with observed improvements in related indicators.

Illegal mining activities in Myanmar undermine sustainable growth efforts in other sectors. Extracting jade and other gems and minerals from the ground often creates significant destruction of forest and other ecosystems. Without an effective taxation system in place, governments and communities lack the authority to hold mining companies responsible for environmental destruction and the funds to restore habitats themselves. Illicit financial flows cause and sustain conflict in areas currently affected by violence and undermine effort towards sustainable development in the sector.

3.3.2   Recommendations

Given the background to the mining sector, our recommendations for the mining sector are organized across: measuring mining in Box 12, revenue sharing in Box 13, and investing resource rents in Box 14.

3.4   Industry, Commerce and Tourism

'While growing fast, Myanmar's trade still has enormous potential for further growth. But it is crucial that the benefits from greater trade are also shared more equally and help to sustain the ongoing political transformation'
[World Bank Group, 2016]

This section reviews Myanmar's industrial profile, considers opportunities for growth and the challenges related to ensuring that these opportunities deliver sustainable outcomes. Recommendations concern efforts to monitor, manage and enforce standards around the emission of pollutants from industrial activity and build capacity amongst industrial sectors for sustainable production. Tourism, other than ecotourism, is also discussed as an industry with high economic potential but important impacts to manage.

Myanmar's industrial development is overseen by the Ministry of Industry, which is tasked with promoting foreign investment and industrial development, and the Ministry of Natural Resources and Environmental Conservation (MONREC), in charge of regulating environmentally degrading activities. The management of 18 industrial zones and 3 special economic zones is included in the Ministry of Industry's portfolio. The Ministry of Hotels and Tourism oversees the tourism industry while the Ministry of Planning and Finance levies fines for any environmental standard infractions. The Ministry of Commerce includes a Department of Trade, which sets export targets across Myanmar's economic sectors. Table 10 lists relevant national policies associated with the industrial, commerce and tourism sectors in Myanmar.

Table 10.   Key policies and ministries for the industrial sector in Myanmar

Policies	Ministries Responsible
– Myanmar Investment Law 2016 – Foreign Investment Law 2012 – Foreign Investment Rules 2013 – National Export Strategy 2015-2019 – National Waste Management Strategy (forthcoming) – Myanmar Tourism Master Plan 2013-2020 – Myanmar Responsible Tourism Strategy 2012 – Policy on Community Involvement Tourism in Myanmar – Destination Management Plan for Inya Lake Region 2014-2019 – Sector Wide Impact assessments – Oil and Gas, Tourism, Mining, Telecommunications [MCRB] – National Strategy for the Development of Statistics (2016)	– Ministry of Natural Resources and Environmental Conservation (Environmental Conservation Department) – Ministry of Planning and Finance – Ministry of Industry – Ministry of Hotels and Tourism – Ministry of Commerce, Department of Trade – City development committees

Source: *Vivid Economics and Spectrum SDKN*

3.4.1   Background

Industry and commerce are key drivers of economic growth and can help deliver Myanmar's goals of doubling its GDP in the next decade while protecting its natural resources. Industrial development is a priority for the GoM, with 40 per cent of GDP expected to come from industry by 2030, compared to 25 per cent at present. Tourism is identified as a priority sector in the GoM's export strategy (Republic of the Union of Myanmar, 2015a). Between 2010 and 2014, both exports in the garment industry and arrival of tourists in Myanmar tripled (Garcia, Rodriguez, Wijen, & Pakulski, 2016). These industries represent the connection between economic benefits and environmental threats inherent in Myanmar's development. While both textiles and tourism are key sources of revenue (tourism generated upwards of $700 million in 2012 while textile exports produced more than $1.4 billion in 2015), unchecked, they can bring significant degradation to Myanmar's water and land-based ecosystems.

Industrial pollution

Myanmar has begun to introduce policy frameworks to ensure a sustainable industrial sector, but a lack of implementation has resulted in an essentially unregulated industry. The 2012 Environmental Conservation Law requires standards to be adopted for water quality, emissions, effluent and solid waste. Existing pollution standards are derived from the International Finance Corporation Environmental Health and Safety Guidelines and cover air, water, noise and odour pollution. Standards for specific pollutants are codified as 'guidelines' for the following industries (Watson, 2015):

- thermal, geothermal and wind power generation, transmission and distribution;
- oil and gas exploration and refining, processing and distribution;
- chemical manufacturing;
- agriculture;
- food and beverage processing;
- breweries and distilleries;
- textiles manufacturing;
- tanning and leather finishing;
- wood manufacturing;
- materials manufacturing including glass, metal, machinery and electronics;
- waste management;
- water supply;
- infrastructure; and
- mining.

While standards have been adopted for a wide range of industries, stakeholder interviews reveal very little capacity for enforcing these standards, in large part due to the absence of systematic monitoring of pollutants. Monitoring of pollution levels is severely limited due to a lack of data collection, with the limited collected data neither being stored nor shared systematically.[33] In particular, textiles, distilling and leather tanning industries have been identified as sectors with high pollution levels. However, due to a lack of data collection mechanisms on discharges and water pollution form industrial processes, there is limited information on pollution levels, much less so a system to fine or charge companies that pollute the environment.

Environmental statistics are included in plans to develop national statistics sets, but are likely to require significant technical capacity and investment to implement an effective data collection mechanism and enforcement regime. Policy options include central data collection of pollution information, company-to-government reporting of pollution, technology adoption requirements and market-based pollution control schemes.

Donor engagement in pollution control activities has targeted particular technologies and pollutants. JICA has engaged to support the installation of air quality monitoring stations, while Korea's development agency (KOICA) has expressed interest in building water quality testing laboratories. Norwegian researchers are currently developing a master plan for hazardous waste management in Myanmar, with delivery planned in 2019 (Karstensen, 2016). The United Nations Environmental Programme has supported Myanmar in assessing mercury emissions related to gold mining. The Myanmar Ministry of Planning and Finance is currently developing a National Plan for the Development of Statistics, which is expected to include pollution monitoring capabilities.

Various efforts are underway to develop monitoring systems for pollutants in Myanmar and interviewees identify an urgent need to develop capacity for monitoring and enforcement.[34] MONREC's Environmental Conservation Department has begun recruiting staff in townships and regions, but these staff lack the training and technical equipment to enforce existing water and air standards. A lack of industrial zoning requirements has given rise to areas where multiple types of industrial pollutant mix in water resources, overwhelming waste water treatment

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[33] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[34] In-country interviews conducted by Spectrum and GGGI in April and May 2017

infrastructure and damaging water quality for all residents and activities in the region. Poor quality water resources have been linked with significant health issues in Myanmar including diarrhoea, malaria, dengue and Chikungunya fever (Asian Development Bank, 2013).

In addition to pollution, industry has significant impacts on the environment through the use of energy in production. Industry accounts for 13 per cent of energy use in the country (see Figure 14). With rapid growth of Myanmar's industry sector in recent years,[35] there are significant opportunities to install energy efficient processes, reducing the increase in emissions that often accompanies economic growth in developing countries. The Ministry of Industry is currently implementing sector-specific capacity building projects to promote energy efficiency. Activities under this program of work include capacity building workshops and knowledge sharing, but have fallen short of developing industrywide standards for energy intensive processes.

Myanmar's garment industry

Myanmar's textiles industry is a key element of the country's efforts to industrialize, with textile exports the largest non-extractive trade flow out of the country (World Bank Group, 2016). Industry projections suggest that total production could reach $10 billion per annum by 2020, quadrupling exports and employing 1.5 million workers (Myanmar Garment Manufacturers Association, 2015). In general, the industry is seen as a relatively clean industry, but the dyeing and tanning processes have significant negative impacts on water resources, with waste water production and water consumption areas of concern.[36] Environmental impacts are expected to increase significantly with a switch from current 'cut-make-pack' manufacturing, where Myanmar factories provide labor for assembling textile products provided from overseas to a 'free on board' model where factories take on a greater share of the production process, including higher profit shares and additional opportunity for negative environmental impacts. Labor practices in the industry remain of concern to civil society organizations, including the continued practice of child and forced labor, salaries below minimum wages and barriers to unionizing (Impactt, 2016).

The Myanmar Garment Manufacturers Association has developed a strategy to 2024 to guide the growth of the industry and recognize areas of improvement for sustainable business (Myanmar Garment Manufacturers Association, 2015). This plan includes a vision of zero child labor, no forced labor within in industry over time, and a minimum wage law. Environmental impacts are acknowledged with a strategic objective to 'actively raise awareness of environmental issues across the industry'. The strategy recognizes the increasing environmental impacts from dyeing processes that will accompany the industry's growth. It calls on government to set sufficient regulations and further commits to establishing a taskforce to lobby for environmentally friendly regulation. Industry aspirations include developing a leading sustainable production model suitable for supporting a 'Made in Myanmar' campaign to associate the industry with a sustainable standard.

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[35] According to World Bank national accounts data (2017), annual growth of Myanmar's industry sector in terms of value added was about 9% between 2011 and 2016.(World bank, 2017c)

[36] In-country interviews conducted by Spectrum and GGGI in April and May 2017

The MGMA strategy lays out a number of targets pertinent to green growth in its 2024 strategy. In 2015, an industry taskforce focused on environmental policy was established. The industry task force is supported by the British Council's Pyoe Pin program and has been recognized for a successful start in tackling many of the environmental issues facing the garment industry. Existing industry working groups include (Impactt, 2016):

- Reduction, reuse and recycling of waste and emissions, led by SMART;
- People and the environment, influencing change and impact in the industry, led by H&M;
- Carbon, water and chemical foot print, led by Eco Dev;
- Water stewardship, led by WWF;
- Energy efficiency and renewable energy use in garment factories, led by SMART; and
- Sustainable wet processing and wastewater treatment, led by Solidaridad.

Branding the sector as a socially and environmentally responsible industry is an important aspect of the strategy. By 2019, the industry expects it will be known internationally for ethical and sustainable manufacture and that the government will adopt environmental policies related to industrial production. By 2022, the ambition is that 'Made in Myanmar' will have a reputation for ethically- and sustainably-produced goods and waste water plants will be constructed in every industrial zone.

Tourism in Myanmar

Myanmar stands to benefit greatly from tourism-related revenue, but growth must be managed to avoid exploitation of the country's environmental assets. As the largest country in Southeast Asia, with rich natural and cultural heritage, Myanmar has potential to generate high flows of tourism. Managing this demand sustainably is key to ensuring that the sector supports the country's green growth. Aside from protected areas specifically classified as ecotourism sites, many of Myanmar's top tourist destinations are in coastal and forested areas that can be significantly negatively impacted by uncontrolled mass tourism traffic.

The tourism industry in Myanmar is in its early stages, but it can learn from experiences in neighbouring countries. The Association of Southeast Asian Nations (ASEAN) facilitates knowledge sharing on ecotourism. Total tourism brought in around 1.5 million foreign tourists, in addition to the 2.5 million domestic tourists observed in 2015 (World Travel and Tourism Council, 2015). ASEAN's Tourism Strategy to 2025 anticipates over 187 million visitors to the region by 2030 (ASEAN, 2015). In-country interviews identified Thailand, Cambodia, Laos as regional leaders in tourism.[37] The ASEAN strategy for all types of tourism (not just ecotourism) calls for 15 per cent of regional GDP to be contributed from tourism activities by 2025, from current levels of 12 per cent (ASEAN, 2015). Myanmar is expected to lag behind the regional trend, with tourism's current contribution to GDP at 5 per cent, expected to rise to 6 per cent by 2025. (World Travel and Tourism Council, 2015).

Mass tourism can have significant impacts on the environment and should be an area of focus for any green growth efforts related to tourism. Focus on environmental outcomes in tourism has traditionally been limited to small-scale sustainable projects, of the type discussed in the AFOLU section of this report, but efforts to reduce the negative impacts of mass tourism can

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[37] In-country interviews conducted by Spectrum and GGGI in April and May 2017

have much larger effects in furthering green growth (Harrison, 2017). The concentrated nature of mass tourism, including transport, accommodation and general consumption must be managed sustainably so as not to impact delicate environments and create large waste streams with negative consequences for shared environmental resources.

Myanmar's Tourism Master Plan includes environmental sustainability as one of seven cross-cutting themes, committing to avoid and minimize negative environmental impacts of tourism infrastructure projects. However, tensions between preserving natural resources and obtaining economic returns from the sector are recognized in the Responsible Tourism and Community Involved Tourism strategies. Environmental degradation has already been observed at some of the country's flagship sites, which jeopardize the long-term economic potential of these areas. A sectoral assessment of tourism sites found poor infrastructure at many tourist and hotel sites, including sparse waste management and waste water treatment facilities (Myanmar Centre for Responsible Business, 2015). Unregulated tourist traffic on beaches and mountainous areas has led to erosion of trails. Local residents dependent on the environment for their livelihood, including farmers and fisherfolk, have found the environment they work in severely degraded by waste produced from nearby tourist activity, endangering their ability to earn a sustainable income.

Financial mechanisms including entry fees and eco-taxes represent a strategy to reconcile the desire to stimulate tourism demand with environmental protection. By charging for the use of natural assets, touristic areas can raise revenues for investment in infrastructure to support tourism without damaging the very attractions visitors travel to see, or at least compensate residents who are negatively impacted by tourism activities. These mechanisms can be politically challenging, as evidenced by the tax introduced in 2002 in Spain's Balearic Islands, which resulted in a change of government and repeal of the €1 tax a year later (Holden, 2017). However, such mechanisms have been anecdotally successful in Thailand, where visitor entry fees are reinvested into forest protection.

Entry fees in Myanmar are collected at the regional and local level, where they are invested in a range of activities, without consistency.[38] Myanmar's *Community Involvement in Tourism Policy* recognizes that many tourist destinations are areas that are governed communally, including traditional villages where public investment in infrastructure and environmental protection is lacking (Myanmar Ministry of Hotels and Tourism, 2013). Local revenues can also be reinvested in sustainable infrastructure required to support tourist activities, including reliable access to electricity and waste management, which can be beneficial for the wider population and economic development in these areas. In turn investments in infrastructure may increase tourist travel by enabling e.g. better waste management in major tourist areas.

3.4.2   Recommendations

Industrial development in Myanmar promises economic rewards for the country, but requires environmental management which is currently lacking. Water pollution and waste management are often uncoordinated across shared environmental resources, resulting in severe degradation. Despite the adoption of a wide range of environmental standards, there is no enforcement system in place to control pollution from industrial activity. Box 15 recommends steps that GGGI

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[38] In-country interviews conducted by Spectrum and GGGI in April and May 2017

could take to set up a pollution control system necessary for sustainable development of the industrial sector in Myanmar.

At the catchment level, consideration of the various users of water resources, including industry, can be helpful to develop a complete understanding of impacts on natural resources. For a given water catchment, the same resources will support industry, environmental ecosystems, farming and fishing activities, and public water supplies. Depending on the complexity of a given area, hydrological models may be useful in providing information on flows throughout the catchment, which can be used to identify pollution source and model impacts of changes in the region. Based on modelled outputs, or local consultation, catchment-level water management plans can inform decisions around treatment of industrial wastewater and regulation of resources used in industrial processes. There is a role for GGGI to develop scalable catchment-level modelling assessments via a pilot study in a priority region. Box 16 includes recommendations for promoting waste management in industrial areas.

Tourism is both an opportunity and risk for Myanmar's green growth and must be managed to deliver returns for sustainable development, rather than environmental exploitation. Box 17

includes steps GGGI could take to help the tourism industry to grow in a sustainable way and increase revenue while conserving environmental and cultural assets.

Box 17. Recommendations: Build capacity in the tourism industry to align sector development with green growth objectives

- Develop a market engagement and infrastructure development plan, including a road map for implementation, for the tourism sector that aligns with existing policy documents as well as green growth objectives, including both transport and waste management infrastructure.
- Develop best practices guide for tourism finance, based on ASEAN country experience, with recommendations for aligning local government reinvestment in tourist assets and natural and cultural capital.

3.5 Urban development and infrastructure

'Chronic underinvestment in urban infrastructure…has resulted in seriously deficient urban services throughout Myanmar' [Republic of the Union of Myanmar, 2015b]

This section reviews opportunities, challenges and current plans related to infrastructure and development in Myanmar's urban areas and provides recommendations for developing sustainable urban areas essential for delivering green growth. Urban planning processes are reviewed along with the role of zoning and finance in driving sustainable urban development. Specific financial reforms discussed include changes to the land tax system, tariffs for utilities, innovative finance for sustainable infrastructure and alternative business models for public services, including waste to energy systems. Infrastructure related to transport and waste management is discussed, and recommendations include strategies for ensuring investments are sustainable, energy efficient and resilient to climate change.

Myanmar's urban development is largely driven by local governments, in cooperation with international development finance institutions and Union-level planning and construction ministries. The 2016 National Urban Policy includes a three-tiered system of urban development, with primary tier cities designated as national strategic growth centers, secondary tier cities designated as regional nodes with strategic importance as transportation and commercial clusters, and tertiary cities as agro-industrial centers. Border towns with potential trade links are also flagged in the National Spatial Development Framework as special purpose cities. Table 11 lists relevant national policies associated with the urban development and infrastructure sector in Myanmar.

Table 11. Key policies and ministries for the urban development and infrastructure sector in Myanmar

Policies	Ministries Responsible
– National Planning Laws – Road Transportation Business Law 2016 – Railway Transportation Business Law 2016 – National Urban Policy – National Spatial Development Framework – National Transport Master Plan – Mandalay City Development Concept Plan Vision 2040 (ADB) – A Strategic Urban Development Plan of Greater Yangon 2014	– Ministry of Planning and Finance; Ministry of Construction; Ministry of Transport and Communications; State and regional governments; city governments

Source: Vivid Economics and Spectrum SDKN

3.5.1 Background

Urban populations in Myanmar are concentrated in two cities with populations above 1 million, followed by 15 smaller cities larger than 100,000 people. The share of national population living in urban areas is 35 percent, compared to the global average of 54 per cent (UN-HABITAT, 2015). Myanmar's most populous urban areas are Yangon (5 million) and Mandalay (1 million), followed by the capital area of Nay Pyi Taw (close to 1 million) (Horton et al., 2017).

Rapid urbanization and population growth are expected to exert significant pressure on Myanmar's cities in coming decades. The share of the population living in cities greater than 200,000 people is expected to double by 2030 to 25 per cent. Myanmar's NLD government included urban reforms in its 2015 election manifesto, committing to develop and refurbish urban infrastructure including transport, water, electricity and sewage, increase housing supply, establish greener cities (including urban gardening, urban forestry and expanding canopy) and create recreational spaces in urban areas (National League for Democracy, 2015).

Climate change is expected to have significant impacts on Myanmar's cities, especially those near the coast. Amongst climate impacts projected to 2050, temperatures are expected to increase by as much as 2.7 degrees Celsius, with days of extreme heat increasing from current levels of one per month to 4-17 days of extreme heat per month. Monsoon season is expected to bring heavier rainfalls and sea levels are anticipated to rise as much as 41 cm (JICA and Yangon City Development Committee, 2014). Increased rainfall and coastal flooding threaten to overwhelm existing infrastructure, including waste treatment systems, creating public health concerns in addition to physical damage from storms. However, detailed analysis of the socio-economic impact of climate change in relation to the current urban infrastructures (e.g. impact on sewage systems, wastewater systems, waste management systems in the coastal zones) has not been conducted for Myanmar.

Urban development planning in Myanmar

To manage pressures from urbanization and growth, Myanmar has developed a set of cross-cutting and sector-specific plans which inform city-level development strategies. National master plans and policies framing urban development include:

- national transportation master plan – which identifies mode-specific infrastructure targets;
- national housing policy – aims to operate across sectors to deliver 1 million homes by 2030, includes the creation of Construction and Housing Bank to provide finance for housing developments;
- national building code – a building code developed with the support of UN-Habitat which presents specifications for buildings used across eight zones of use; and
- national planning laws – including a National Urban System Plan which sets out the system of tiered cities and transport links that connect them, state and region level system plans, town-level concept plans and detailed plans.

City-level development plans in Myanmar are managed locally with support from donor agencies, which can create conflicting recommendations and input from relevant national ministries. Overlapping master plans and conflicting interests from their authors were cited as barriers to sustainable development in Myanmar's urban areas.[39] For example, Yangon's master plans include various priorities and input from the Asian Development Bank as well as Japanese, Korean, British, French, Italian and Dutch development agencies. The Myanmar Ministry of Transport and Communications has represented the Union government in these planning activities. In Mandalay, the Ministry of Construction's Department of Housing and Sustainable Human Development has worked with the Japanese development agency to support the Mandalay Regional Government and Development Committee to draft a 2040 Urban Development Concept Plan Vision 2040. As an alternative development process, the capital city of Nay Pyi Taw followed a simple two step plan to develop its growth trajectory, as described in Box 18.[40]

Box 18. **Nay Pyi Taw's urban development objectives**

Nay Pyi Taw employed an objectives-based planning model to develop growth plans for the city. First, a set of objectives were agreed with stakeholders to include:

1. Environmentally friendly and sustainable city

2. Green and livable city (i.e. urban gardening, urban forestry and expansion of canopy)

3. Centre for higher education

4. Transport and logistics hub

5. Climate change resilient city

The objectives then were applied to city-level plans to identify policies, projects and strategies for implementing the shared vision.

Source: In-country interviews conducted by Spectrum and GGGI in April and May 2017

The current national government promoted green cities in its election manifesto and has recently passed a motion in Parliament to implement green city plans across major urban areas. It is unclear how this program will be implemented in Myanmar's cities, but provides a strong signal of interest in green growth in the country's urban areas. As cities develop plans in line with this program, master planning documents will need to be updated to include sustainable transport options, access to sustainable waste and wastewater infrastructure, creation of green space, flood protection and energy efficiency measures in buildings.

Each city has its unique problems and priorities, requiring locally relevant development plans.

– Yangon – as the historical economic capital of Myanmar, Yangon has the most significant infrastructure challenges of Myanmar's urban areas. The city has traditionally been connected by buses and recently installed a bus rapid transit system to improve

[39]In-country interviews conducted by Spectrum and GGGI in April and May 2017

[40] In-country interviews conducted by Spectrum and GGGI in April and May 2017

connectivity. However, car traffic has rapidly increased, doubling from 2007 to 2015, causing widespread congestion in the city center (Asian Development Bank, 2016b). The region's Strategic Urban Development Plan is largely concerned with further transport interventions, including a circular rail link, airports and seaports. It also proposes green space throughout and around the city and industrial zones along the city's ring road (OECD/IEA, 2014b).

- Mandalay – the smaller, second city of Myanmar, Mandalay has adopted the goal in its Urban Development Concept Plan to be a 'green cultural city with clean air, a center of tourism, a trade and logistics hub, and an IT center for upper Myanmar'. Transport in the city has transitioned from bicycles to motorcycles, without much impact on congestion, yet, due to high levels of road capacity. However, high levels of motorcycle use produce air and noise pollution. Instead of large-scale transport systems, development plans for Mandalay target high-use corridors to pilot road designs compatible with pedestrians, cyclists, buses and motorcycles (D-waste, 2014).

- Nay Pyi Taw – a much younger city than its two larger peers, the political capital is adopting lessons from urban growth in Yangon and Mandalay. Nay Pyi Taw originally employed broad use-based zoning rules that were rejected after causing congestion and replaced with mixed-use zoning as practiced in Yangon.[41] The city aims to become a model for green urban space, but lacks significant infrastructure required to support an urban population, primarily waste management. The city is not compact, which necessitates motorized transport, rather than walking and cycling.

3.5.1.1 Infrastructure for Myanmar's cities

As identified in master plan documents, Myanmar's cities have significant infrastructure needs, particularly for transport and waste management. Infrastructure was identified as a top government priority in in-country interviews, along with economic production and strengthened governance.[42] Transport needs are particularly high in Yangon, where congestion is becoming a significant barrier to growth. Waste management was identified as a top concern in Nay Pyi Taw. Green infrastructure and energy efficient buildings offer solutions for continued economic growth while increasing resilience towards he impacts of climate change and reducing GHG emissions.

Transport

Transport shapes urban environments and has significant implications for greenhouse gas emissions. Carbon emissions from transport account for 20 per cent of global emissions, Transport is growing rapidly in Myanmar, a trend accelerated by urbanization and economic growth. In 2011, the transport sector accounted for roughly a quarter of total emissions in Myanmar. This share had increased to about 36 per cent only in 2014 (IEA, 2016). Therefore, developing and implementing urban plans around safe transport links that are universally accessible, low cost and low carbon is key concern of green growth.

Transport in Myanmar's cities is increasingly under pressure. While Yangon has recently deployed a bus rapid transit service, infrastructure for non-motorized transport is lacking across

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[41] In-country interviews conducted by Spectrum and GGGI in April and May 2017

[42] In-country interviews conducted by Spectrum and GGGI in April and May 2017

cities, and car travel is growing rapidly, indicating additional demand for transport infrastructure and public. Transport links between residential zones, employment areas and services such as education and healthcare should be designed to accommodate all modes of travel, with dedicated bus and bike lanes, and pedestrian-friendly infrastructure (e.g. crosswalks and links between motorized and non-motorized transport). Investment in such infrastructure is required, as, over the past decade, vehicle registration has tripled and speed of travel in Yangon has slowed by a factor of two to three.

Waste management

Current solid waste levels contribute to significant pollution and emissions in Myanmar. Studies of waste management techniques have found that open burning of waste contributes to the high level of air pollution and GHG emissions in Asian and African countries. In Myanmar, emissions from burning rubbish are estimated to be equivalent to 80% of the country's overall reported emissions (Ministry of Environmental Conservation and Forestry, 2012).[43]

Waste increases with population and urban areas require infrastructure to collect and dispose of solid waste and wastewater. Currently, Myanmar leads its peers in low amounts of waste generated per capita (160 kg/year). This rate is slightly higher in Yangon at 190 kg per capita per year, but remains below other countries in the region (e.g. Thailand generates over 365 kg per capita per year) (Hoornweg & Bhada, 2012). This trend is likely to change with economic growth. Myanmar's government has created a draft National Waste Management Policy, with the support of UNEP.

Wastewater infrastructure is essential for disposing and treating waste in highly populated areas. In Yangon, very few households are connected to waste treatment infrastructure. Rather than treat sewage and recycle waste into freshwater and fertiliser, household waste enters natural waterways, which can contaminate water used for public drinking supply or returned to the environment.

Urban waste management requires a sustainable business model and education of both local government and resident populations. Nay Pyi Taw's solid waste collection system is funded by annual fees of $2 per household, which are used to pay a private collection company. This company is also allowed to keep profits from selling recycled materials, though less than 50 per cent of waste generated in the city is currently recycled in this system (with much lower shares recycled in other areas). Interviews revealed technical capacity for siting and designing landfills and wastewater treatment plants as a top priority for the sector, along with widespread education amongst residents on sustainable consumption (3R, recycle, reuse, reduce) and how to sort and dispose of waste in urban areas.[44]

Waste to resource technologies offer an additional business model that can convert waste into electricity or recycled goods, particularly in urban areas where demand for goods and electricity is high. Specific technologies ranging from recycling mechanisms to waste to energy plants must respond to locational characteristics include waste stream composition and delivery systems. For example, incineration of waste can reduce volume by up to 90 per cent, while generating

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[43] The GoM did not include emissions from incineration and open burning of waste as part of its official reporting of national GHG emissions.

[44] In-country interviews conducted by Spectrum and GGGI in April and May 2017

electricity to be fed back into the power grid. In landfills, anaerobic decomposition of organic material produces landfill gas, which can be collected for use as fuel, with the proper infrastructure. The International Energy Agency estimates up to 40 per cent of municipal solid waste can be converted to energy in urban areas (Soz, Kryspin-Watson, & Stanton-Geddes, 2016).

Green infrastructure

Green infrastructure offers urban areas flood management and air regulation services, delivering environmental and cultural co-benefits. Green infrastructure deploys natural systems to deliver infrastructure needs, offering co-benefits including water management, climate resilience, health and recreation. In urban areas with impermeable ground cover, water that would normally be absorbed in the ground builds up to high volumes during rain storms, creating surface flows five times the size of those in rural areas (OECD/IEA, 2014a). By retaining storm water in natural storage areas, green infrastructure can provide effective flood management services at low costs, compared to traditional 'grey' infrastructure solutions. Planting trees along streets, preserving wetlands in natural runoff areas and creating green space throughout the urban space are all examples of green infrastructure.

Flood management through green infrastructure is especially relevant for Myanmar given the expected adverse impacts of climate change. By using existing, native habitats including mangrove forests and wetlands, coastal areas allow for flexibility in water levels while providing a habitat for biodiversity, improving water quality and avoiding carbon emissions from the construction of concrete seawalls and other grey infrastructure. Green infrastructure can provide higher returns for investment than grey infrastructure due its ability to naturally regenerate, saving maintenance and replacement costs. In addition, green infrastructure provides co-benefits to the society as a whole in terms of health, well-being and eco-system services. In the Greater Mekong region, green infrastructure investment can provide cities with essential flood management, water supply and storm water mitigation surfaces (Elkhamlichi & Sarkar, 2016).

Green space can also be effective in mitigating urban heat island effects, which cause increased temperatures in cities where many dark surfaces absorb, rather than reflect, solar heat. Urban areas in China, Indonesia and South Africa were developed with little consideration for accessible green space and are now facing impacts from pollution and climate change which could in part be alleviated with ample green space incorporated into city designs. As Singapore comes under pressure on its existing green spaces from high population density, it has instituted a requirement of green roofs, walls and open spaces for all new developments, and has made a substantial effort to green roadsides. Green roofs, parks and plant beds along city streets can provide cooling effects to urban areas, mitigating temperature-related climate impacts. Green spaces also provide valuable recreation and cultural space in densely populated cities, a feature reflected in Yangon's vision to become 'A city of green and gold.'

Energy efficiency in buildings

Energy consumption in buildings is another area relevant to green growth that is likely to see significant increase in importance as Myanmar's urbanisation accelerates. Currently, the share of emissions from Myanmar's electricity and heat production is half of the global average (24 per

cent, compared to 49 per cent globally) (Mogi, 2012). As the country expands access to electricity and urban populations grow, demands for residential energy in cities will likely increase rapidly. Spatial planning can allow for implementation of district energy to provide cooling services for densely populated areas and energy efficiency standards can help to reduce the growth in energy demand and emissions.

At the city block level, district energy systems can provide cooling services demanded as urban areas develop while maximising energy efficiency in delivering these services. Worldwide, the use of air conditioning in homes is expected to grow with increases in temperature and household income. World Bank-supported pilot projects for district cooling systems in Mexico and the Philippines are currently under way in municipal and office buildings, respectively. These studies have found that large-scale cooling systems can provide air conditioning services at lower cost, with 40 to 60 per cent less energy than conventional, single unit systems (IGC, 2016). Cost-effective deployment of district cooling requires integration of necessary infrastructure into early urban design, including central chillers and distribution systems throughout new construction blocks.

More broadly, energy efficiency has been promoted around the world through energy efficiency codes for buildings and appliances. Japan's Top Runner programme is a leader in this area. It selects the most efficient technology in a given market and requires all products to meet a similar standard in three to ten years. The programme has been effectively deployed for household appliances, electronics and automobiles and has recently been expanded to include building materials such as windows and insulation. The programme targets markets that are high volume, high energy and have a high potential for energy efficiency improvements (Joffe, Hoffman, & Brown, 2008).

A high rate of urban development in Myanmar presents an opportunity for improving energy efficiency. Phased energy efficiency requirements for municipal and new buildings may allow Myanmar to benefit from the latest innovations in building materials to develop energy efficient building stock without the high retrofit costs faced in more developed countries with lower rates of urban growth.

Financing urban development

Developing the infrastructure necessary to support economic and urban growth in Myanmar will require significant financial investment. Infrastructure needs in the country to 2030 are estimated to cost over $300 billion (Climate Bonds Initiative, 2016). To date, Yangon has been the focus of much of donor interest, with Mandalay also receiving technical capacity and planning support. The funding gap for other cities, including Nay Pi Taw, remains significant.[45]

Sustainable infrastructure is a significant funding priority for international donors. Globally, traditional infrastructure funding commitments have been aligned with international commitments to deploy $100 billion in climate finance each year to 2030. Funding sources with a focus on sustainable infrastructure include:

- international climate-specific funds, led by the Green Climate Fund, which funds adaptation and mitigation projects;

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[45] In-country interviews conducted by Spectrum and GGGI in April and May 2017

- multilateral development bank programmes, including the World Bank's energy efficiency programme ($1 billion per year funding target) and the Asian Development Bank's Leading Asia's Private Infrastructure programme ($6 billion infrastructure spending target). The Asian Infrastructure Investment Bank also includes low carbon infrastructure in its range of investments and has recently entered Myanmar; and
- bilateral development programmes from national development agencies representing the UK, Denmark, Norway, Germany, Japan and Korea, amongst others, with climate-oriented programmes.

Innovative finance products have been increasingly deployed to fund infrastructure and development projects relevant for green growth. Results-based funding schemes and non-traditional bonds are examples of sustainable infrastructure financing mechanisms. Performance-based contracts, for example between a municipality and water utility, can be effective at encouraging improvements in service and investment in distribution networks. Contracts including financial incentives for reducing non-revenue water use have been deployed in southern Africa (IGC, 2016). Climate-aligned bonds, including municipal and catastrophe bonds, offer a route to finance for publicly-financed infrastructure projects with climate resilience benefits. The 2016 market for such bonds was estimated to include nearly $700 billion in funding (Government of Indonesia - GGGI Green Growth Program, 2015). Climate-aligned bonds, including green bonds, can be issued by banks, asset managers, sovereign governments and municipalities. Examples of these instruments financing sustainable infrastructure include the city of Johannesburg's municipal green bond, supported by the IFC.

A range of green financing strategies can support Myanmar's development goals. Municipal green bonds may be a promising solution for Yangon and Mandalay, with large urban populations and substantial infrastructure. Area-specific services, such as municipal waste collection and industrial zone wastewater treatment plants can benefit from performance-based contracts which reward sustainable operations. National schemes, such as the Green Economy facility recommended in the forthcoming Green Economy Framework could be used to leverage finance for sector-specific investments in urban areas across the country.

Tax revenue and tariff systems for public services enable government to raise money to directly finance infrastructure development. Tax collection in Myanmar's urban areas centres mainly on land tax, which is currently levied on land size, irrespective of its value or use. Low levels of revenue from income taxes result from a large informal economy and low capacity for tax collection. Mobile tax collection technology has been piloted by the International Growth Centre, the Asia Foundation and Koe Koe Tech in Taunggyi and Pathein and may offer a means to increase collection of personal and business income taxes (Lynn & Oye, 2014). Tariffs for electricity and waste management services are heavily subsidised and have not been effective at encouraging the investment necessary to ensure adequate services for Myanmar's urban areas.

Private sector investment can deliver many of Myanmar's infrastructure needs, but requires a secure investment environment. Successful public private partnerships (PPPs) require legal and economic frameworks that support a low-risk business environment. Legal frameworks to support these arrangements include guarantees of third party enforcement of partnership agreements, under e.g. common law. Uniform standards for public services are also important for competitive sectors to ensure level playing fields. For example, universal air pollutant

emissions standards for all buses operating in city limits prevent a bus provider constrained by the requirements of a PPP from being undercut by a more polluting, but cheaper, operator. The ADB is currently working with the Ministry of Transport and Communications to build capacity on private public partnerships.

3.5.2   Recommendations

Master planning in Myanmar's urban areas has been effective at identifying challenges facing cities as they grow, but plans must be translated into action to enable green growth. A range of donor agencies have contributed to master planning documents, but there is a need to align these inputs in city-led strategies which include major infrastructure projects and timelines for development and address climate resilience and green growth issues specific to each city. City-level strategies can then inform a national urban development program that balances the needs of urban areas throughout the country. A national program for cities can support the government's Greening of Cities initiative and strengthen Myanmar's case to donors interested in sustainable infrastructure. This leads to three sets of recommendations, on urban area action plans, in Box 19, knowledge sharing on best practice for sustainable infrastructure, in Box 20, and demonstrating the benefits of green urban growth, in Box 21.

Box 19.   Recommendations: Develop, align across government and implement action plans for urban development

GGGI could:

- Create city-level strategic plans designed to inform climate resilient development, including the sustainable infrastructure necessary to support urbanisation through to 2050 and targeting city-level government staff.
- Convene city-level stakeholders, including development partners, financiers and insurers to provide input to city-level plans and identify priority areas of green cities development in support of the government's greening of cities initiative. Based on these city-level plans, develop project proposals and the implementation of projects.
- Set up a cross-government program for sustainable urban development at the national level to coordinate city development plans across all of Myanmar's primary, secondary and tertiary cities.
- Develop and implement a building code to increase energy efficiency in buildings.

Box 20.   Recommendations: Share knowledge on best practice sustainable infrastructure

- Conduct city-level analysis on sustainable infrastructure options delivering priority services, including:
    - public transport, non-motorised and green transport;
    - solid waste and wastewater management, including waste to energy technologies;
    - flood risk management, including green infrastructure;
    - district cooling; and
    - green streets, space and roofs to mitigate urban heat island effects.

- Disseminate knowledge on these technologies for city, regional and national governments, as well as donor agencies.
- Undertake research and/or facilitate research projects concerning the impact of climate change on urban areas in Myanmar and the infrastructure requirements to adapt to these impacts.

Box 21. Recommendations: Demonstrate the economic and social benefits of green urban growth

- City authorities should cooperate with civil society (e.g. UN-Habitat Myanmar) to pilot the government's Greening of Cities (GoC) initiative in an urban district "green zone", demonstrating sustainable urban design standards including green infrastructure, multi-modal street and public spaces and cost-effective energy efficient building measures.
- Introduce city and national policies to scale-up results of the GoC pilot, including energy efficiency for new buildings, appliances and automobiles in line with the Top Runner programme used in Japan.[46]

Myanmar's $300 billion infrastructure funding gap to 2030 will require a mix of funding sources. GGGI can offer significant value in detailing the international finance landscape in relation to urban infrastructure needs, identifying institutional reforms needed to access development finance and developing capacity in local and national governments to access international finance for infrastructure. By identifying resources from donors, public finance and the private sector, GGGI can help local and national governments develop a roadmap to implement urban infrastructure action plans. This leads to three sets of recommendations, on developing a financing roadmap, in Box 22, on developing an enabling environment for private sector investment, in Box 23, and strengthening revenue collection capacity, in Box 24.

Box 22. Recommendations: Develop a financing roadmap for sustainable infrastructure in Myanmar's urban areas

- Provide an inventory of the development finance landscape in relation to Myanmar city infrastructure needs, including climate finance, international development bank programmes, bilateral donor priorities, public finance products and private sector collaborations for development.
- Identify steps for Myanmar national and city governments to access international finance sources for sustainable infrastructure in urban area development plans.
- Explore and develop mechanisms for infrastructure financing, such as climate-aligned bonds.

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[46] Japan's Top Runner programme has resulted high levels of energy efficiency in appliances and vehicles in Japan since 1998. The programme selects high-performing models across the economy and requires all manufacturers to align to efficiency levels of the market leader. In 2014, the programme was expanded to include building materials (Ministry of Economy Trade and Industry, 2014).

Box 23. Recommendations: Creat an enabling environment for private sector support of urban infrastructure

GGGI could:

– Engage the private sector in Myanmar and abroad to identify gaps in the enabling environment for private sector investment in urban infrastructure.
– Building on this gap analysis, develop a model public private partnership framework for various urban infrastructure sectors including transport, property development and waste management.
– Implement policies and legal structures necessary to enable private sector support for infrastructure, such as common law dispute settlement guarantees, long-term tariff floors, enforcement of single-provider markets following competitive tender processes, and development of complementary standards and regulations for service providers.

Box 24. Recommendations: Strengthen public sector capacity for revenue collection

GGGI could:

– Implement mobile tax collection technology, based on results from the IGC/Asia Foundation pilot project.
– Assess the implications for reducing inequality and increasing public sector revenue from implementing a value-based land tax system.
– Share best practices in land valuation to support a regularly updated land registry that supports the implementation of a value-based land tax system.
– Assess the impact of volume- and use-based tariffs for public services, including waste disposal.

3.6   Cross-cutting support sectors

'Green growth depends on education…but regarding environmental education, nothing is happening'[47]

This section reviews the institutional arrangements and human capital necessary to support a green growth agenda, including education and public administration. Recommendations are presented for educational curricula for three audiences: 1) general (formal) education, 2) areas where vocational skills are needed to provide capacity to deliver progress in other areas of green growth, and 3) areas of capacity development amongst civil servants. Efforts to combat corruption and strengthen public administration and governance throughout the country are also discussed.

Myanmar's education system is overseen by the Ministry of Education, while governance and public administration across government is managed by national, regional and local government leaders. The Union Civil Service Board oversees training and capacity in the national government workforce. The Ministry of Planning and Finance plays an important role in administering national budgets, including state and regional share of funds. Revenue sharing and taxation shape capacity and control across sectors in Myanmar. Powers to set financial rules are granted by Parliament to various departments and across levels of government.

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[47] Quote from in-country interviews conducted by Spectrum and GGGI April and May 2017

Table 12. Key policies and ministries for the cross-cutting support sectors in Myanmar

Policies	Ministries Responsible
– Constitution of the Republic of the Union of Myanmar 2008 – National Comprehensive Development Plan 2015 – Myanmar Climate Change Strategy and Action Plan 2017 – Foreign Investment Law 2014 – State Owned Economic Enterprises law (1988/1989) – Myanmar Investment Law 2016 – National Sustainable Development Strategy 2008 – Myanmar Agenda 21, 1997 – Road Transportation Business Law 2016 – Railway Transportation Business Law 2016 – Arbitration Law 2016 – National Environmental Strategic Framework – Environmental Conservation Law 2012 – National Environmental Policy 2017 – Environmental and Conservation Rules 2013 – National Environmental (Emission) Quality Guidelines 2008 – National Environmental Policy 2017 – National Conservation Law 2013 – National Environmental Quality (Emissions) Guidelines 2015 – Environmental Impact Assessment Procedures 2015 – National Strategic Plan for the Advancement of Women – Strategic Environmental Assessment for Hydropower Baseline Study 2017 – Intended Nationally Determined Contributions 2015 – Conservation of Water Resources and Rivers Law 2015 – National Water Resource Policy 2017/8 – National Social Protection Strategic Plan 2017 – Framework for Economic and Social Reforms 2013 – Green Economy Framework 2017 (draft) – Green Growth Strategy 2017 (forthcoming) – Waste Management Strategy 2016 – Master Plan for Hazardous Wastes 2016 (Sintef)	– National Environmental Conservation and Climate Change Central Committee; State and regional governments
– National Comprehensive Education Sector Development Plan 2017	– Ministry of Education; State and regional governments
– National Framework for Community Disaster Resilience 2017 – National Action Plan for Disaster Risk Reduction 2012 – Civil Service Reform Strategic Action Plan 2017 – Medium Term Fiscal Framework 2015 – Budget Law yearly started from 2011-2012 FY – Citizen's Budget yearly from 2015-2016 FY – Public Debt Law 2015 – Revenue (Tax) Law 2016, 2017 – Code of Criminal Procedure Amendment 2016 – Payment of Wages Law 2016 – Shops and Establishments Law 2016 – National Planning Law, 2016-2017 – The Financial Institution Laws 2016	– Ministry of Planning and Finance; State and regional governments

Source: *Vivid Economics and Spectrum SDKN*

3.6.1 Background

Corruption

Corruption, and perceptions of corruption, undermine the government's legitimacy, threatening its ability to set and enforce policies necessary to deliver green growth, as well as other outcomes. Transparency International's Corruption Perception Index indicates that political reforms in 2012 and commitments to liberalisation from the government currently in office have improved perceptions of corruption in Myanmar (see Figure 18), but the country still has high perceptions of corruption, and is currently ranked 136 out of 170 countries. In a survey of government employees, 56 per cent of civil servants though that at least 'some' of their colleagues asked for additional payments to do their work, indicating a residual culture of corruption in the public work force (Republic of the Union of Myanmar, 2017).

Figure 18. Corruption is perceived as high in Myanmar, but the situation is improving
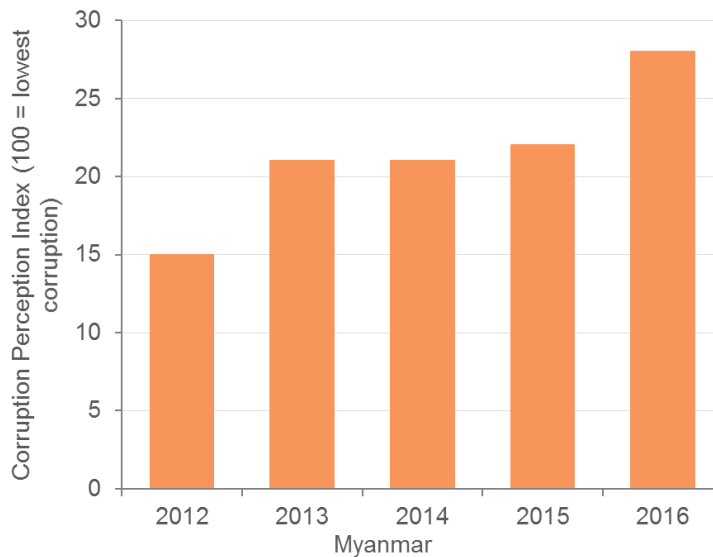
Source: Transparency International

Trust in the civil service is a necessary element of instituting reforms throughout the country. A civil service strategic action plan sets out reforms to 2020 to improve public trust in Myanmar's government staff (Republic of the Union of Myanmar, 2017). Recommendations from the report are summarised in Box 25.

As a signatory to the UN Convention Against Corruption, Myanmar has committed to work with international institutions to continue the development of anti-corruption practices in the country. Through cooperation with the UN Office on Drugs and Crime, GoM is currently preparing for a second cycle of work under the convention, to focus on preventative measures and asset recovery. Other areas of work under the convention include education and awareness raising around corruption and implementation of social accountability mechanisms (Spectrum SDKN, 2017b).

The role of conflict in Myanmar's green growth path

Ongoing violent conflict between Myanmar's army and the Kachin Independence Organization and its allies has created a severe humanitarian crisis in Kachin and northern Shan states (BNI, 2017)**.** While conflict is typically not discussed in green growth policy assessments, activity related to this crisis, and conflict elsewhere in Myanmar,[48] is already impacting green growth prospects and will continue to present a clear barrier to sustainable development. Conflict prevents positive green growth interventions by removing access to technical assistance and isolating communities from the markets and infrastructure necessary for economic activity. Violent conflict also directly impacts environmental resources through destruction of

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[48] For example, conflict in Rakhine state has caused major displacement and violence and has drawn major international attention to the region from August 2017.

ecosystems. Militia groups are also likely to exploit natural resource reserves, including illegal logging and mining, in conflicted areas to raise revenue for military operations.

The ongoing crisis demonstrates the special importance of an inclusive approach to green growth in Myanmar, with interventions offered beyond urban areas to all provinces and regions. Over the long term, green growth efforts can improve stability in post-conflict areas, by providing rural areas with sustainable incomes and promoting dialogue between different stakeholders in society.

Revenue, power sharing and coordination

The sharing of powers and revenues between national, state and regional governments is enshrined in the 2008 constitution, but continues to be cited as a top priority for green growth issues. As discussed in sections relating to AFOLU, mining and industry, many of the key issues related to green growth in Myanmar span government structures across national ministries and between levels of government. While questions of devolution and power sharing are a higher political issue, coordination between central, regional and local governments is required to enforce and implement key green growth policies. Support for building capacity around enforcement and education throughout Myanmar's regions can make significant progress towards green growth goals. For example, training national environment ministry staff working at the township level is important for developing a national pollutants inventory that can inform an environmental standards enforcement scheme.

For green growth to be achieved in Myanmar, it must remain a cross-government priority, rather than the focus of one ministry. GGGI has worked closely with MONREC throughout the GGPA process, which is a key stakeholder in managing many of the green growth areas discussed in this report. However, many initiatives require collaboration with other ministries, including those tasked with regulating energy, agriculture, industry and tourism, as well as cross-cutting ministries of construction and planning and finance. Indonesia's green growth roadmap shows the benefits of integrating green growth with national development goals[49] can include improved access to international finance, stronger community ownership and local political support (Government of Indonesia - GGGI Green Growth Program, 2015).

Central government coordination committees include green growth topics, but may lack effectiveness on implementation due to focus on the top levels of government. Senior civil servants are significantly over worked due to high international interest in all sectors in Myanmar and centralized decision making is causing severe bottlenecks.[50] Building capacity amongst more junior levels of government and encouraging department leaders to delegate implementation-related tasks will be important for delivering an integrated development program in the country.

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[49] National development goals in Indonesia include1) sustained economic growth, 2) inclusive and equitable growth, 3) social, economic and environmental resilience, 4) healthy and productive ecosystems providing services, and 5) reduction in greenhouse gas emissions (Government of Indonesia - GGGI Green Growth Program, 2015).

[50] In-country interviews conducted by Spectrum and GGGI in April and May 2017

Committees to coordinate different branches of the central government coordination include green growth topics, but may lack effectiveness on implementation due to focus on the top levels of government. Committees dealing with green growth related issues are led by Vice Presidents but these compete amongst each other and with other committees that receive higher level patronage (i.e. by the President) and so may not be prioritized at the highest levels of government.[51] However, elevating committees dealing with green growth issues to a higher political level is not a practical solution as this will further centralize decision-making, rendering the process slower and less efficient. Senior civil servants are significantly over worked due to high international interest in all sectors in Myanmar and centralized decision making is causing severe bottlenecks.[52] Therefore, building capacity amongst more junior levels of government and encouraging department leaders to delegate implementation-related tasks will be important for delivering an integrated development program in the country.

Coordination between central, regional and local governments is required to enforce and implement key green growth policies. This may include devolution of issues including energy, agriculture and forestry to regional government. Local governments are also important for assisting with enforcement and technical capacity in agriculture and forestry. The share of revenue collection responsibilities and income between national, regional and local governments is often not aligned to policy goals and expectations. Aligning revenue streams with enforcement responsibilities may allow for more effective enforcement of existing and future regulatory schemes.

The sharing of powers and revenues between national, state and regional governments is enshrined in the 2008 constitution, but continues to be cited as a top priority for green growth issues. Decentralization has tended to follow a 'deconcentration' model rather than a 'devolution' model, with implementation delegated to local governments, but under the control of the central government (Asia Pacific Community of Practice on Managing for Development Results, 2011).

Finance for delivering green growth

The Myanmar Investment Law (2016) strives to balance economic development with environmental protection. The law includes the following objective:

> *'to develop responsible investment businesses which do not cause harm to the natural environment and the society for the benefit of the Union and its citizens.'*

A new Myanmar Green Economy Framework (MGEF), developed by the WWF for MONREC, sets out a green financing system for delivering green growth in the sectors identified in this

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[51] The national coordination committees relevant to green growth include the Climate Change Mitigation Committee, Green Economy Committee, Environmental Conservation and Climate Change Coordination Committee.

[52] In-country interviews conducted by Spectrum and GGGI in April and May 2017

report. The Green Economy Framework is structured around four overarching objectives (WWF-Myanmar, 2017):

– stimulating green investments;

– managing brown investments;

– ensuring sustainable finance; and

– developing human capital.

Finance mechanisms proposed in the MGEF include 1) green banking (applying environmental, social and governance criteria to investments and financial products offered), 2) green financing facilities (including a bilateral or multilateral financing facility to support green growth investments across sectors in Myanmar) and 3) green finance culture (collaborating with financial institutions to develop ethical guidelines including sector-wide codes of conduct and training programs). If these recommendations are adopted, they will likely present opportunities for GGGI to collaborate for the delivery of green growth objectives in Myanmar.

The MGEF outlines how green economy issues intersect with the global sustainable development agenda. The 17 Sustainable Development Goals provide global targets to 2030 for development areas ranging from ending hunger to achieving gender equality. Despite high interest in SDGs amongst the international development community and significant relevance for green growth, they are not yet well integrated into government policies and strategies. The MGEF identifies investment needs related to the SDGs in Myanmar, offering a useful framework for coordination amongst donors and across government departments.

Education

Table 13 identifies educational needs for delivering green growth interventions discussed elsewhere in this report. Educational needs are presented for three different types of capacity development:

– basic education: green growth concepts and practices such as impacts of climate change, benefits of forest resources and best practices for household waste management require widespread knowledge for interventions to be effective, and represent areas of scientific knowledge that are important to educate individuals on for their own agency and capacity;

– vocational skills: areas where developing a local workforce is necessary to deliver green growth objectives, especially in tourism, forest management and urban planning, although the tourism industry has some programs in place to train tour guides and hospitality staff; and

– government staff capacity: while regulation and legal frameworks are in place for a number of areas relevant to green growth, there is a high level of concern that government staff lack the capacity to deliver authorized programs and enforce environmental standards, especially in states/regions and rural areas.[53] Due to a high level of donor and international organization activity in Myanmar over the past five years, senior civil servants have a good knowledge of policy areas around green growth, but are often overburdened with meetings and activity. It is important, then to build capacity

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[53] In-country interviews conducted by Spectrum and GGGI in April and May 2017

amongst junior-level civil servants in order to integrate green growth principles across policy areas, engage donors knowledgably to develop projects aligned with green growth throughout the country and effectively enforce national standards and regulatory systems for managing impacts on environmental resources. The government's recently opened Civil Service Academy offers one vehicle to deliver this capacity building.

Table 13. Education needed in core sectors

Sector	General education	Vocational skills required for green growth	Civil service capacity required
Agriculture, forestry and other land use	Ecosystem services provided by forest cover Climate change impacts, risks and projections for Myanmar, mitigation and adaptation measures[54]	For farmers: sustainable education including climate resilient crops and alternatives to rice, low water-intensive practices, organic farming methods, and benefits and marketing of sustainable agriculture products For local residents around ecotourism sites: hospitality skills, local history, guiding skills, business training	International finance sources for the AFOLU sector, eligibility criteria for projects and process to access finance Climate modelling and implications for policy Tracking and reporting progress against long-term policy objectives Budget making process and best practices for collaboration across ministries and levels of governments
Energy	Support energy literacy, education and awareness, work to help prepare for improved acceptance of tariff reform processes Energy efficiency measures, and their potential cost savings	Technical skills to develop sites and install renewable energy equipment Manufacture and installation of energy efficiency kit	Electricity generation technologies, associated costs, environmental and emissions impacts Legal and regulatory frameworks and policies required to support renewable energy deployment Structuring cost-reflective tariffs and available support mechanisms for poorer households Local and national finance options for clean energy access
Mining	Environment and labor rights should be incorporated throughout basic education	Quality inspectors to accurately assess jade, gems and other minerals Environmental mitigation specialists for restoring mined areas after the closure of the mine	For government staff on all levels with responsibility for enforcing concessions and collecting taxes: existing rules and regulations for the sector, specific status of concessions and companies engaged in mining, and latest knowledge on tactics used to underreport value in mining and logging concessions Accountants to verify reporting of produced/exported goods
Industry, commerce and tourism	Benefits of tourism and best practices for making it sustainable	Educate industry on clean technology practices, environmental standards Best practice on waste and wastewater management for industry	Train government staff on systematic data collection and data management, environmental monitoring, quality testing for air, soil and water, enforcement Use of industrial and special economic zones to develop

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[54] In 2017, the World Bank launched a disaster risk management programme to develop adaptive capacity for natural disasters, including infrastructure in Yangon and planning capacity in the national Ministry of Planning and Finance (World Bank, 2017)

			Awareness of 'urban possibilities' for infrastructure and spatial planning throughout administrative activities
	Hospitality sector skills, including language skills, accommodation and food management, and tour guiding		infrastructure and practice for sustainable manufacturing
Urban Development and Infrastructure	Benefits of sustainable waste management, waste reduction strategies, recycling and household action required to support waste management in urban areas	Urban planning is a major area of need, with rapidly growing cities and very few qualified planners in the country	Awareness of 'urban possibilities' for infrastructure and spatial planning throughout administrative activities Options for green growth compatible infrastructure, including green space and natural infrastructure, waste management, recycling and disposal and alternative transport; financing models and paths to deployment

Source: GGGI

Implementing green growth programmes could unlock relatively high earnings potential across sectors in Myanmar. With the country's growth potential strongly tied to improvements in labour productivity, renewable energy, ecotourism and recycling-based waste management are all examples of areas where green programmes can generate higher employment than 'brown' alternatives (Chhor et al., 2013). Vocational training programmes such as those outlines in table 11 can develop skills to prepare Myanmar's workforce to deliver these high-value jobs.

3.6.2   Recommendations

Mainstreaming green growth areas with Myanmar's National Comprehensive Development Plan (NCDP) will align green growth with core strategies across government ministries. The NCDP framework of policies, including the 2012-2015 Framework for Economic and Social Reforms, addresses environmental dimensions of growth (Republic of the Union of Myanmar, 2012). Most of Myanmar's sectoral and general development goals around reducing poverty, providing infrastructure and managing natural resources are also closely aligned with a green growth approach. An overarching green growth program that includes a role for ministries across sectors would make explicit these links and provide a reference for collaboration on green growth issues throughout government. As recommended in Box 26, in GGGI's work with individual ministries and parliament, GGGI could advocate for, and fund the development of, a formal green growth policy for Myanmar.

Box 26.   Recommendation: Strengthen public administration

– Align green growth objectives with economic development aims through a national green growth plan.
– For relevant sectors, introduce regional revenue sharing and develop best practices for investing local revenues in assets allowing for sustainable economic growth.

Successful implementation of a green growth agenda will require building capacity amongst the general population, labour force and the civil service. Table 13 outlines sector specific topics for each audience. Box 27 includes recommendations for building capacity to deliver green growth programmes in Myanmar.

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Box 27.   Recommendation: Build capacity to benefit from green growth solutions through education and training

- Integrate topics relevant to green growth and sustainable development in general education curricula throughout Myanmar, including ecosystem services, sustainable livelihoods, waste management, efficient use of resources and climate change.
- Introduce government-supported training programmes to build a workforce with the necessary skills to strengthen green growth, including guides for sustainable tourism, urban planners and organic farmers, in addition to other professions laid out in Table 13.
- Develop modules compatible with the Civil Service Academy and regional equivalents for environmental enforcement, air, soil and water quality monitoring, incorporating impacts of climate change into policy, sustainable finance and industrial development (including environmental standards and monitoring), as well as other topics identified in Table 13 and throughout this report.
- Deliver training material through in-person instruction where logistically feasible and via webinar to reach audiences, in particular those outside of Nay Pyi Taw.

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4 Conclusion

Myanmar is at a crucial point in its development, with an opportunity to pursue an ambitious economic transformation while conserving crucial environmental assets. As the results of GGGI's Green Growth Performance Assessment, this report has mapped the primary challenges facing Myanmar's development from a green growth perspective, and identified key sectors for green growth opportunities and provided options of how to implement them. Based on a combination of quantitative analysis and stakeholder consultation the key areas for this report were identified. These are:

education,
natural resource depletion,
poverty,
forest cover change, and
agricultural productivity.

While the country demonstrates huge potential for and active interest in green growth, the amount and scope of necessary reforms will require coordination across donors, civil society and government. A broad range of sectors were identified as necessary for a development following the principle of green growth. In many aspects, these sectors are highly interconnected, with changes and reforms in one sector directly impacting other sectors. This report reviewed in detail the challenges and opportunities across a number of sectors relevant for efforts towards sustainable development. Expert interviews, existing policy frameworks and existing evidence drawn from a wide range of literature have informed specific recommendations for the following sectors: agriculture, land use and forestry; energy; mining; industry, commerce and tourism; urban development and infrastructure, as well as cross-cutting sectors including public administration and education.

Myanmar's agriculture, forestry and land use sector is crucial to the country's economy, representing an important pillar of its economy and forest, in particular, representing a key natural asset. Over 70 per cent of the population lives in rural areas, where agriculture is the main livelihood, primarily in cultivating rice—with low profits and high demand for resources including water, labor and fertilizer. Suggested reforms include building capacity for crop diversification, organic farming practices and climate-smart agricultural techniques. The country has one of the highest levels of forest cover in the world, which is under threat from illegal logging, mining and other land use activities. Improved governance of forest resources through community forestry schemes and stronger enforcement of forest use concessions can preserve the vital ecosystem services provided by these forests. Ecotourism represent a significant opportunity to support human and economic development while protecting forests and other natural assets. Financial models which leverage ecotourism to support forest conservation have been successful in other countries in the region and should be studied in detail for application in Myanmar.

The energy sector in Myanmar is undeveloped compared to regional peers, presenting an important opportunity for leapfrogging conventional fossil fuel based technologies; but a course correction from current plans is required. The country's electricity access rate is low and increasing access is a top priority for government and development partners alike. Despite massive potential for affordable electricity generation from solar, wind and small-scale

hydropower, coal and other fossil fuels have been given a long-term commitment in national energy plans. A commitment to expand the national electricity grid to remote rural communities threatens to crowd out opportunities for off-grid electricity from renewable sources, which could rapidly deliver electricity essential for economic growth to areas with the greatest need. Interventions in this sector include shifting national priorities for energy and electricity supply to a more sustainable mix, encouraging support for renewable energy and identifying which technologies can best deliver electricity to areas which currently lack access at the lowest costs. As the national economy grows, energy efficiency measures can help to limit the accompanying rise in emissions. Specific policies and technologies appropriate for Myanmar should be the subject of further study.

Myanmar is the primary global supplier of jade and a significant source of other gems and minerals, but the larger population benefits little from these resources due to corruption and poor governance. Only 6% of the annual estimated jade exports are reported to the government while untaxed profits are supporting conflict and crime in the country, rather than fueling sustainable development. Institutions charged with overseeing the sector are dependent on the industry for funding and lack the capacity and geographic proximity for enforcement and effective taxation. The government is supportive of increased transparency in the sector and has partnered with EITI to develop reforms, but these must go further to achieve increase sustainability and social inclusion in the sectors. Recommendations in the mining sector include revisiting the governance structures around mining operations to incentivize enforcement and taxation, as well as investment of resource rents in long-term development of human, social and natural capital.

Industrialization is regarded as a promising strategy for economic development, but environmental standards must be implemented to ensure sustainability. The textile industry, in particular, is ambitious in its voluntary sustainability practices, but central coordination between users of shared natural assets is necessary to manage the impacts of pollution on shared air and water resources. The lack of a national pollutants database poses an immediate challenge to regulating industrial activity. Recommendations for the sector relate to establishing a system for regulating, monitoring and enforcing environmental standards for industrial activity. Mass tourism represents an important industry for economic growth but must be managed to minimize environmental impacts. Ensuring infrastructure and services – such as waste management, recycling and waste water treatment – are provided in pace with demand at various tourism sites is key to managing the sector's impact on the country's ecosystems.

As economic opportunities grow, so do Myanmar's cities. Cities such as Yangon and Mandalay are pressured by increasing urbanization and require planning and infrastructure to sustainably support large populations. Diverging interests of development partners present challenges in focusing on priorities in urban areas while government institutions lack capacity for managing urban growth across all levels. Congested transport systems, waste management and increasing flood risk are all challenges that should be addressed in Myanmar's cities. Recommendations for the sector include building knowledge and capacity for planning, financing and building sustainable urban infrastructure to cope with these challenges.

Education and public administration are crucial delivery systems for green growth in Myanmar. Establishing educational programs to support public participation in reforms and initiatives in other sector, developing the workforce needed for their implementation, and building capacity in the civil service for effective regulation and enforcement are all essential for ensuring a

development trajectory following green growth principles. Cross-cutting issues such as anticipating and adapting to climate change, resolving violent conflicts, fighting corruption and accessing finance for sustainable development must be considered in any green growth effort.

Myanmar finds itself at an important juncture in its development efforts and this report has identified high-level interventions to help steer the country toward a more sustainable development. By leveraging global expertise and coordinating amongst donor agendas, the GGGI can help Myanmar protect valuable natural assets while delivering inclusive and sustainable growth to its people. Recommendations provided here are often located at the policy level, reflecting the country's relatively young transition to democracy and an outstanding need to specify an initial policy framework for development. Following this report, the next step in GGGI's engagement in Myanmar is to develop a more in depth Country Planning Framework.

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Appendix

A.1   Consultation Workshop Participants List

Invited participants from Myanmar's national government included representatives from Parliament, Directors-General of 28 government departments, and 11 officials from the Ministry of Natural Resources and Environmental Conservation (MONREC). Representatives from 19 NGOs and commercial associations were invited, including international and local organizations. Four media organizations were also represented. Invited participants to the GGPA Myanmar workshop include representatives from organizations listed in Table 14.

Table 14.   Invited representatives to participate in the GGPA consultation workshop

Parliament
Chair, Parliamentary Oversight Commission on Legislative and Special Issues
Chair, Parliamentary Committee (Upper House) on Natural Resources & Environmental Conservation
Chair, Parliamentary Committee (Lower House) on Natural Resources & Environmental Conservation
Government
DG, International Organizations & Economic Dept. Ministry of Foreign Affairs
DG, General Administration Dept. Ministry of Home Affairs
DG, Information & Public Relations Dept. Ministry of Information
DG, Fisheries Dept., Ministry of Agriculture, Animal Husbandry & Irrigation
DG, Agriculture Dept., Ministry of Agriculture, Animal Husbandry & Irrigation
Rector, Yezin Agriculture Institute, Ministry of Agriculture, Animal Husbandry & Irrigation
DG, Water Resources Management & Development Dept., Ministry of Transport & Communication
DG, Meteorology & Hydrology Dept., Ministry of Transport & Communication
DG, Road Transport Dept., Ministry of Transport & Communication
DG, Myanmar Railways Dept., Ministry of Transport & Communication
DG, Hydropower Dept., Ministry of Electric Power & Energy
DG, Electric Power Planning Dept., Ministry of Electric Power & Energy
DG, Labour Dept., Ministry of Labour, Immigration & Manpower
DG, Industries Cooperation Dept., Ministry of Industry
DG, Industries Management & Inspection Dept., Ministry of Industry
DG, Trade Dept. Ministry of Trade & Commerce
DG, Human Resource & Planning Dept., Ministry of Education
DG, Research and Innovation Dept., Ministry of Education
DG, Public Health Dept. Ministry of Health and Sports
DG, Planning Dept., Ministry of Planning & Finance

DG, Investment & Companies' Administration Dept., Ministry of Planning & Finance

DG, Central Statistical Office, Ministry of Planning & Finance

DG, Relief & Resettlement Dept., Ministry of Social Welfare, Relief & Resettlement

DG, Hotel and Tourism Dept., Ministry of Tourism

DG, Urban Planning & Development Dept., Ministry of Construction

DG, Education & Training Dept., Ministry of Border Areas Development

DG, Ethnic Nationalities Affairs, Ministry of Ethnic Nationalities

DG, Law Review Dept., Attorney General's Office

DG, Forest Dept., Ministry of Natural Resources and Environmental Conservation

DG, Greening of Dry Zone Dept. Ministry of Natural Resources and Environmental Conservation

Managing Director, Timber Corporation, Ministry of Natural Resources and Environmental Conservation

DG, Land Records Dept., Ministry of Natural Resources and Environmental Conservation

DG, Environmental Conservation Dept, Ministry of Natural Resources and Environmental Conservation

Dr. Myint Oo, Rector, University of Forestry, Ministry of Natural Resources and Environmental Conservation

DG, Mines Dept., Ministry of Natural Resources and Environmental Conservation

DG, Geological Survey & Exploration Dept., Ministry of Natural Resources and Environmental Conservation

MD, Mining Corporation (No. 1), Ministry of Natural Resources and Environmental Conservation

MD, Myanmar Gems Corporation, Ministry of Natural Resources and Environmental Conservation

MD, Myanmar Pearl Production & Sales Corporation, Ministry of Natural Resources and Environmental Conservation

NGOs

Forest Resources Environment Development and Conservation Association (FREDA)

Biodiversity and Nature Conservation Association−BANCA

Wildlife Conservation Society (WCS) Myanmar Program

Ecosystem Conservation and Community Development Initiative (ECCDI)

Ecologically Progressive Ecosystem Development / Advancing Life and Regenerating Motherland (ECODEV /ALARM)

Renewable Energy Association Myanmar- REAM

Myanmar Engineers Society (MES)

Myanmar Environment Institute (MEI)

Myanmar Development and Research Institute (MDRI)

Comprehensive Development Education Centre (CDEC)

Professional Consultancy Research

World Wildlife Fund (WWF)
Myanmar Green Network
Institute for Global Environment Strategy-IGES
Green Economy Green Growth - GEGG Myanmar
Industrial Zone (Thilawa)
Fishery Businessmen Association
Mining Businessmen Association
Rice-mill Owners' Association
Media
Forest Department
Myanmar Radio & Television (government TV channel)
Myawaddy TV (military TV channel)
Skynet TV (privately-owned satellite TV)

A.2 Interview questionnaire

For all sectors identified in Table 5:

Table 15. Priority sectors and related green growth areas

Sector	Related Priority Areas	Interlinkages with other sectors
Forestry and Land-use	Natural Resource Depletion, Changes in Forest Cover, Agricultural Productivity	Energy and Mines, Agricultural Productivity
Education	Poverty, Education, Agricultural Productivity	Public Administration, Commerce
Agriculture and Fisheries	Agricultural Productivity, Natural Resources Depletion	Forestry and Land-use
Public Administration	Education, Poverty, *Health and Well-being*	Education
Energy and Mines	Natural Resource Depletion, Changes in Forest Cover, *Electricity Losses*	Forestry and Land-Use
Commerce	Poverty, Agricultural Productivity, Education	Education
Urban Development	Changes in Forest Cover, Education	
Transportation	Agricultural Productivity, Education	
Industry	Natural Resource Depletion	
Health Services	Education, Poverty	

Note: Italicized priority areas are additional to those identified by workshop participants, drawn from analysis of breakout group discussions

Source: Vivid Economics

The following interview questions should be asked:

1. Introduce GGPA, results from workshop and priority sector identification

The Green Growth Performance Assessment is an exercise led by the Global Green Growth Institute to support the government of Myanmar to set an agenda for green growth. *We have identified priority areas of green growth and related sectors in Myanmar and are exploring potential interventions to address these areas. Your sector [XXXX] was selected as one of the top sectors to focus on in Myanmar's green growth agenda.*

2. The following priority areas were identified as relevant for your sector: [XX, XX, XX]

From our initial research, your sector is important for improving the following areas of green growth:

–   [XX]
–   [XX]
–   [XX]

3. How do you see your sector impacting these areas and green growth in general, both positively and negatively?

4. What are existing policies to address the negative impacts and/or strengthen the positive impacts (identified above)?
   a) If such policies exist, are these policies effective? If not, in your opinion, how could they be more effective?
   b) If such policies do not exist, in your opinion what would be suitable policies/measures to address the negative impacts and/or strengthen the positive impacts (identified above)?
5. What initiatives or pilot projects would help the Myanmar government to improve outcomes related to green growth in these areas?
6. What barriers exist to implement these interventions?
7. What future barriers do you expect to appear to green growth in your sector?
8. How can present barriers be overcome? How can future barriers be avoided?
9. Are the initiatives and pilot projects you suggested earlier struggling to attract finance? If so, why?
10. Do you have ideas of how these initiatives or pilot projects might better attract finance?
11. Who would be best placed to implement the initiatives and pilot projects you suggested?
12. Has there been a noticeable impact on your sector from climate change?
13. How do you think climate change may impact activities in this sector in the future?
    a. Do you think Ministries within the Myanmar government will be able to coordinate to improve green growth indicators in your sector? How? Which Ministries are important to work with in your sector?
14. What actions, if any, are being taken to mitigate the impacts of climate change now and in the future?

For top 5 sectors in Table 1 (interlinkage-specific question):

1. We have identified other sectors that affect the same areas of green growth as your sector. We would like to understand how these sectors are related. We believe your sector is related to these: XX, XX, XX
2. What areas of interrelation do you see between your sector and the ones mentioned above?
3. Is there competition between sectors over resources to address priority areas?
4. What are the benefits to green growth from working together with other sectors?
5. What interventions can help stakeholders better understand these trade-offs and make efficient decisions?

A.3   List of Interviewed Experts

Table 16 includes a list of all in-country experts interviewed.

Table 16. Experts interviewed as part of GGPA

Sector	Expert	Affiliation
Forestry and Land-use	Dr Nyi Nyi Kyaw	Forestry, Ministry of Natural Resources and Environmental Conservation (MONREC)
	U Kyaw Kyaw Lin	
	U Tin Tin	
	Dr Thaung Naing Oo	
	Dr Naing Zaw Oo Tun	
	U Aung Win Tun	
	Win Myo Thu	CEO, ECODEV / ALARM
	Richard Holloway	EU FLEGT Project Director
Education	U Win Khaing Moe	Director General, Research and Innovation, Ministry of Education
Agriculture and Fisheries	U Maung Win	Rural Development, Ministry of Agriculture, Livestock and Irrigation (MOALI)
	Dr Khin Thida Myint	Yezin Agricultural University
	Duncan Boughton	University of Michigan
Public Administration	U Maung Win	Ministry of Planning and Finance
	U Thang Do Cin	
	Prof Sean Turnell	NLD Senior Economic Advisor (MDI) & Macquarie University
Energy and Mines	U Win Htein	Department of Mines, MONREC
	U Kyaw Thet	
	Hanna Helsingen	WWF
	David Levrat	Tractebel/Engie
	Shoon So Oo	WWF-Myanmar
	Hein Htet	Deputy Director General, Department of Hydropower Planning, Ministry of Electricity and Energy
Urban Development	Moe Kyaw Swar	Pollution Control and Cleansing, Naypyitaw City Development Council
Industry/Commerce	U Sein Htoon Lin	Environmental Conservation, MONREC
	U Than Aye	
	Kyaw San Naing	
	Dr San Oo	
	U Min Maw	Pollution Control, MONREC
	Matthew Baird	Vermont Law School

U Tint Thwin	
U Tin Myo Aung	
U Naung Naung Lin Aung	Ministry of Hotels and Tourism
U Yan Naing Win	
U Win Thein	
Excellency Salai Isaac Khen	Chin State Minister for Development Issues, Electricity, Industry and Tourism

Source: Vivid Economics and Spectrum

A.4 GGPA performance indicators for Myanmar

Raw Data for Myanmar and Lower Middle Income group

Theme	Sub-theme	Indicator	Unit	Myanmar	Lower Middle Income	Upper Middle Income
Resource Efficient Growth	Energy Efficiency	Energy intensity	MJ/USD	3.19	6.09	5.32
		Distribution losses of electricity	% of total	29	16.73	14.31
	Resource Productivity	Material Intensity	kg of domestic consumption / unit GDP	9.09	5.77	2.79
		Municipal Solid Waste Generation Intensity	kg of waste / unit GDP	0.042	0.11	0.05
		Recycling Rate of Solid Waste	% of waste generated	3.4	4.3	3.0
		Water Productivity	GDP/ m^3 of freshwater withdrawal	1.978	23.06	36.61
		Agricultural Land Productivity	USD / km^2	N/A	0.07	0.09
	Other Productivity Factors	Labor productivity	GDP (1,000 USD) per worker	2828	4,463	12,690
		Logistics performance index	1 – 5 (higher the better)	2.5	2.57	2.79
		Technological readiness	1 – 7 (higher the better)	2.16	3.16	3.84
Eco-Efficient Growth	Quantity of Natural Assets	Fish Stock	% of overexploited species in total catch	13.57	24.91	30.05
		Changes in forest cover	Annual rate of change (%)	-0.3	-0.2	0.11
		Water stress	0 – 5 (Higher the greater competition among users)	0.3	2.06	2.41
		Natural resources depletion	% of GNI	3.95	6.50	5.02
	Quality of Natural Assets	Threatened Species	Percentage of species	3.83	4.73	8.26
		Water quality index	0 – 100 (Higher the better)	45.73	55.71	57.26
		Trends in soil health	0 – 50 (Higher the better)	28.43	39.52	42.08

		Population-weighted exposure to PM2.5	micrograms per m^3	14.7	8.54	7.07
Climate Resilient Growth	Climate Change Mitigation	CO$_2$ emission trends	Annual growth rate (%)	-4.66	3.24	2.36
		Carbon Intensity	tCO$_2$. per unit GDP (USD)	0.000207	0.60	0.67
		Renewable energy production	% of total electricity production	0.43	4.08	3.19
		Carbon stock in living forest biomass	million tonnes / yr	-18.3	-9.48	2.98
	Climate Change Adaptation	Climate change exposure	0 – 1 (lower the less exposed)	0.9	0.50	0.49
		Climate change sensitivity	0 – 1 (lower the less sensitive)	0.38	0.48	0.41
		Adaptive capacity to climate change	0 – 1 (lower the higher adaptive capacity)	0.64	0.57	0.45
Socially Inclusive Growth	Quality of Life	Poverty headcount ratio at $1.90 a day (2011 PPP)	% of population	37.5	18.54	4.82
		Prevalence of undernourishment	% of population	14.2	14.42	8.78
		Healthy Life Expectancy at birth, total	years	59.1	59.81	64.55
		Net Primary Enrolment Rate	%	94.53	87.88	92.25
	Inequality	Gender Inequality Index (GII)	0 – 1 (higher the greater inequality)	0.41	0.49	0.36
		GINI Index	0 – 100 (higher the greater inequality)	29	39.02	41.30
	Governance	Corruption Perception Index (CPI)	0 – 100 (higher the less corrupt)	22	31.63	36.84
		Public Expenditure on Health and Education	% of GDP	3.8	6.60	7.35

Information on Indicator/Index

Theme	Sub-theme	Issue	Indicator	Unit	Description	Source
Resource-Efficient Growth	Energy Efficiency	Energy Intensity	Energy Intensity Level of Primary Energy	MJ / unit GDP	An indication of how much energy is used to produce one unit of economic output. It is the ratio between energy supply and GDP measured at purchasing power parity. Lower value indicates that less energy is used to produce one unit of output. (GDP: 2011 USD PPP) http://data.worldbank.org/indicator/EG.EGY.PRIM.PP.KD	WB
		Energy Loss	Electric Power Transmission and Distribution Losses	% of output	Losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage. http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS For Myanmar, data sourced from World Bank, 2016, Energizing Myanmar http://documents.worldbank.org/curated/en/938301468186274141/pdf/103332-WP-P158050-PUBLIC-energizingmyanmar.pdf	
	Resource Productivity	Material Intensity	Material Intensity	kg of domestic consumption / unit GDP	Refers to the quantity of material used to produce goods and services. It is the ratio between GDP and the total amount of domestic materials (construction/industrial minerals, metal, ores, fossil fuels and biomass) extracted. http://www.materialflows.net/data/datadownload (flow type "Extraction" flow sub-type "Used" reference parameter "Per GDP", GDP: constant 2005 USD)	SERI
		Waste Generation	Municipal Solid Waste Generation Intensity	kg of waste / unit GDP	Municipal waste is defined as the waste mainly produced by households, including also similar waste generated from sources such as commerce, offices and public institutions. The amount of municipal waste generated consists of waste collected by or on behalf of municipal authorities and disposed of through the waste management system. The indicator is the ratio between GDP (constant 2010 USD) and municipal solid waste generated. http://www.atlas.d-waste.com/ (for municipal solid waste generation) http://data.worldbank.org/indicator/NY.GDP.MKTP.KD (for GDP) For Myanmar, data sourced by Spectrum from a range of local studies	Dwaste, WB
		Waste Recycling	Recycling Rate of Solid Waste	% of waste generated	Recycling rate of municipal solid waste generated. http://www.atlas.d-waste.com/ For Myanmar, data sourced by Spectrum from a range of local studies	Dwaste
		Water Productivity	Water Productivity	GDP/ m^3 of freshwater withdrawal	Indication of the efficiency by which a country uses its water resources. Calculated as GDP (2010 USD) in constant prices divided by the annual freshwater withdrawal. http://data.worldbank.org/indicator/ER.GDP.FWTL.M3.KD For Myanmar, data sourced from most recently available data from the World Bank	WB

		Land-use Productivity (Agricultural)	Agricultural Land Productivity	USD / km²	Ratio between agricultural production and total area of arable land under permanent crops, and under permanent pastures. Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. http://faostat3.fao.org/download/Q/QV/E (gross production value constant 2004-2006) http://data.worldbank.org/indicator/AG.LND.AGRI.K2 (for further description of agricultural land)	FAO WB
	Other Productivity Factors	Labor Productivity	Labor Productivity	GDP / worker	GDP per worker of labor force (ages 15 and older who meet the ILO definition of the economically active population). http://www.ilo.org/global/statistics-and-databases/research-and-databases/kilm/lang--en/index.htm Indicator: Output per worker (GDP constant 2005 USD) For Myanmar, data sourced from most recently available data from the World Bank	ILO
		Logistics Performance	Logistics Performance Index	1 – 5 (higher the better)	Performance of countries in six areas that capture the most important aspects of the current logistics environment (efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time). http://data.worldbank.org/indicator/LP.LPI.OVRL.XQ http://siteresources.worldbank.org/INTLAC/Resources/ConnectingtoCompete.pdf For Myanmar, data sourced from most recently available data from the World Bank	WB
		Technology	Technological Readiness	1 – 7 (higher the better)	Aims to measure the agility with which an economy adopts existing technologies to enhance the productivity of its industries; the index covers the areas of (1) technological adoption (availability of latest technologies, firm-level technology absorption, FDI and technology transfer) and (2) ICT use (internet users, broadband internet subscriptions, internet bandwidth, mobile broadband subscriptions, mobile telephone subscriptions, fixed telephone lines). http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf	WEF
Eco-Efficient Growth	**Quantity of Natural Assets**	Fishing Pressure	Fish Stock	% of overexploited species in total catch	Fish Stocks measures the percentage of a country's total catch – within its exclusive economic zone (EEZ) - that is comprised of species that are overexploited or collapsed, weighted by the quality of fish catch data. http://epi.yale.edu/sites/default/files/2016EPI_Raw_Data_0.xls	EPI
		Forest Cover Changes	Changes in Forest Cover	annual change (%)	Annual percent change in forest cover between 2005 and 2015 (Definition of forest: Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use). http://faostat3.fao.org/download/R/RL/E For Myanmar, data sourced by Spectrum from a range of local studies	FAO

		Water Consumption	Water Stress	0 – 5 (higher the greater competition among users)	Ratio of total annual water withdrawals (municipal, industrial, and agricultural) to total renewable supply and the values are normalized from 0 to 5. http://www.wri.org/sites/default/files/aqueduct_coutnry_rankings_010914.pdf	WRI
		Natural Resource Depletion	Natural Resource Depletion	% of GNI	Sum of net forest depletion, energy depletion, and mineral depletion, as a percentage of GNI. Net forest depletion is unit resource rents times the excess of round wood harvest over natural growth. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. Mineral depletion is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. http://data.worldbank.org/indicator/NY.ADJ.DRES.GN.ZS	WB
	Quality of Natural Assets	Endangered Species	Threatened Species	Percentage of species	The number of threatened species, which are defined by IUCN divided by the total. http://cmsdocs.s3.amazonaws.com/summarystats/2016-1_Summary_Stats_Page_Documents/2016_1_RL_Stats_Table_5.pdf (Threatened Species) http://data.worldbank.org/indicator/EN.POP.DNST (Population Density)	IUCN
		Water Quality	Water Quality Index	0 – 100 (higher the better)	Uses three parameters measuring nutrient levels (Dissolved Oxygen, Total Nitrogen, and Total Phosphorus) and two parameters measuring water chemistry (pH and Conductivity) to understand levels of water quality. http://www.epi.yale.edu/files/2010epi_data.xls	EPI
		Soil Quality	Trends in Soil Health Index	0 – 50 (higher the better)	Measures the physical part related to loss of soil mass and structure; and the long-term chemical well-being of the soil in terms of nutrients and absence of toxicities built up. http://www.fao.org/nr/lada/index.php?option=com_docman&task=doc_download&gid=773&lang=en	FAO
		Air Quality	Population-Weighted Exposure to PM2.5	$\mu g / m^3$	Average exposure to PM2.5, particles less than 2.5 micrometers in diameter. http://epi.yale.edu/sites/default/files/2016EPI_Raw_Data_0.xls	EPI
Climate-Resilient Growth	Climate Change Mitigation	CO_2 Emissions	CO_2 Emission Trends	annual growth rate (%)	Annual growth rate in national emissions of CO_2 over the latest five years available. http://data.worldbank.org/indicator/EN.ATM.CO2E.KT	WB
		Carbon Intensity	Carbon Intensity	tCO_2 / unit GDP	Amount of carbon dioxide emissions (those stemming from the burning of fossil fuels and the manufacture of cement) per unit of gross domestic production (GDP: constant 2010 USD). http://data.worldbank.org/indicator/NY.GDP.MKTP.KD (for GDP) http://data.worldbank.org/indicator/EN.ATM.CO2E.KT (for CO_2)	

SIG					
				For Myanmar, data sourced from most recently available data from the World Bank	
		Renewable Energy	Renewable Energy Production	% of total electricity output	Share of electricity production from renewable energy in total production, including geothermal, solar, tides, wind, biomass, and biofuels, excluding hydroelectric. http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS For Myanmar, data sourced from the IEA and by Spectrum from a range of local studies	
		Carbon Stock Changes	Carbon Stock in Living Forest Biomass	annual change in million tonnes	Annual changes in carbon stock, which is a quantity of carbon contained in a reservoir or system of living forest biomass which has the capacity to accumulate or release carbon. http://www.fao.org/3/a-i4808e.pdf	FAO
	Climate Change Adaptation	Exposure	Climate Change Exposure	0 – 1 (lower the less exposed)	The degree to which a system is exposed to significant climate change from a biophysical perspective. It is a component of vulnerability independent of socio economic context. Exposure indicators are projected impacts for the coming decades and are therefore invariant overtime. http://index.gain.org/ranking/vulnerability/exposure For Myanmar, data sourced from German Watch, 2016, Global Climate Risk Index, https://germanwatch.org/en/cri	NDGAIN
		Sensitivity	Climate Change Sensitivity	0 – 1 (lower the less sensitive)	The extent to which a country is dependent upon a sector negatively affected by climate hazard, or the proportion of the population particularly susceptible to a climate change hazard. A country's sensitivity can vary over time. http://index.gain.org/ranking/vulnerability/sensitivity	
		Adaptive Capacity	Adaptive Capacity to Climate Change	0 – 1 (lower the higher adaptive capacity)	The availability of social resources for sector-specific adaptation. In some cases, these capacities reflect sustainable adaptation solutions. In other cases, they reflect capacities to put newer, more sustainable adaptations into place. Adaptive capacity also varies over time. http://index.gain.org/ranking/vulnerability/capacity	
SIG	Quality of Life	Poverty	Poverty headcount ratio at $1.90 a day (2011 PPP)	% of population	The percentage of the population living on less than $1.90 day. http://data.worldbank.org/indicator/SI.POV.DDAY For Myanmar, data sourced from World Bank, 2014, Myanmar – Systematic Country Diagnostic http://documents.worldbank.org/curated/en/871761468109465157/pdf/930500CSD0P150070Box385388B00OUO090.pdf	WB
		Hunger	Prevalence of undernourishment	% of population	The percentage of population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment). It shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS	WB
		Health and Well-being	Healthy Life Expectancy at birth, total	years	Average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury. Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. http://apps.who.int/gho/data/view.main.HALEXv	WHO

	Education	Net Primary Enrolment Rate	%	The number of children enrolled in primary school who belong to the age group that officially corresponds to primary schooling, divided by the total population of the same age group. http://data.uis.unesco.org/Index.aspx?queryid=145	UNESCO
Inequality	Gender Inequality	Gender Inequality Index (GII)	0 – 1 (higher the greater inequality)	The GII measures gender inequalities in three important aspects of human development — reproductive health, measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and economic status, expressed as labor market participation and measured by labor force participation rate of female and male populations aged 15 years and older. http://hdr.undp.org/en/composite/GII	UNDP
	Inequality	GINI Index	0 – 100 (higher the greater inequality)	The GINI index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. http://data.worldbank.org/indicator/SI.POV.GINI For Myanmar, data sourced from World Bank, 2014, Myanmar – Systematic Country Diagnostic http://documents.worldbank.org/curated/en/871761468109465157/pdf/930500CSD0P15007 0Box385388B00OUO090.pdf	WB
Governance	Corruption	Corruption Perception Index (CPI)	0 – 100 (higher the less corrupt)	The CPI scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of reputable institutions. https://www.transparency.org/cpi2015/results	TI
	Public Expenditure	Public Expenditure on Health and Education	% of GDP	Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Public expenditure on education (current, capital, and transfers) consists of government expenditure for all levels of education, and includes expenditure funded by transfers from international sources to government. http://data.worldbank.org/indicator/SH.XPD.PUBL.ZS (Public Health expenditure) http://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS (Government expenditure on education) For Myanmar, data sourced from World Bank Public Expenditure Report and updated with latest Government of Myanmar announcements	WB

A.5   Policies for green growth

Table 17.   Policies for priority sectors and related green growth areas

Sector	Key policies and strategic planning documents	Ministries responsible / Other bodies drafting
Cross-cutting	– Constitution of the Republic of the Union of Myanmar 2008 – National Comprehensive Development Plan 2015 – Myanmar Climate Change Strategy and Action Plan 2017 – Foreign Investment Law 2014 – State Owned Economic Enterprises law (1988/1989) – Myanmar Investment Law 2016 – National Sustainable Development Strategy 2008 – Myanmar Agenda 21, 1997 – Arbitration Law 2016 – National Environmental Strategic Framework – Environmental Conservation Law 2012 – National Environmental Policy 2017 – Environmental and Conservation Rules 2013 – National Environmental (Emission) Quality Guidelines 2008 – National Environmental Policy 2017 – National Conservation Law 2013 – National Environmental Quality (Emissions) Guidelines 2015 – Environmental Impact Assessment Procedures 2015 – National Strategic Plan for the Advancement of Women – Strategic Environmental Assessment for Hydropower – Baseline Study 2017 – Intended Nationally Determined Contributions – INDCs 2015 – Conservation of Water Resources and Rivers Law 2015 – National Water Resource Policy 2017/8 – National Social Protection Strategic Plan 2017 – Framework for Economic and Social Reforms 2013 – Green Economy Framework 2017 (draft) – Green Growth Strategy 2017 (forthcoming) – Waste Management Strategy 2016 – Master Plan for Hazardous Wastes 2016 (Sintef)	National Environmental Conservation and Climate Change Central Committee; Union government; State and regional governments
Land-use, forestry and agriculture	– National Environment Strategy Plan – National Agriculture Policy – Myanmar Forestry Policy 1995 – Agricultural Development Strategy	Ministry of Agriculture, Livestock and Irrigation; MONREC (Forestry); National Land Committee; State and regional governments; MCCA

	– National Biodiversity Strategy and Action Plan 2016 – National Land Use Policy 2016 – Land Acquisition Act 1894 – Vacant Fallow, Virgin Lands Management Law (2012) – Farmland Law 2012 – Protected area ecotourism plans – Various individual plans and management plans developed – National Action Plan for Food and Nutrition Security (draft) – Conservation of Water Resources and Rivers Law 2006 – Rural Development Strategy for Poverty Reduction Concept Note (5th) draft. – Seed Law 2012 – Pesticide Law 2016 – Fertilizer Law 2002 – Law Relating to Aquaculture 1989 – Freshwater Fisheries Law 1991 – Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law 1994 – New Generation of Plants (Seedling) Protection Law 2016	
Energy	– Petroleum Law 1937 – Electricity Law 2014 – Electricity Rules 2015 – Electricity Regulations (being drafted by ADB) – Grid Code 2017 (being drafted by MOEE) – National Electrification Plan 2014 (WB) – National Electricity Plan 2014 (JICA) – National Electricity Plan redraft 2017 (JICA) – Myanmar Electricity Vision 2015 – National Energy Policy (NEMC) – National Energy Master Plan 2016 (ADB) – National Energy Efficiency and Conservation Policy	Ministry of Agriculture, Livestock and Irrigation (Rural electrification); Ministry of Electrical Power and Energy; Ministry of Industry; National Energy Management Committee; State and regional governments
Mines	– Salt Enterprise Law 1992 – Pearl Law 1992 – Gemstone Law 1995 – Gems Law Second Amendment 2016 – Mining Law 1995 – Mining Rules 1996 – Mining Law 2014 (Draft) – EITI Report & Recommendations 2013-2014 FY	MONREC
Industry, commerce and tourism	– Foreign Investment Law 2012 – Foreign Investment Rules 2013 – National Export Strategy 2015-2019 – National Waste Management Strategy – Myanmar Tourism Master Plan 2013-2020	Ministry of Hotels and Tourism (eco-tourism); Ministry of Planning and Finance (fines for pollution); Ministry of Industry; State and regional governments

	– Myanmar Ecotourism Policy and Management Strategy – Myanmar Responsible Tourism Strategy 2012 – Policy on Community Involvement Tourism in Myanmar – Destination Management Plan for Inya Lake Region 2014-2019 – Sector Wide Impact assessments – Oil and Gas, Tourism, Mining, Telecommunications [MCRB] – National Strategy for the Development of Statistics (2016)	
Urban development and infrastructure	– National Planning Laws – Road Transportation Business Law 2016 – Railway Transportation Business Law 2016 – National Urban Policy – National Spatial Development Framework – National Transport Master Plan – Mandalay City Development Concept Plan Vision 2040 (ADB) – A Strategic Urban Development Plan of Greater Yangon 2014	Ministry of Planning and Finance; Ministry of Construction; State and regional governments
Education	– National Comprehensive Education Sector Development Plan 2017	Ministry of Education; State and regional governments
Public Administration	– National Framework for Community Disaster Resilience 2017 – National Action Plan for Disaster Risk Reduction 2012 – Civil Service Reform Strategic Action Plan 2017 – Medium Term Fiscal Framework 2015 – Budget Law yearly started from 2011-2012 FY – Citizen's Budget yearly from 2015-2016 FY – Public Debt Law 2015 – Revenue (Tax) Law 2016, 2017 – Code of Criminal Procedure Amendment 2016 – Payment of Wages Law 2016 – Shops and Establishments Law 2016 – National Planning Law, 2016-2017 – The Financial Institution Laws 2016	Ministry of Planning and Finance; State and regional governments

Source: *Vivid Economics*

About the Global Green Growth Institute

The Global Green Growth Institute was founded to support and promote a model of economic growth known as "green growth", which targets key aspects of economic performance such as poverty reduction, job creation, social inclusion and environmental sustainability.

Headquartered in Seoul, Republic of Korea, GGGI also has representation in a number of partner countries.

Member Countries: Australia, Cambodia, Costa Rica, Denmark, Ethiopia, Fiji, Guyana, Hungary, Indonesia, Jordan, Kiribati, Republic of Korea, Mexico, Mongolia, Norway, Papua New Guinea, Paraguay, Philippines, Qatar, Rwanda, Senegal, Thailand, United Arab Emirates, United Kingdom, Vanuatu, Vietnam

Operations: Cambodia, China, Colombia, Ethiopia, Fiji, India, Indonesia, Jordan, Lao PDR, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Nepal, Peru, Philippines, Rwanda, Senegal, Thailand, Uganda, United Arab Emirates, Vanuatu, Vietnam