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OECD Green Growth Policy Review of Indonesia 2019

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Preface

Indonesia's tropical and archipelagic landscape makes it one of the world's 17 megadiverse countries. It has one of the largest tropical forests in existence, as well as extremely rich coastal and marine ecosystems. Its fertile land and its resource endowments make it one of the largest producers and exporters of minerals, energy resources, timber and agricultural products. Indonesia's economic and social development since the 1997-98 Asian financial crisis has been impressive, with millions of people lifted out of poverty.

Economic success, however, has come at a high environmental cost. Deforestation and peatland burning are major sources of greenhouse gas emissions and drivers of biodiversity loss. Pollution from mining, industry and agriculture, as well as insufficient infrastructure for water supply, sewerage and solid waste management, is also putting pressure on Indonesia's unique natural capital. These pressures, if unchecked, will put Indonesia's economic success and the well-being of its citizens at risk.

The *OECD Green Growth Policy Review: Indonesia 2019* assesses progress in addressing these challenges. It provides 49 recommendations to help Indonesia move towards greener growth, with a special emphasis on the nexus of land use, ecosystems and climate change.

Indonesia should be commended for its efforts to integrate environmental sustainability into its national development planning. This is a key step for reaping the benefits of policies fostering both socio-economic and environmental goals. The shift from coal-based electricity to renewable energy sources is a case in point. The review argues that more and better use of green taxes and cost-reflective pricing for green infrastructure and services would further support the transition to a green economy. Well-designed social policies will be key in ensuring that reforms do not harm the most vulnerable.

Indonesia has already laid the groundwork for better land management. Among other measures, it has adopted moratoriums to slow conversion of peatland to agriculture; the One Map initiative to clarify the legal status of land; and social forestry programmes to improve community access to land. The government needs to keep monitoring these programmes to ensure that they lead to more sustainable management on the ground. This will require securing sufficient financial and human resources to build capacity, align sector policies and effectively co-ordinate action across government levels.

This review is the result of a constructive dialogue between Indonesia and the countries participating in the OECD Working Party on Environmental Performance. We stand ready to support Indonesia, an OECD key partner, in the implementation of the recommendations outlined in this report. I am confident that this collaborative effort will be useful in improving our understanding of how to tackle our many shared environmental challenges and move towards greener, more sustainable growth.

Angel Gurría

OECD Secretary-General

Foreword

The OECD Green Growth Policy Review (GGPR) was initiated in 2015 by Siti Nurbaya Bakar, Minister of Environment and Forestry of Indonesia, and Simon Upton, then the OECD Environment Director. The GGPR is one of the main activities in the OECD-Indonesia Work Programme 2017-18, launched in 2016 by Minister of Finance Sri Mulyani and OECD Secretary-General Angel Gurría. As the first of its kind, the report aims to review Indonesia's policy framework for green growth and provide recommendations to help the country move towards a green and sustainable economy.

The GGPR was developed within the same peer review framework applied to the OECD Environmental Performance Reviews. The principle aim of this programme is to support member and selected partner countries in improving their individual and collective performance in environmental management by:

- helping individual governments evaluate progress in achieving their environmental goals
- promoting continuous policy dialogue and peer learning
- stimulating greater accountability from governments towards each other and the public.

This report examines the state of Indonesia's environment and reviews the country's green growth performance since 2005. Progress in meeting domestic objectives and international commitments provides the basis for assessing the country's environmental and green growth performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. To the extent possible, assessment of environmental and green growth performance is based on the OECD Environment Statistics and OECD Green Growth Indicators. The assessment is also placed within the context of Indonesia's geography, endowment in natural resources, socio-economic conditions and demographic trends.

The OECD is indebted to the government of Indonesia for its co-operation in providing information; for the organisation of the review mission to Jakarta and Samarinda (2-10 May 2018), workshops held in Jakarta in November 2017 and May 2018 and the policy missions to Jakarta in November 2018; and for facilitating contacts both inside and outside government institutions. Particular thanks is due to the Ministry of Environment and Forestry, which co-ordinated the review from the Indonesian side under the leadership of Laksmi Dhewanthi, special advisor to the minister. We are also grateful to officials and experts from the other ministries of the GGPR core co-ordination group: the Ministry of National Development Planning, Ministry of Finance and Coordinating Ministry for Economic Affairs.

The report was managed by Nathalie Girouard, Head of the Environmental Performance and Information Division of the OECD Environment Directorate. Britta Labuhn co-ordinated the analytical content and Eija Kiiskinen the process. Chapters 1 and 2 were written by Britta Labuhn, with contributions from Jeremy Faroi on Chapter 1. Chapter 3

was written by Michael Mullan, with contributions from Jeremy Faroi and Will Symes. Eugene Mazur and Eija Kiiskinen provided valuable contributions. Carla Bertuzzi provided statistical support, Annette Hardcastle and Marielle Guillaud provided administrative support, Rebecca Brite copy-edited the report and Natasha Cline-Thomas supported communications and dissemination activities. OECD Environment Director Rodolfo Lacy led the policy mission to Jakarta in November 2018.

The preparation of the GGPR benefitted from a broad consultation process. Special thanks are due to the representatives of two examining countries, Elisabet Kock (Sweden) and Gabriel Henrique Lui (Brazil). We are also grateful to contributions from international partner organisations, including the Asian Development Bank, Climate Policy Initiative, Global Green Growth Institute, World Bank, World Resources Institute, the New Climate Economy project and Center for International Forestry Research, along with the Natural Capital Working Group of the Green Growth Knowledge Platform. The review team also consulted with experts in OECD member country embassies based in Indonesia. Several colleagues in the OECD Secretariat provided comments and feedback, including Gérard Bonnis, Peter Borkey, Nils Axel Braathen, Rafal Brykowski, Ivana Capozza, Nathalie Cliquot, Luisa Dressler, Jane Ellis, Andrés Fuentes Hutfilter, Katia Karousakis, Nicolina Lamhauge, Bérénice Lasfargues, Xavier Leflaive, Eeva Leinala, Christine Lewis, Patrice Ollivaud, Özlem Taskin and Kurt van Dender. The contributions of Aad van Bohemen and Kieran Clarke of the International Energy Agency, John Maughan and his colleagues of the Green Growth Knowledge Platform, Ann Jeanette Glauber and her colleagues of the World Bank Jakarta Office and Philip Gass of the International Institute for Sustainable Development are also gratefully acknowledged. Last but not least, we are thankful to Massimo Geloso Grosso and Yulianti Susilo of the OECD Jakarta Office, who provided invaluable support by facilitating collaboration between the review team and Indonesian partners throughout the process.

This report was made possible through voluntary contributions from Germany, Japan, Korea, the Netherlands, New Zealand, Norway, Sweden and Switzerland, as well as the MAVA Foundation through the Green Growth Knowledge Platform of the UN Environment Programme.

The OECD Working Party on Environmental Performance discussed the draft Green Growth Policy Review of Indonesia at its meeting on 12 February 2019 in Paris, and approved its Assessment and Recommendations. The review was also discussed by the OECD Environmental Policy Committee at its meeting on 13 February 2019.

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Reader's guide

Signs

The following signs are used in figures and tables:

.. : not available

– : nil or negligible

. : decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Israel*, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: Indonesian Rupiah (IDR)

In 2018, USD 1 = IDR 14 232.9

In 2017, USD 1 = IDR 13 380.9

In 2016, USD 1 = IDR 13 308.3

In 2015, USD 1 = IDR 13 389.4

Cut-off date

This report is based on information and data available up to January 2019.

Disclaimer

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Abbreviations and acronyms

AQI	Air Quality Index
B3	Hazardous and toxic materials (*bahan berbahaya dan beracun*)
BAPPENAS	Ministry of National Development Planning
BAU	Business as usual
CBD	Convention on Biological Diversity
CSR	Corporate social responsibility
DR	Reforestation Fund (Dana Reboisasi)
EEA	Essential ecosystem area
EEZ	Exclusive economic zone
EGS	Environmental goods and services
EIA	Environmental impact assessment
EQI	Environmental Quality Index
ERC	Ecosystem restoration concession
FiT	Feed-in tariff
FMU	Forest Management Unit
GHG	Greenhouse gas
HCV	High conservation value
HTW	Hazardous and toxic waste
IFT	Intergovernmental fiscal transfer
IPP	Independent power producer
ISPO	Indonesian Standard for Sustainable Palm Oil
IUCN	International Union for Conservation of Nature
KEN	National Energy Policy (Kebijakan Energi National)
LEPM	Law on Environmental Protection and Management
LPG	Liquefied petroleum gas (propane)
LULUCF	Land use, land-use change and forestry
MoEF	Ministry of Environment and Forestry
MoEMR	Ministry of Energy and Mineral Resources
MoF	Ministry of Finance
MRV	Monitoring, reporting and verification
MSW	Municipal solid waste
Mt CO_2 eq	Million tonnes of CO_2 equivalent
NDC	Nationally Determined Contribution

NGO	Non-government organisation
ODA	Official development assistance
OJK	Financial Services Authority (Otoritas Jasa Keuangan)
PDAM	Government-owned water utilities (*perusahaan daerah air minum*)
PES	Payment for ecosystem services
PLN	State Electricity Company (Perusahaan Listrik Negara)
PM	Particulate matter
PNBP	Non-tax state revenue (*penerimaan bukan pajak*)
PROPER	Program for Pollution Control, Evaluation, and Rating
PSDH	Forest Resource Rent Provision (Provisi Sumber Daya Hutan)
PSE	Producer support estimate
RAN-API	National Action Plan for Climate Change Adaptation
RAN-GRK	National Action Plan for Reducing Greenhouse Gas Emissions
R&D	Research and development
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RPJMN	National Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional)
RSPO	Roundtable on Sustainable Palm Oil
SDG	Sustainable Development Goal
SEA	Strategic environmental assessment
SEEA	System for Environmental-Economic Accounting
SOE	State-owned enterprise
SVLK	Timber legality information system (Sistem Verifikasi Legalitas Kayu)
TPES	Total primary energy supply
VA	Volt-ampere
VAT	Value-added tax
VOC	Volatile organic compound
WQI	Water Quality Index

Country abbreviations

Country	Code	OECD member	G20 member
Argentina	ARG		✓
Australia	AUS	✓	✓
Austria	AUT	✓	
Belgium	BEL	✓	
Brazil*	BRA		✓
Canada	CAN	✓	✓
Chile	CHL	✓	
China (People's Republic of)*	CHN		✓
Czech Republic	CZE	✓	
Denmark	DNK	✓	
Estonia	EST	✓	
European Union	EU		✓
Finland	FIN	✓	
France	FRA	✓	✓
Germany	DEU	✓	✓
Greece	GRC	✓	
Hungary	HUN	✓	
Iceland	ISL	✓	
India*	IND		✓
Indonesia*	IDN		✓
Ireland	IRL	✓	
Israel	ISR	✓	
Italy	ITA	✓	✓
Japan	JPN	✓	✓
Korea	KOR	✓	✓
Latvia	LVA	✓	
Lithuania	LTU	✓	
Luxembourg	LUX	✓	
Mexico	MEX	✓	✓
Netherlands	NLD	✓	
New Zealand	NZL	✓	
Norway	NOR	✓	
Poland	POL	✓	
Portugal	PRT	✓	
Russia	RUS		✓
Saudi Arabia	SAU		✓
Slovak Republic	SVK	✓	
Slovenia	SVN	✓	
South Africa*	ZAF		✓
Spain	ESP	✓	
Sweden	SWE	✓	
Switzerland	CHE	✓	
Turkey	TUR	✓	✓
United Kingdom	GBR	✓	✓
United States	USA	✓	✓

Notes: * marks OECD key partner countries.
ASEAN member countries: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

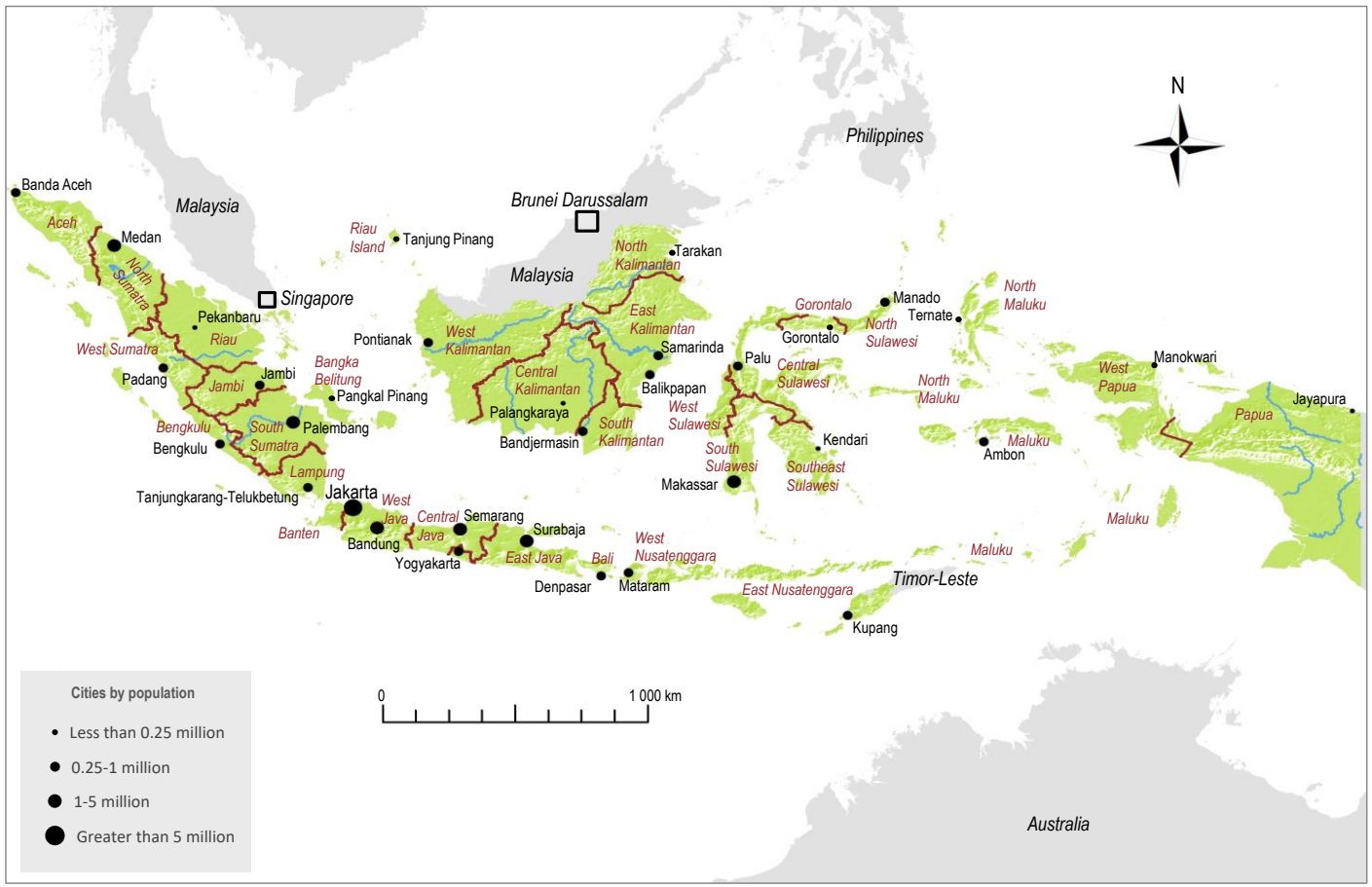
Basic statistics of Indonesia

2017 or latest available year (OECD values in parentheses)[a]

PEOPLE AND SOCIETY						
Population (million)		264		Population compound annual growth rate, latest 5 years	1.1	(0.6)
Share of population by area:	Urban (%)	55.2	(80.5)	Income inequality (Gini coefficient)	0.39	(0.32)
	Rural (%)	44.8	(19.5)	Poverty rate (% of pop. with less than 3.2 USD, 2011 PPPs)	36	
Population density per km^2		140	(35)	Life expectancy	69.1	(80.6)
ECONOMY AND EXTERNAL ACCOUNTS						
Total GDP (IDR, trillion)		13 589		Imports of goods and services (% of GDP)	19	(29)
Total GDP (USD, billion, current PPPs)		3 243	(56 613)	Main exports (% of total merchandise exports):		
GDP compound annual real growth rate, latest 5 years		5.1	(2.1)	Fuels	21.8	
GDP per capita (1 000 USD current PPPs)		12.3	(44)	Vegetables	17.5	
Value added shares (%):				Machinery and electrical equipments	8.5	
Agriculture		14	(2)	Main imports (% of total merchandise imports):		
Industry including construction		41	(25)	Machinery and electrical equipments	23.1	
Services		45	(73)	Fuels	17.8	
Exports of goods and services (% of GDP)		20	(29)	Chemicals	10.2	
GENERAL GOVERNMENT						
		Percentage of GDP				
Expenditure		17	(41)	Education expenditure	2.7	(5.2)
Revenue		14	(38)	Health expenditure	1.4	(7.8)
Gross financial debt		28	(112)	Environmental protection expenditure	0.2	(0.5)
Fiscal balance		-2.5	(-2.8)	Environmental taxes: (% of GDP)	0.8	(1.6)
				(% of total tax revenue)	7.7	(5.3)
LABOUR MARKET, SKILLS AND INNOVATION						
				Patent applications in environment-related technologies		
Unemployment rate (% of civilian labour force)		6.0	(5.8)	(% of all technologies):[b]	11.8	(9.5)
Tertiary educational attainment of 25-to-64 year-olds (%)		12	(37)	Environmental management	3.4	(4.2)
Gross expenditure on R&D (% of GDP)		0.1	(2.3)	Water-related adaptation technologies	0.4	(0.5)
				Climate change mitigation technologies	9.8	(7.1)
ENVIRONMENT						
Energy intensity: TPES per capita (toe/cap.)		0.88	(4.1)	Motor vehicle ownership (veh./100 inhabitants)	49	(63)
TPES per GDP (toe/1 000 USD, 2010 PPPs)		0.08	(0.11)	Water stress (abstraction as % of available resources)	8.7	(10)
Renewables (% of TPES)		34	(10)	Water abstraction per capita (m^3/cap./year)	663	(804)
Carbon intensity (energy-related CO_2):				Municipal waste per capita (kg/capita)[d]	249	(523)
Emissions per capita (t/cap.)		1.7	(9.02)	Material productivity (USD, 2010 PPPs/DMC, kg)	1.1	(1.9)
Emissions per GDP (t/1 000 USD, 2010 PPPs)		0.17	(0.24)	Land area (1 000 km^2):	1 812	(34 476)
GHG intensity:[c]				% of arable land and permanent crops	25	(12)
Emissions per capita (t CO_2 eq/cap.)		3.1	(11.9)	% of permanent meadows and pastures	6	(22)
Emissions per GDP (t CO_2 eq/1 000 USD, 2010 PPPs)		0.30	(0.31)	% of forest area	50	(34)
Mean population exposure to air pollution ($PM_{2.5}$), µg/m^3		16.7	(12.5)	% of other land (built-up and other land)	18.3	(34.3)

a) Values earlier than 2010 are not taken into consideration. OECD value: where the OECD aggregate is not provided in the source database, a simple OECD average of the latest available data is calculated.
b) Higher-value inventions that have sought patent protection in at least two jurisdictions. Average of latest 3 years.
c) Gross GHG emissions (excluding emissions/removals from land use, land-use change and forestry). Intensities of net GHG emissions in Indonesia were 5.6 t/capita and 0.53 t/USD 2010 PPPs (2017) and in the OECD 10.9 t/capita and 0.28 t/USD 2010 PPPs (2016).
d) Municipal waste defined according to Law 18/2008 and referring to urban areas.
Source: Calculations based on data extracted from databases of OECD, IEA/OECD, EUROSTAT, IMF and the World Bank.

Administrative map of Indonesia



Source: OECD.

Executive summary

Indonesia is the world's fourth most populated country and largest archipelagic one. Economic growth has averaged more than 5% per year since the 1997-98 Asian financial crisis, raising per capita income and reducing poverty. Natural resources have been a pillar of this growth, accounting for 20% of GDP and 50% of exports in 2017. Yet strong economic development, population growth and rising living standards have increased demand for land, energy and other resources, as well as pressures on the environment.

Being among the world's largest greenhouse gas emitters, Indonesia plays an important role in addressing climate change. It aims to reduce its emissions by at least 29% compared to a business-as-usual scenario by 2030. Better land management is key to achieving this, as deforestation and loss of carbon-rich peatland form one of the main sources of emissions. Accelerating the use of renewable energy sources, which has declined to 10% of total energy use, is another key strategy to help Indonesia meet its climate goals, particularly since emissions from energy use are expected to continue to rise, reflecting growing demand and plans to significantly increase coal use.

Indonesia plans to make its 2020-24 national development plan its first low-carbon one. This is an opportunity to better align sector policies with environmental sustainability. The plan aims to tackle some of the most pressing environmental challenges, including loss of forest and peatland, waste generation exceeding management capacity, water resource depletion and water pollution. Addressing these will require capacity building and institutional strengthening. Better aligning the tax system with environmental objectives and the polluter-pays principle would make the transition more cost-effective. The absence of carbon pricing, for example, combined with low energy taxes and fossil-fuel subsidies, discourages energy saving and the shift to cleaner energy sources. Similarly, low retail tariffs discourage investment in waste, water and sewerage infrastructure. Direct social assistance and income support would be a more effective way to address poverty and affordability concerns. Indonesia is to be commended for its success in better targeting some energy subsidies to poor and vulnerable households, which helped cut subsidies from about 30% to 10% of central government expenditure over 2014-16.

Achieving a sustainable land sector is pivotal for green growth. In addition, the natural environment and archipelagic landscape are deeply rooted in Indonesia's cultural identity. However, natural resource-based activities, such as mining, agriculture, forestry and fishery, put serious pressure on ecosystems. Annual deforestation remains among the world's highest, threatening Indonesia's unique and globally important biodiversity. Better balancing economic, social and environmental objectives in land use has become a government priority. About 7% of land has been allocated to providing local communities with legal access to land. Indonesia has stepped up efforts to clarify land rights and strengthen law enforcement. Moratoriums on use of primary forest and peatland, as well as timber and palm oil certification programmes, help protect valuable ecosystems. Expansion of protected areas and use of payments for ecosystem services offer good potential to complement these efforts.

Assessment and recommendations

The assessment and recommendations present the main findings of the OECD Green Growth Review of Indonesia and identify 49 recommendations to help Indonesia make further progress towards greening its economy. The OECD Working Party on Environmental Performance reviewed and approved the assessment and recommendations at its meeting on 12 February 2019.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1. Key environmental trends: An overview

Indonesia is the world's fourth most populated country, and the largest archipelagic one. It possesses extensive tropical rainforests, which are home to some of the highest levels of biodiversity in the world. It is also endowed with vast energy and mineral resources. Economic and social progress since the 1997-98 Asian financial crisis has been remarkable. Gross domestic product (GDP) has grown by more than 5% annually since the turn of this century, the poverty rate has been halved, living standards are rising and access to public services is improving. Natural resources are a mainstay of the economy, accounting for more than 20% of GDP and 50% of exports in 2017, and providing the livelihood of a large share of the population.

As in other emerging economies, fast development has increased environmental pressures from growing demand for land, water, materials, energy and transport. Although Indonesia has made progress in decoupling its strong economic growth from environmental pressures, unsustainable extraction of natural resources, pollution and environmental degradation remain serious challenges. The development of transport, waste management and water supply and sanitation services has not kept pace with population growth and urbanisation, creating environmental, economic and health costs, especially for vulnerable and poor people. Indonesia faces the complex challenge of maintaining strong and inclusive growth while addressing environmental pressures and risks that, if unchecked, will impede economic growth, development and citizens' well-being.

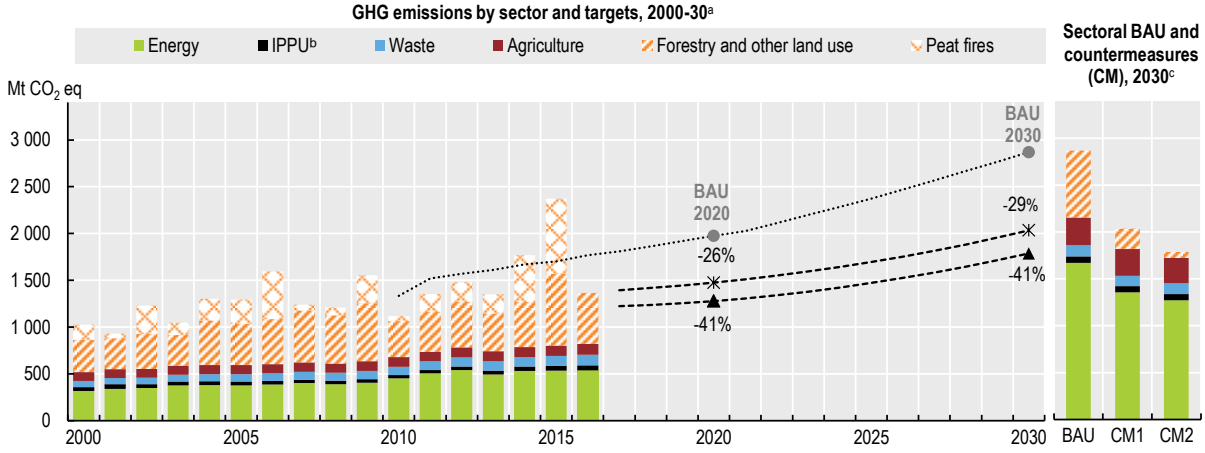
The natural environment and archipelagic landscape are deeply rooted in the country's cultural identity. Its tropical rainforests are home to iconic species, such as the orangutan and Sumatran tiger, and provide the livelihood of numerous traditional communities. Indonesians seem generally satisfied with their country's state of environment (BPS, 2018) in spite of the challenges the country is facing. Continued efforts appear to be needed to enhance public awareness about the state of the environment, the carrying capacity of nature and its ability to provide ecosystem services, as well as the economic and health costs of environmental degradation. Dedicated campaigns and the integration of environmental education into school curricula, as has been done under the Green School programme, could help raise awareness. Efforts to strengthen the knowledge base and publicly disclose information on the state of the environment need to continue. In a welcome step, in July 2018 the government published a comprehensive report, *The State of Indonesia's Forests 2018*. The authorities should also consider reviving regular State of the Environment reports (last published in 2014) and ensure regular publication of consistent reports at provincial level.

Accelerating climate change action to achieve mitigation targets

Indonesia plays an important role in meeting the international goal of keeping the global temperature rise to 2°C above pre-industrial levels. The country is among the world's ten largest greenhouse gas (GHG) emitters (WRI, 2018). Its emission intensity is nearly twice the OECD average.[1] Indonesia's GHG emissions, including land use, land-use change and forestry (LULUCF), have risen by 42% since the turn of the century and are projected to grow even faster over the next 15 years under a business-as-usual (BAU) scenario (Figure 1) (MoEF, 2018a). This increase was driven by rising emissions from the energy and land-use sectors. Land-based emissions, mostly from forest and peat fires (Section 4), account for nearly half of total GHG emissions.

In 2009, Indonesia voluntarily pledged to reduce emissions by 26% from a BAU scenario by 2020 (and up to 41% conditional on international support). This was followed by a commitment to reduce emissions by 29% below BAU by 2030 (and up to 41% conditional on international support) in its Nationally Determined Contribution (NDC). The government has reported that Indonesia is on track to meet its 2020 target. At the same time, it acknowledged that more effort was needed to bring emissions from forestry and energy on track with the 2030 target (MENKO, 2018). Indonesia is yet to commit to a long-term emission reduction target beyond 2030, as called for in the Paris Agreement. The development of emission scenarios for beyond 2030 has, however, started.

Figure 1. Indonesia needs to accelerate climate action to achieve its 2030 mitigation targets



a) 2020 and 2030 targets refer to unconditional mitigation scenario and conditional mitigation scenario according to the business-as-usual (BAU) projections from the National Determined Contribution and Second Biennial Updated Report submitted by Indonesia to the United Nations Framework Convention on Climate Change.
b) Industrial processes and product use.
c) Forestry and other land use includes peat fires.
Source: MoEF (2018), *Second Biennial Updated Report under the United Nations Framework Convention on Climate Change.*

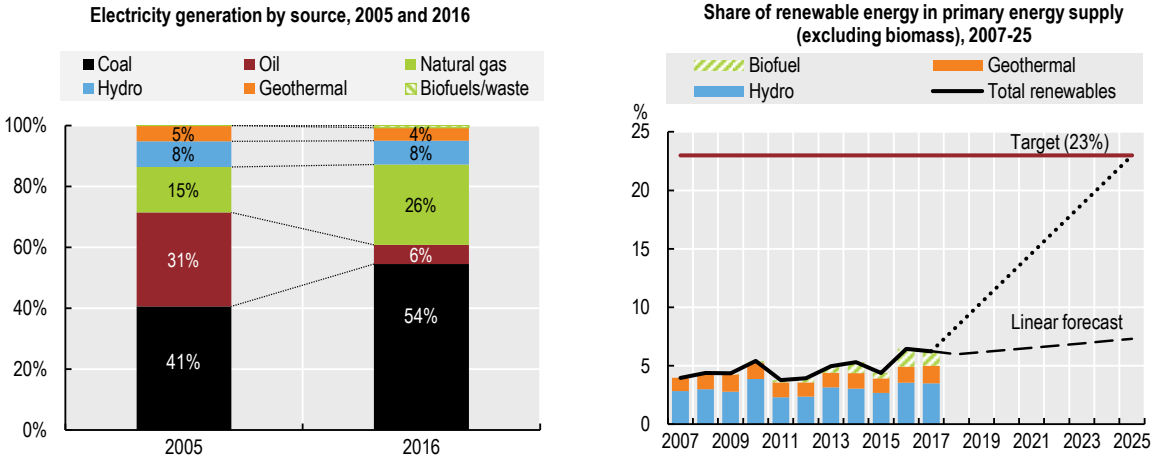
StatLink http://dx.doi.org/10.1787/888933930860

Most GHG emission reductions are expected to come from cuts in land-based emissions. Indonesia has made considerable progress in addressing such emissions, including through updated forest and peat regulations (such as a moratorium on new land use change permits on peatland and new regulations on peatland protection and management), establishment of the Peatland Restoration Agency, better law enforcement, social forestry programmes and efforts to control and prevent fires (Section 4). Thanks to such initiatives, the forestry sector was the biggest contributor to emission reduction in 2016 and 2017. Still, the target is ambitious (reaching close to zero net emissions in 2030 under the 41%-reduction scenario) and will require continued improvement in forest governance and compliance with land-use regulations.

Efforts to decarbonise the energy sector need to be accelerated. Energy demand is growing rapidly as GDP, the population, living standards and energy access all increase. The energy supply heavily relies on fossil fuels, and GHG emissions from the sector are projected to more than double by 2030, even in the most ambitious reduction scenario (Figure 1). Indonesia is one of the world's largest coal producers, and generates more than half its power from coal (Figure 2). This, combined with the fact that most plants use low-efficiency technology, makes Indonesia's power sector one of the most carbon-intense (IEA, 2018). While an increasing number of countries have committed to phase out

unabated coal,[2] Indonesia's 2014 National Energy Policy envisages nearly doubling its use by 2025 (compared to 2015 levels) to achieve affordable electricity supply for all. This puts coherence with climate change objectives into question and creates a risk of stranded assets at large scale. While the government supports the development of renewables (Section 3), they need to expand much faster to meet the target of 23% of energy supply by 2025 (Figure 2). The government plans to review its energy policy to reconcile the energy security and low-carbon development objectives.

Figure 2. The expansion of renewable energy sources has been slow



Source: IEA (2018), *IEA World Energy Statistics* (database); MoEMR (2018), *2018 Handbook of Energy & Economic Statistics of Indonesia*.

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The overarching framework for Indonesia's climate strategy is the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK), adopted in 2011 to implement its 2009 voluntary mitigation pledge. The NDC sets the post-2020 framework. An inter-ministerial committee headed by the president was created to co-ordinate climate action, but was later merged with the REDD+ agency to become a permanent directorate general in the MoEF to make co-ordination of climate change policies more effective. All provinces have developed action plans for reducing GHG emissions.

The government is reviewing the RAN-GRK in the context of the new 2030 commitment made under the NDC. It plans to align all sector mitigation targets with broader development objectives under the next medium-term national development plan for 2020-24, under the Low Carbon Development Indonesia initiative. This is complemented by initiatives to strengthen green budgeting and climate finance (Section 3). Continued efforts are needed to strengthen Indonesia's national carbon accounting system in order to build a strong monitoring, reporting and verification system that would allow Indonesia to track progress and evaluate the effectiveness of climate policies. This includes improving the calculation of GHG emissions, the annual baseline and sector reduction targets (MENKO, 2018). Efforts are also needed to synchronise and improve the quality of provincial GHG emission data. In addition, the government plans to introduce an emission intensity target to better track the balance among economic, social and environmental objectives under the low-carbon development initiative.

Indonesia's geographical and socio-economic conditions make it very vulnerable to natural disasters, including extreme weather and climate change (MoEF, 2017). The OECD

projects that overall climate change damage will reach about 2.3% of GDP by 2060. The National Action Plan for Climate Change Adaptation (RAN-API), adopted in 2014, is under review. Development of provincial action plans has been slow, with only 8 out of 34 provinces having adopted one by 2018. In 2016, the MoEF issued a ministerial regulation providing guidance for the formulation of local adaptation action plans. A vulnerability index is being prepared and could inform the development of a comprehensive evidence-based strategy including milestones that can be monitored and broken down subnationally. Nearly 2 000 villages have participated in the government's Climate Village Programme, adopted in 2012, which aims to enhance communities' resilience to climate change impacts and reduce their GHG footprint by promoting low-carbon lifestyles.

Developing a comprehensive strategy to address air pollution

According to OECD data, 95% of the population was exposed to harmful levels of air pollution (above the WHO guideline value) in 2017 (OECD, 2018a). Air pollution caused an estimated 215 deaths per million inhabitants in 2017 (OECD, 2018a). Transport, coal-fired power generation and waste burning are major sources of pollution. Forest and peat fires have been driving year-to-year variability and pollution peaks across Indonesia and neighbouring Malaysia and Singapore, although efforts to reduce fires have started to bear fruit (Section 4). National data on ambient air quality are based on small samples, but efforts are under way to install continuous monitoring equipment in all major cities (to reach 40 cities in late 2018). A new electronic environmental reporting system for industrial facilities should broaden data collection on air emissions and could, in the medium term, help in the establishment of a comprehensive air emissions inventory.

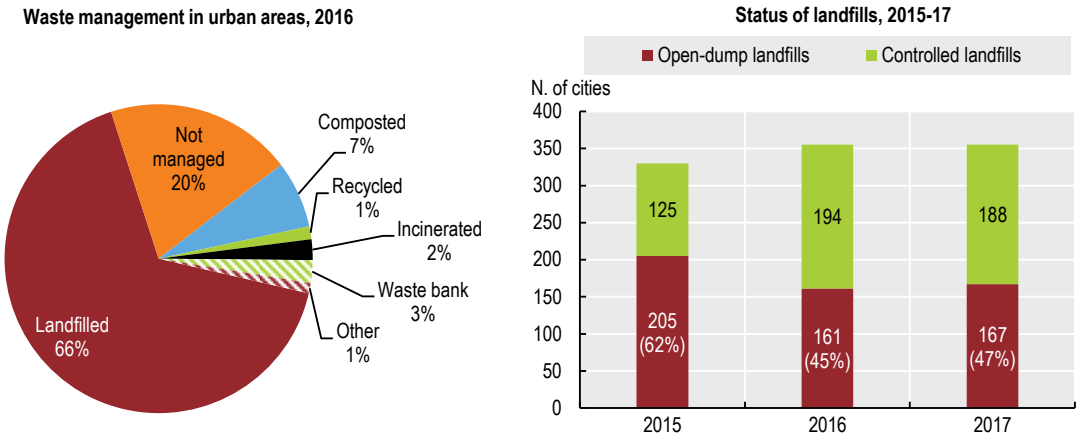
Policy efforts to improve air quality focused on reducing industrial emissions and promoting sustainable urban transport. In 2017, the MoEF signed a long-awaited regulation stipulating Euro 4 emission standards for passenger cars, buses and trucks. Testing and enforcement of existing standards remain a challenge, however. The capital city, Jakarta, is leading the way, stepping up action to test vehicle emissions and better enforce standards. It also holds air quality forums with stakeholders, procures waste management trucks running on natural gas and restricts vehicle circulation through an odd-even system and car-free days, in addition to expanding public transport and electronic road pricing on highways. These measures will bring valuable lessons for other cities and provinces. National emission standards for the cement industry were raised in 2017. Standards for coal-fired power plants and the pulp and paper industry remain significantly less stringent than international standards. The government plans to introduce stricter standards for coal-fired power plants in 2019.

Narrowing the gap between legal waste provisions and actual practice

Indonesia has a good legal basis for waste management. The 2008 National Solid Waste Act calls for sound waste handling (collection, transport and landfilling) based on the "3R principle" (reduce, reuse and recycle) and mandates implementation of waste segregation. However, more effort is needed to close the gap between legal provisions and actual practices. On average, 30% of solid waste is not collected and managed. Several areas lack public waste service. Collected waste mainly ends up in landfills, nearly half of which are uncontrolled open dumps (although the number is decreasing) (Figure 3). The associated contamination of soil, air and water has severe environmental, economic and public health consequences that go beyond boarders. Indonesia is a major contributor to plastic marine debris, largely due to improperly disposed waste from land.

The government is stepping up efforts to address these challenges. The National Solid Waste Management Policy and Strategy aims to reduce 30% of waste by 2025 and properly manage the remainder. It requires local authorities to develop waste management strategies for 2025 (less than half of cities and regencies have waste strategies) and to regularly report on progress. Capacity building will be needed to help local governments develop achievable plans linked to local budgets and sustainable financing and investment strategies. The central government provides funding for waste infrastructure (such as sanitary landfills), but local capacity constraints have meant that facilities turned into open dumps over time. Improving information collection and statistics will be important for informing policy making and tracking progress.

Figure 3. Waste is mostly landfilled, and half of landfills are not environmentally sound



Source: MoEF (2017), *Peran Pemerintah Daerah Dalam Pelaksanaan Mitigasi Emisi Gas Rumah Kaca Sektor Limbah* [The role of the regional government in the implementation of GHG reduction targets in the waste sector].

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Waste banks (where people trade their waste against small amounts of money) have proved to be an innovative and effective tool to speed up the improvement of municipal waste services. With support from the national and provincial governments, almost 7 500 banks had been created across the country by early 2019, handling 2% of waste generated nationally. The banks are helping to raise public awareness and to promote waste segregation and the development of recycling capacity. They also generate socio-economic value by creating job opportunities and engaging the large workforce that is involved in informal recycling. Several successful pilot projects focus on improving local waste management. The challenge is to improve the situation at scale.

A recent decision by the People's Republic of China (hereafter "China") and other countries to restrict waste imports may increase waste flows to Indonesia (whose law allows for the import of a limited amount of non-hazardous plastic waste), presenting an opportunity to strengthen local markets, but also accentuating the need to scale up environmentally sound waste treatment facilities. Dedicating more resources to inspections, improving the permitting system (e.g. through stronger reporting obligations for operators handling waste) and setting administrative fines for unlawful practices could help strengthen enforcement. The MoEF is preparing a draft regulation on the development of a ten-year roadmap for extended producer responsibility programmes. Following good results from a pilot project, Indonesia also plans to introduce an excise tax on plastic bags.

These plans should be speeded up and complemented by extended producer responsibility programmes for waste posing high risk to the environment, such as batteries, tyres and electronic waste. Involving the informal sector in such programmes and in the broader recycling infrastructure will be a critical success factor.

Developing a national inventory of hazardous waste and chemical substances

More attention needs to be given to hazardous waste management. Indonesia has only one private engineered hazardous waste landfill (located in West Java). Most hazardous waste is temporarily stored by industries on site, subject to licensing provisions under the 2009 Environmental Protection and Management Law. Verification of storage conditions has been challenging due to a general lack of resources, and it is unclear what happens to the waste once the storage permit expires (MoEF, 2015a; MoEF, 2015b). Knowledge on hazardous waste management has improved (the number of companies monitored rose from 39 to 295 over 2012-16), but continued improvement is needed. Additional hazardous waste treatment infrastructure in other parts of the country could facilitate proper management. The government has increased resources to control medical waste from hospitals, which is often disposed of in municipal landfills, and has built the country's first medical waste incinerator in South Sulawesi province.

Indonesia has ratified all major international chemical conventions. As the chemical sector plays an increasingly important role in the economy, there is a need to improve data on chemicals. For example, data on the production of chemicals in Indonesia are limited. Also lacking are a comprehensive assessment of existing chemicals and data on pollutant releases. Regulations address only a small subset of hazardous substances among what likely amounts to thousands of chemicals used in the Indonesian market, and information requirements are limited (e.g. one-time registration and provision of a safety data sheet). There appears to be a need for a stronger regulatory framework that would allow for development of an inventory of chemical substances manufactured or imported in Indonesia. This in turn, in the medium term, would allow Indonesia to address pressures, carry out systematic investigation and undertake risk management of chemicals.

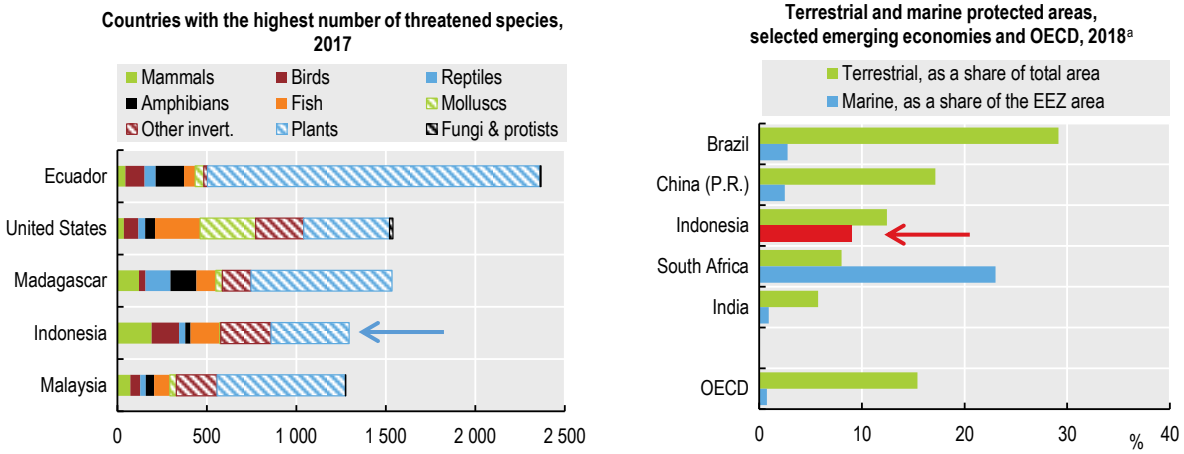
Accelerating implementation of the biodiversity strategy

Indonesia is globally important as a centre for biodiversity. It is home to one of the world's largest tropical forests, some 10-15% of global flora and fauna species and some 18% of global coral reefs and mangrove habitats (CBD, 2018; Dirhamsyah, 2016). Its ecosystems face significant pressures from habitat loss due to deforestation and forest degradation, pollution, overexploitation, including for wildlife trafficking, invasive alien species and climate change (MoEF, 2014). Indonesia has lost 7% of its forests since 2005, the second largest area in absolute terms, after Brazil (FAO, 2018). In addition, it registers one of the highest rates of species decline worldwide (Waldron et al., 2017). Terrestrial and marine protected areas covered 12% of land and 2.8% of marine area, below the respective targets of 17% and 10% (Figure 4), and effective management remains a challenge. Additional land is protected in "protection forests", "essential ecosystem areas" and "high conservation value forests" (Section 4).

The Biodiversity Strategy and Action Plan 2015-20 aims to address some key challenges for effective conservation, such as weak monitoring and evaluation at local level, insufficient human capacity, low political priority and lack of stakeholder participation (MoEF, 2014). The government is partnering with local communities to enhance effective management. Developing eco-tourism could be another means of expanding and better

resourcing protected areas (OECD, 2018b). The national list of protected species was recently updated to more than 900 species, and 272 monitoring stations have been set up to monitor 25 priority species with a view to increasing their population by 10%. Indonesia has also strengthened efforts to combat illegal wildlife trafficking.

Figure 4. Protected areas could be expanded



Source: IUCN (2018), "Table 8a", IUCN Red List version 2018-1; OECD (2018), "Biodiversity: Protected areas", *OECD Environment Statistics* (database).

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Improving monitoring of groundwater levels and enforcement of permits

Freshwater resources are abundant, but unequal distribution, growing water demand and poor management are creating water stress in some areas. Land-use change (notably deforestation) is contributing to both water stress and flood risk, which are projected to increase under continued urbanisation, economic growth and climate change. Indonesia seeks to achieve water security through watershed restoration and conservation and development of reservoir and irrigation networks.

Indonesia is one of the ten largest groundwater-consuming countries (ADB, 2016a). Limited water supply infrastructure and polluted surface water have forced households and businesses to rely on groundwater. Large users must have an extraction permit, but awareness and enforcement of this requirement are often low. Illegal wells are common, and industrial water abstraction is not monitored (OECD, 2016). In a welcome step, the Jakarta government has announced to plans improve enforcement action for high-rise buildings. Small water providers (e.g. small-scale commercial or community-based groups) are not regulated. Given their overall number, the lack of regulation may threaten the sustainability of groundwater management in the long term. Over-extraction of groundwater has had wide-ranging consequences, including infiltration of saltwater and land subsidence (e.g. in Jakarta, Semarang and Bandung).

Expanding and improving sanitation facilities to reduce water pollution

Freshwater quality is poor and has declined over the past decade. Half of the rivers of Java, the most populated island, are considered polluted or heavily polluted. Wastewater from households (untreated domestic sewage) is the main source of water pollution, followed by solid waste disposal, industrial effluent, mining, agriculture and urban run-off. Monitoring

on wastewater effluent is generally weak, but it is estimated that just 14% of wastewater is treated (OECD, 2016; ADB, 2016b). Various policy initiatives to reduce pollution discharge have achieved encouraging results, but their scale has been too small to significantly improve quality of the targeted rivers (MoEF, 2016a).

Access to improved water and sanitation has increased, although access rates are still low compared to other Southeast Asian countries. The government's indicative target is to reach 90% access to improved sanitation (including 20% safely managed sanitation) and 75% access to improved water by 2024. Promoting off-grid technology (septic tanks, decentralised sanitation), improving quality of septic tanks and supporting investment in small-scale projects may be the best way forward, with investment in piped infrastructure being part of the solution in the medium to longer term. Continued efforts are needed to enhance the capacity of regulators and water suppliers at the local level. Treating wastewater is especially key since reclaimed water can be an alternative to groundwater, thus limiting depletion. Developing comprehensive strategies and policies for urban water supply, sanitation and urban wastewater management at the national and subnational levels would greatly aid in achieving targets in this sector.

Box 1. Recommendations on climate change, air, waste, water and environmental information

Climate change

- Continue to develop a national climate change strategy under the Low Carbon Development Indonesia initiative to address the 2030 target and beyond. Integrate the 2030 target into the national development plan for 2020-24 (as planned) and ensure that the long-term goals are broken down into short-term goals and clear responsibilities among actors. Strengthen capacity for assessing mitigation options, including their economic, environmental and social impact.
- Continue to improve the quality of GHG emission data (both sectoral and provincial), annual baselines and sectoral mitigation targets in order to establish a credible reference making it possible to track progress and assess the effectiveness of climate policies.
- Revise national energy policy to ensure consistency with climate change policy. Guide the energy transition through an emission reduction goal for the power sector, supported by market-based instruments, to reduce its carbon intensity (e.g. through carbon pricing). Ensure that any new coal power plants are high-efficiency plants, that existing plants are refurbished and that the most inefficient plants are phased out. Plan for halting investment in unabated coal by 2030.

Air management

- Continue to develop air quality monitoring systems. Expand information on air emissions from stationary sources and start to systematically collect data on emissions from mobile sources. Make the data publicly available and, in the medium term, work towards establishment of a national air emission inventory.
- Develop a comprehensive and integrated strategy to address air pollution that covers all major pollution sources, with priority actions including i) updating emission standards for heavily polluting sectors such as coal-fired electricity generation and pulp and paper; ii) strengthening and enforcing vehicle emission

and fuel quality standards; iii) promoting vehicle electrification, notably for motorcycles; v) protecting and investing in natural capital that contributes to the ecosystem service of air filtration; and iv) ensuring effective implementation of local clean air programmes in areas regularly exceeding air quality standards.

Waste management

- Accelerate efforts to expand formal waste collection services to reach 100% of the population. Phase out open dumps and ensure that landfills meet environmental standards. Increase investment in waste disposal capacity, in line with projected future demand, and ensure that new infrastructure captures GHG emissions.
- Formalise waste sorting and recycling, for instance through continued involvement of the informal sector in waste banks and by providing training and social empowerment (e.g. through co-operatives).
- Implement extended producer responsibility programmes for the most harmful and abundant products to limit the need for new disposal capacity, and reduce the environmental and health problems associated with improper management of dangerous waste. Consider supporting the construction of hazardous waste treatment infrastructure to cover eastern Indonesia.

Chemical management

- Strengthen the legal framework for the management of industrial chemicals in order to create a national inventory of chemicals and provide authority for systematic assessment and management of chemicals as information evolves. Improve the monitoring of chemicals in the environment.

Water management

- Implement integrated urban water management to enhance water safety. Expand piped water services to increase access to safe drinking water and reduce groundwater use. Enhance capacity of regulators and water supply providers, including for monitoring of groundwater levels and enforcement of permits. Develop long-term strategies to ensure water security for areas where water stress is projected to intensify, taking into account nature-based solutions.
- Improve monitoring of water pollution and enhance pollution prevention and mitigation. Continue to expand and improve sanitation facilities by promoting off-grid technology, faecal sludge management systems, investment in small-scale projects and expansion of centralised sewerage networks in metropolitan areas, taking into account possible use of reclaimed water as an alternative to groundwater to limit depletion.

Information and education

- Continue to undertake public communication campaigns to raise public awareness about the state of the environment. Foster environmental education to enhance understanding of the environmental, economic and health risks associated with pollution and environmental degradation. Further develop environmental education in school curricula.

- Revive regular publication of the State of the Environment Report and consider establishing a green growth monitoring and reporting framework linking economic activity with environmental performance.

2. Environmental governance and management

Decentralised governance in need of better co-ordination

Since 2001, Indonesia has undergone far-reaching political, administrative and fiscal decentralisation. As a result of this reform, provincial and local governments have gained more authority to manage their natural resources. There has been a significant increase in numbers of provincial and local regulations and policies. The 2014 Law on Local Government strengthened provinces' role in development, spatial planning and land administration. However, environmental management at the provincial and local levels is inconsistent due to differences in institutional capacity. The 2009 Law on Environmental Protection and Management increased the power of the environment ministry to oversee compliance monitoring and enforcement activities by provincial and local governments. This led to interventions against wastewater disposal in the Citarum watershed and closure of illegal mines in Gunung Botak, for example. Since 2015, the MoEF has increasingly used such "second-line" enforcement.

The MoEF was formed in 2015 by a merger of the environment and forestry ministries. Indonesia's environmental legislation is primarily sector-based, with several other ministries having important environmental responsibilities. The MoEF's powers are more limited than those of sector ministries, and it lacks financial and human resources to fully exercise its mandate. Four so-called co-ordinating ministries strive to address policy development fragmentation. Nevertheless, environmental management, particularly permitting and compliance assurance, often involves overlapping interests and institutional conflicts. Some regions have initiated inter-jurisdiction collaboration on environmental matters at the local level to help disseminate good practices and build capacity.

Building technical capacity for environmental assessment

Environmental impact assessment (EIA) is the backbone of the country's environmental regulation. It is undertaken primarily at the local and provincial levels. Its use has improved in recent years due to stricter regulatory requirements and better guidance. However, many projects are still approved without appropriate EIA. In 2018, a practice of issuing provisional business licences through an online platform before the EIA is completed was introduced, which compromises consideration of alternatives in the EIA process. While there has been some progress, EIA documents still tend to be of low quality and overlook important potential environmental effects, and many authorities lack capacity for adequate assessment. EIA provides a key opportunity for public participation, but in practice it remains limited.

If an activity does not require EIA, the operator must submit an Environmental Management and Monitoring Program (EMMP) document or an even less onerous statement. These documents are usually very general, and local authorities review them only superficially. EIA or EMMP approval results in issuance of an environmental permit that does not cover wastewater discharges or waste management, which are governed by separate permits. Environmental permits rarely contain limits on polluting activities, are valid indefinitely and are not subject to periodic review (Sano, 2016).

Strategic environmental assessment (SEA) is increasingly used for spatial plans at the provincial and local levels, for some national and sector policies and, most recently, for national and local development plans. SEA is hindered by limited stakeholder and public involvement, limited technical capacity and insufficient monitoring and follow-up. Technical guidelines for SEA implementation are under development.

Data gaps and weak sanctions impede compliance assurance

Strengthening the enforcement of environmental and forestry legislation is a priority of the MoEF. Compliance monitoring and enforcement are hampered by low institutional capacity. Inspections are mostly reactive, responding to accidents, complaints and third-party reports of non-compliance. There are no systematic data on the regulated community, its compliance behaviour or enforcement sanctions. Enforcement approaches vary by jurisdiction and sanctions are inconsistently applied. Written warnings and compliance orders are by far the most used enforcement tool. The only administrative monetary penalties are fines for ignoring compliance orders. Despite an ongoing environmental certification programme for judges, criminal enforcement is limited by judicial capacity and procedural constraints (Sembiring, 2017).

The environmental liability regime is enshrined in law but its implementation started only recently, in the forestry sector. A requirement for operators to furnish guarantee funds to pay for eventual remediation of environmental damage exists but has not yet been put into practice, although progress has been made with the adoption of regulations on environmental economic instruments (in 2017) and an environmental fund (in 2018). The problem of contaminated sites for which no responsible party can be identified is particularly acute: district governments are meant to identify, assess and report them, but lack resources and political will to do so. The national government is only starting to compile an inventory of contaminated sites and has no programme or set of norms guiding remediation. Better use of technology can help trace the source of contamination and pursue responsible parties.

Efforts to promote green business practices are expanding. The number of, and adherence to, environmental certifications is low but rapidly rising. Special initiatives, such as the Green Industry Award and Green Industry Certification, encourage the greening of industrial performance. The government plans to introduce sustainable public procurement criteria over the course of 2021 and 2022. Almost 2 000 companies participate in the Program for Pollution Control, Evaluation, and Rating (PROPER), a voluntary, colour-coded rating system grading factories' environmental performance against regulatory standards. However, just 6% of large industrial enterprises participate. PROPER has considerable potential as a compliance promotion programme. Disclosing the data underlying a rating (e.g. on emissions or effluents) would enhance transparency. A facility's PROPER-related evaluation does not systematically entail enforcement measures in cases of serious non-compliance, however (Sembiring, 2017).

Box 2. Recommendations on environmental governance and management

- Create formal mechanisms of horizontal and vertical co-ordination on environmental matters; expand MoEF oversight on provincial and local environmental policy implementation to cover SEA, EIA and permitting.
- Build capacity of provincial and district authorities in SEA, EIA and environmental permitting; ensure consideration of alternatives in environmental assessment; integrate wastewater discharge and hazardous waste storage permits into environmental ones, and ensure their periodic review as well as regular self-reporting of permitted businesses.
- Introduce administrative fines for non-criminal offences and provide detailed and uniform guidance to inspectors and the police on the use of enforcement tools; build judicial capacity to handle environmental cases.
- Implement the system of financial guarantees from businesses to constitute funds for remediation of damage to soil, water bodies and ecosystems; compile a nationwide inventory of contaminated sites and design a programme for their gradual remediation in collaboration with provincial and district governments; adopt technical standards and guidelines for environmental remediation.
- Improve disclosure of information about industrial environmental performance (e.g. on emissions of air pollutants and wastewater effluent collected through PROPER) and, in the medium term, work towards setting up a pollutant release and transfer register.

3. Towards green growth

Indonesia expresses a strong commitment to sustainable development and has integrated green growth elements, as well as most Sustainable Development Goals (SDGs), into its national development planning framework. The 2015-19 National Medium-Term Development Plan (RPJMN) contains targets to improve environmental quality, incorporates the climate change mitigation targets to 2020 and acknowledges the need to manage natural resources sustainably. However, conflicting sector development goals and policies, along with challenges in policy co-ordination, have meant that pressures on the natural asset base have continued to increase. Difficulties in implementing and enforcing environmental legislation are compounding these issues.

Concerns about the economic and social impact of environmental degradation have stimulated efforts to more effectively integrate environmental considerations into development planning. The Low Carbon Development Indonesia initiative highlights remarkable efforts to build modelling capacity and strengthen the evidence base on economy-environment links. The plan will, for the first time, reflect the contribution of the environment to the economy and the impact of the economy on the environment. It will provide an opportunity to explicitly identify and resolve conflicting sector policy objectives and to align infrastructure investment plans and fiscal reform with long-term sustainable development strategies. Low-carbon policy scenarios will become major inputs to the 2020-24 RPJMN. Achieving green growth goals will require more effective co-ordination across ministries and levels of government. A specific monitoring framework on key green growth objectives could help increase transparency and allow evaluation of policies' effectiveness.

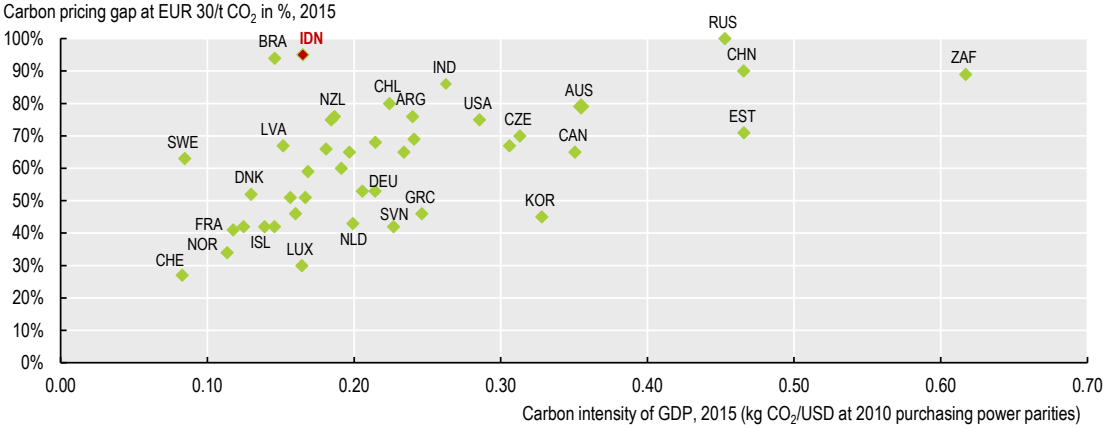
Using market-based incentives to support the green economy transition

The transition to a greener economy requires stronger market-based incentives. Revenue from environmentally related taxes in 2016 reached 0.8% of GDP, a relatively low value compared to most OECD and G20 countries. Most of the revenue stems from vehicle taxation, while in most OECD and G20 countries, a majority comes from transport fuel taxes. Overall, the tax system does not capture the cost of environmental damage and lacks alignment with environmental objectives and the polluter-pays principle. Government Regulation No. 46/2017 on environmental economic instruments, expected to be fully implemented by 2020, aims to reconsider and expand the use of taxes for environmental purposes.

Moving towards cost-reflective pricing in the energy sector

A major opportunity for better use of prices for the green growth transition lies in the energy sector. Bringing energy prices closer to their true environmental, social and economic cost is a crucial step if Indonesia is to meet its energy security and sustainability goals. Currently, energy prices in Indonesia are well below their true costs owing to a combination of low energy taxes and energy subsidies. Only two low-level energy taxes are in place at subnational levels: a regional motor vehicle fuel tax and a local street lighting tax. Hence, 84% of CO_2 emissions from energy use are unpriced. The fuel tax, an excise tax that is capped by national regulation at 5% of the sale price, is low by international standards. It amounts to an average effective tax of EUR 7.6 per tonne of CO_2 emitted from fuel consumption in transport, much lower than the rates in India (EUR 49/t CO_2), China (EUR 70/t CO_2) or South Africa (EUR 95/t CO_2) (OECD, 2018c). Indonesia's carbon pricing gap is thus one of the largest among OECD and partner countries (Figure 5). The government is revising the national regulation to enable subnational governments to increase the fuel tax rate. Efforts are also under way to reduce fuel subsidies by using a more targeted mechanism.

Figure 5. The effective price on carbon is low



Note: The carbon pricing gap shows the extent to which countries price carbon emissions below the benchmark value. It measures the difference between the benchmark and the actual rate for every percentile and sums all positive differences. The gap is measured as a percentage. If the effective carbon rate on all emissions were at least as high as the benchmark value, the gap would be zero; if the effective carbon rate were zero throughout, the gap would be 100%. EUR 30 is a low-end estimate of the climate damage from 1 tonne of CO_2 emissions. Data refer to CO_2 emissions from energy use only.
Source: OECD (2018), *Effective Carbon Rates*; IEA (2018), IEA *CO_2 Emissions from Fuel Combustion Statistics* (database).

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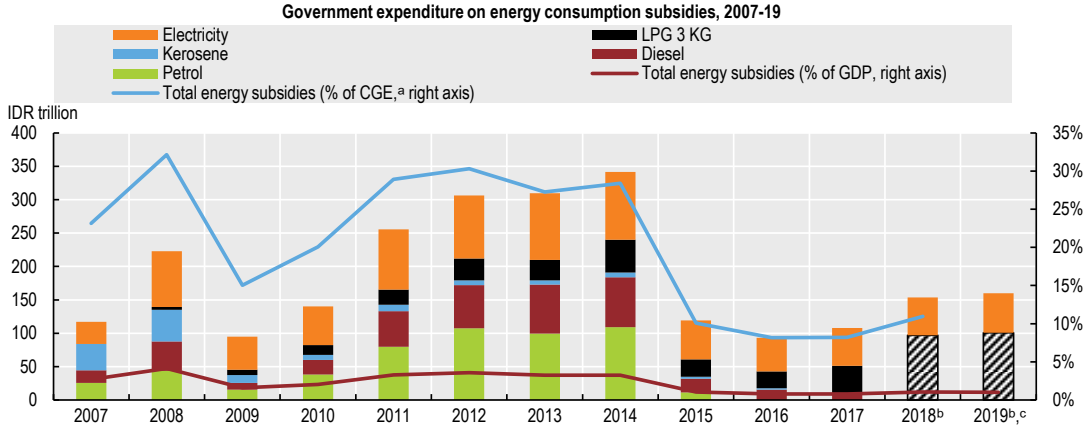
The government began considering a carbon tax in 2009, but little progress has been made since. A 2009 Green Paper on Climate Change proposed introducing a tax amounting to USD 10/t CO_2 on fossil-fuel combustion for electricity generation and large industrial installations as of 2014. In line with international best practice, the suggestion was to gradually increase the rate (by 5% per year to 2020) and to use part of the revenue to alleviate the impact of higher prices on the poor and on vulnerable communities. It was estimated that the tax would reduce CO_2 emissions from fossil-fuel combustion by 10% compared to BAU by 2020 without negatively affecting growth or poverty reduction aspirations. No legislation has been introduced to impose the tax. However, Presidential Regulation No. 77/2018 provides a legal framework for the establishment of a carbon market. Indonesia should continue to pursue options for pricing carbon emissions. OECD research shows that the EU Emissions Trading System has effectively reduced emissions without harming firms' competitiveness (Dechezleprêtre, Nachtigall and Venmans, 2018).

Continuing to phase out fossil-fuel subsidies

Much progress has been made in reducing subsidies to fossil-fuel consumption. Indonesia has a long history of subsidising end-user prices for petrol, diesel, electricity and other energy products to keep energy affordable for the poor, increase energy access and raise household purchasing power (private consumption contributes more than half of GDP). Until 2014, consumption subsidies amounted to about 30% of government expenditure, equal to nearly 4% of GDP. Pressured by an increasingly large fiscal burden, the government has embarked on major reforms, linking domestic transport fuel prices to international prices and better targeting electricity subsidies to needy households. This helped cut subsidy expenditure by roughly half between 2014 and 2015 alone (Figure 6), freeing resources for infrastructure and social development. Subsidies to fossil fuel-producing industries are estimated to be considerable, but considered necessary to maintain the purchasing power of low-income groups. Indonesia's engagement in international forums, including through participation in a peer review on fossil-fuel subsidy reform under the auspices of the G20, helped shed light on the subsidies (OECD, 2018d).

Figure 6. Fossil-fuel subsidies have dropped



a) CGE = Central government expenditure.
b) Detailed breakdown for fuel subsides not available.
c) Data refer to planned budget.
Source: Country submission; MoF (2019), *Indonesia's Effort to Phase out and Rationalise its Fossil-fuel Subsidies: A Report on the G20 Peer-review of Inefficient Fossil-fuel Subsidies that Encourage Wasteful Consumption in Indonesia.*

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While energy consumption support dropped markedly, not all price reforms have been implemented as announced, putting into question the stability and durability of reform. Subsidies to petrol (RON 88) were officially abolished in 2015, yet domestic prices have not been adjusted to rising global oil prices since mid-2016. In March 2018, the president announced that petrol and electricity prices would be kept stable until at least the end of 2019 to ensure affordable energy for poor households, and diesel subsidies were increased in mid-2018. In 2017, the government launched the "single fuel price" policy, which aims to harmonise fuel prices and address inequality across the archipelago. It is questionable whether the state-owned petroleum company, Pertamina, will be able to deliver set fuel prices without government subsidies.

Universal, ill-targeted energy subsidies disproportionally benefit wealthier households and therefore are less efficient in addressing poverty and inequality concerns than direct support to vulnerable households. Indonesia should instead rigorously stick to its subsidy reform timetable. Current efforts to better target electricity and liquefied petroleum gas subsidies should continue. In the medium term, subsidies should be replaced with targeted support to the vulnerable via conditional cash and non-cash transfer programmes. Work should continue to systematically track subsidies to fossil-fuel production.

Aligning vehicle taxation to environmental performance

In addition to fuel pricing, other fiscal measures should be considered to manage the environmental impact of transport. This is becoming a growing concern as the rapidly rising motorisation rate is contributing to air pollution and crippling congestion in cities. The national and some provincial governments have begun to consider environmental dimensions in tax design, for example through a reduced luxury goods tax for so-called low-cost and green cars. Rather than applying exceptions to certain car types, Indonesia could link its main vehicle taxes (e.g. registration and ownership taxes) to parameters such as fuel efficiency and CO_2 and local air pollutant emissions – an option the government is already considering. The experiences of Israel and Chile could provide guidance. The World Bank (2018) estimates that better aligning motor vehicle taxes with environmental externalities of vehicle use and transforming the luxury goods tax into a specific excise tax (to avoid transfer pricing) could increase state revenue by 0.64% of GDP. Well-designed traffic congestion pricing can help address congestion while raising revenue for improvement of transport services.

Establishing a commission for comprehensive green fiscal reform

Green fiscal reform can help Indonesia reduce pollution and other environmental externalities cost-effectively, while raising much-needed revenue for infrastructure and social spending. OECD experience has shown that establishing green fiscal reform committees can help bring consensus among stakeholders, reduce resistance from business and facilitate co-ordination among government bodies. As part of a broader green fiscal reform, Indonesia should consider introducing taxes on pollution or products causing pollution and waste. The planned introduction of a plastic bag excise tax is a step in the right direction. Other taxes on pollution (including fertiliser, pesticides and wastewater releases) should be considered. Currently, fertiliser use is heavily subsidised. Efforts are under way, however, to better target the subsidy.

Efforts to combat illegal extraction of natural resources, such as timber, fish and metals, and to strengthen land-use governance and law enforcement should continue. These challenges weigh on tax revenue and create environmental costs. It is estimated that only one-third of potential revenue from Indonesia's main forestry levies was collected between 2003 and 2014 (KPK, 2015). In addition, Indonesia should consider improving the structure and raising the rates of royalties, especially in the forestry sector, in order to collect full economic rent on natural resource use. While the government increased the forest user fee for mining and plantation companies in 2014, the two most important levies on timber extraction have not been adjusted for nearly two decades, eroding their potential to promote sustainable forestry and to allow the government to capture economic rents on natural resource use. Indonesia's participation in the Extractive Industries Transparency Initiative is driving governance improvements in that sector.

Investment in the green economy is increasing

Public environmental expenditure has declined in recent years, amounting to 0.9% of the central government budget in 2017 (BPS, 2017). The MoEF budget was cut significantly in 2017, forcing the ministry to prioritise high-impact projects. Subnational spending on the environment varies widely. Initiatives such as a climate change budget tagging system and the Green Planning and Budgeting Strategy are enhancing transparency of environment-related spending and will help the government align national expenditure and revenue processes with climate and other environmental goals. Results show that about 1% of central government expenditure was devoted to green economy investment in 2011-14 (MoF, 2015). This was below investment needs and also below expenditure on environmentally harmful subsidies for fossil-fuel consumption (which reached 27% of central government expenditure in 2011-14). Budget support to the green economy has since increased significantly, reaching 5.4% of the state budget in 2018.

Enhancing incentives for investment in waste, water and sanitation

The government has made it a priority to tackle Indonesia's infrastructure gaps and significantly increase public spending. This will boost the economy and represents an opportunity to provide much-needed funding for environment-related infrastructure. Water, sanitation and waste management services remain severely underfunded. Their fees and tariffs are too low to cover the cost of service provision, let alone investment. In response, a special allocation fund has been set up to financially assist local governments in managing their drinking water companies. Strengthening cost recovery will be important to reach the entire population and improve services. This will require higher user fees, for those who can afford to pay; targeted cross-subsidies may be needed to ensure service provision to poorer users. Improving service quality and providing transparency on revenue use will be paramount in securing users' willingness to pay. At the same time, there is a strong rationale for central government subsidies for basic service delivery in areas currently lacking it.

Implementing the sustainable finance regulation

Private investment in the green economy is nascent, reflecting a lack of demand for green credit and high risk associated with green investment. Indonesia launched its first green sukuk (Islamic bonds) in 2018. It also set up the Tropical Landscapes Finance Facility in 2016 to leverage private long-term finance for projects and companies that stimulate green growth and improve rural livelihoods. The Financial Services Authority has taken steps to enhance financial sector engagement in sustainable growth. A 2017 regulation made

Indonesia one of the first countries with regulation on sustainable finance. Continued capacity building will be needed to enhance the understanding and practical application of sustainable financing principles among regulated institutions. In the medium term, the regulation could be used to limit access to finance for businesses operating without an environmental permit (or not complying with it), making it a potentially powerful tool for enforcing environmental law.

Renewables, energy efficiency and sustainable transport are priority areas

Investment in clean energy has been increasing, but remains small relative to investment in oil, gas and coal. At USD 1.6 billion in 2017, investment in renewable energy sources also falls short of the estimated USD 15 billion needed per year to meet the 23% renewables target (IESR, 2017; BNEF, 2018). To encourage investment in renewables, the government has put in place several incentives, but they have not led to investment as hoped, for various reasons. In 2017, feed-in tariffs for renewables were replaced with a mechanism capping tariffs in accordance with average regional electricity generation costs. This makes renewables investment attractive in remote areas, where generation costs are high, but renders renewables projects economically unviable in other parts of the country, especially where most of the population and economic activity are concentrated, or where electricity is oversupplied.

Developing a plan to scale up renewables

The cost of renewables is high in Indonesia, compared with other countries in the region. This makes it hard for renewables to compete with cheap and abundant coal (most of which is low-grade). Investment in the sector is associated with high risk, given political uncertainty (i.e. lack of a long-term carbon price signal), regulatory instability (dozens of regulatory adjustments over 2017), off-take risks, and burdensome and slow licensing and land acquisition processes. The latter have been eased recently, including through the development of an online submission system for permitting. Local-content requirements further increase costs, at least in the short run. Reducing these risks will require a comprehensive, transparent and achievable plan for renewables development, backed by strong and sustained political commitment.

Continuing improving energy efficiency…

A stronger focus on energy demand management would help avoid the need for expansion of energy supply. Meeting Indonesia's goal of reducing energy intensity by 1% per year to 2025 would avoid 341 Mt CO_2 eq between 2017 and 2025 (IEA, 2017). There is significant scope to improve efficiency further. The government adopted energy efficiency measures, including energy performance standards for lighting, appliances and buildings, as well as energy management requirements for large industry that appear to have lowered its energy intensity. While the private sector has made some effort to raise energy efficiency, for example through PROPER, compliance is not yet comprehensive and some standards are too lax to have a significant effect on the market. Given the substantial economic and environmental benefits of energy efficiency, Indonesia should continue to strengthen and effectively implement energy efficiency measures.

…and investing in public transport infrastructure

Investment in the transport sector is, as in many countries, heavily tilted towards roads. Investment in public transport has increased, in particular through large-scale projects in

Jakarta. The government also plans to build urban mass rapid transit systems in more than 20 other cities. Besides public transport investment, Indonesia's policy to reduce GHG emissions from transport has focused on promotion of biodiesel. Electrification of urban transport (particularly motorcycles) can bring important benefits for urban air quality, although the effect on GHG emissions may be modest, given the carbon intensity of the power sector. The potential for electric vehicles is held back by the lack of a regulatory framework, supporting infrastructure (e.g. charging stations) and supporting policies (e.g. fiscal incentives). A presidential decree on electric vehicles is under development to address these barriers.

Strengthening eco-innovation and green markets

Balancing the focus of energy-related R&D budgets

Indonesia is less R&D-intense than other Southeast Asian countries and fast-growing economies such as India and China (OECD, 2013). However, there is encouraging growth in the number of patent applications for climate change-related technology. Policy action to stimulate innovation is increasing, including through the launch of the Indonesian Science Fund, the country's first research funding institution, in 2016. In a welcome step, Indonesia pledged to increase the state R&D budget on clean energy ninefold over five years, although with most resources devoted to developing cleaner fossil energy. A greater focus on demand-side management (energy efficiency) would be a good complement to the current focus on the supply side. More technology neutrality in energy R&D funding would help ensure that the most cost-effective technology is pulled into the market (IEA, 2015).

Indonesia's environmental technology market is among the ten largest in the world, at USD 6.9 billion in 2017 (ITA, 2017). Market barriers remain substantial, however. Even as environment regulations have become more stringent, slow implementation and lack of enforcement limit their effect on demand for environmental goods and services (EGS). In addition, local content requirements and lack of transparency in public tenders hinder foreign investment in the sector. Domestically, continued efforts are needed to build technical skills to implement advanced environmental systems and to improve asset management in public projects. Green public procurement has considerable potential to stimulate demand for, and supply of, EGS in Indonesia, where public procurement already accounts for about 30% of the government budget. The MoEF is co-ordinating an inter-ministerial team on preparation of sustainability criteria for public procurement of products and services, as well as list of goods and services meeting the criteria.

Indonesia is among the few countries to have made corporate social responsibility mandatory by law. Several positive initiatives are under way to promote good environmental management by businesses, including development of Green Industry Standards (initially voluntary), a Green Industry Certification Body and a Green Industry Authorization Committee by the Ministry of Industry. PROPER has been the central government's innovative attempt to incentivise better business practices by ranking companies for performance. It has shown positive results in compliance promotion, but should not be an alternative to enforcement. To amplify the public pressure effect of PROPER ratings, the government needs to invest more in consumers' environmental awareness, continue to develop strict green public procurement policies and work with investors and banks to limit access to finance for poorly performing companies.

The role of development co-operation and trade

Indonesia has been among the ten largest recipients of official development assistance (ODA) worldwide in recent years. ODA targeting climate change mitigation has significantly increased since 2011, driven by energy and transport infrastructure projects, while ODA to general environmental protection, agriculture and water and sanitation has declined. The country launched the Indonesia Climate Change Trust Fund in 2010 as its first climate finance institution. While the level of funding has been low, 76 mitigation projects have been financed through the fund. These projects reduced GHG emissions by 9 Mt CO_2 eq at relatively low cost (USD 1.5/t CO_2 eq). In 2010, Norway pledged USD 1 billion if Indonesia reduced emissions from deforestation and forest degradation. So far, 13% has been disbursed for policy milestones and support to preparatory work. Indonesia is preparing a mechanism to receive international climate finance from Norway and other partners for demonstrated results (Section 4).

With nearly half of exports coming from natural resource-based activities, Indonesia would benefit from the inclusion of environmental provisions in regional trade agreements. Trade and investment restrictions aimed at developing local industry should be carefully reviewed, as these measures pose a heavy burden on imported products and could negatively affect the diffusion of environmental services and technology not supplied domestically. As a member of the Asia-Pacific Economic Cooperation alliance, Indonesia pledged to cut most-favoured nation applied tariffs to 5% or less by 2015 on environment-friendly goods contained in 54 product categories. Indonesia partly missed the deadline, with a dozen tariff lines or specific products not yet in compliance, but lowered some tariffs in 2017 and announced plans to reduce remaining tariffs gradually by 2021 (ICTSD, 2016).

Continuing to fight illegal wildlife trade

As a member of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Indonesia has put in place several measures to control wildlife trade. Illegal trade has become one of the main pressures on biodiversity: its volume quadrupled between 2010 and 2017, reaching an estimated value of USD 1.2 billion (Gokkon, 2018). In addition to the growing international market, Indonesia represents a huge domestic market. Strengthening traceability, compliance and enforcement agencies, promoting inter-agency collaboration and a multi-door approach, raising awareness and closing regulatory loopholes that prevent successful prosecution are important components of stronger law enforcement. Partnering with civil society organisations and using social media channels could facilitate monitoring of wildlife trade.

Box 3. Recommendations on green growth

Framework

- Fully follow through with SEA of the 2020-24 RPJMN. Implement the System of Environmental-Economic Accounting Central Framework to properly value the country's natural capital in economic planning at the national and subnational levels.

Getting prices right

- Make better use of environmentally related taxes and charges with a view to better applying the polluter-pays principle. Consider establishing a dedicated commission to develop options and pathways for comprehensive green fiscal reform. Items for reform include:
  - Moving towards cost-reflective energy pricing (bringing the implicit price of carbon to positive levels) by continuing to phase out fossil-fuel subsidies, while gradually raising the regional fuel tax and expanding energy/carbon taxation to non-road sectors such as industry. Regularly adjust fuel prices to global oil prices and continue to better target electricity and LPG subsidies. In the medium term, replace energy subsidies with cash transfers for poor households. Introduce an explicit carbon price, even if initially very low.
  - Align vehicle taxation to environmental performance, for example by linking tax rates to fuel efficiency and the emission of CO_2 and local air pollutants to encourage the purchase of more fuel-efficient and low-emission vehicles.
  - Continue to enhance transparency and law enforcement related to forest concessions as well as mining and fishery permits. Review the structure and rates of royalties, especially in the forestry sector, in order to collect full economic rent on natural resource use. Continue efforts to better enforce water abstraction fees.
  - Introduce the planned plastic bag excise tax. Consider introducing taxes on air pollutants and wastewater discharge.
- Reorient agricultural production support away from market price and direct input support towards productivity and income-enhancing investment (e.g. R&D, education, infrastructure, creation of value added, restoring ecosystem services). Replace fertiliser subsidies with more productive and sustainable support programmes for farmers.

Investment

- Enhance incentives for investment in waste, water and sanitation by gradually increasing user fees to make service providers more independent, commercially and financially robust and capable of funding capital investment. Poor households should be compensated through existing conditional cash transfer programmes or other social protection programmes. Support local institutions in improving service quality (a prerequisite for ensuring citizens' willingness to pay) and enhance enforcement capacity.
- Continue to build capacity among financial institutions to comply with the sustainable finance regulation and to improve their contribution to financing of climate and green economy-related projects. Explore options on how the regulation could be used to promote compliance with environmental law.
- Develop a comprehensive, transparent and achievable plan to scale up renewables, backed by high-level commitment and buy-in from all stakeholders. Remove regulatory barriers and streamline processes for granting permits. Develop mechanisms to reduce the risk premium on finance for renewables (e.g. using guarantees). Work towards a level playing field by phasing out subsidies benefiting coal, oil and natural gas production.

- Increase the stringency of energy performance standards (particularly for air conditioning) and enhance enforcement and compliance with energy efficiency regulations.
- Develop support measures for adoption of electric vehicles, particularly electric motorcycles.

Environment-related goods and services and innovation

- Balance the focus of energy-related R&D budgets under Indonesia's Mission Innovation commitment to adequately support research on renewables and energy efficiency, in addition to cleaner fossil fuels.
- Scale up the Sustainable Consumption and Production programme across ministries; continue to build product certification programmes; consider extending sustainable procurement to smallholders (e.g. those involved in social forestry and agricultural products).
- Reform trade barriers such as local content requirements and foreign equity restrictions, which prohibit Indonesia from adopting modern clean energy technology.
- Continue to fight illegal wildlife trade, prioritising protection of the most endangered species and partnering with civil society to enhance law enforcement.

4. The land-use, ecosystems and climate change nexus

Achieving a sustainable land-use sector is pivotal for green growth

Indonesia's rich natural resources have enabled continued economic growth and provided livelihoods for millions of people. Land-based activities such as mining, agriculture, forestry and fishing account for 20% of GDP overall, and for more than 50% in the provinces of East Kalimantan, Riau and Papua. The agricultural sector accounts for 30% of employment and represents the main economic activity of roughly half the households living close to forest areas (BPS, 2014). In addition to its economic role, the land has high ecological value as well as strong spiritual, medicinal and cultural significance, particularly for indigenous communities.

Development of natural resources has increased pressure on ecosystems. Continuing conversion of forests, peatlands, mangroves and other ecologically valuable land to agriculture, expansion of industrial timber plantations, urban development, industry, and pollution from mining and agriculture are among the main concerns. Progress has been made with respect to long-standing weaknesses in the enabling environment for land management. They include lack of clarity about land status, inadequate permitting arrangements and insufficient monitoring and enforcement. These issues have contributed to the spread of illegal activities and created incentives to clear primary forest and peatland, which are less likely to be subject to ownership disputes. Achieving a sustainable land-use sector is pivotal to meet the Paris Agreement targets and the SDGs, and, ultimately, to unleash Indonesia's full green growth potential.

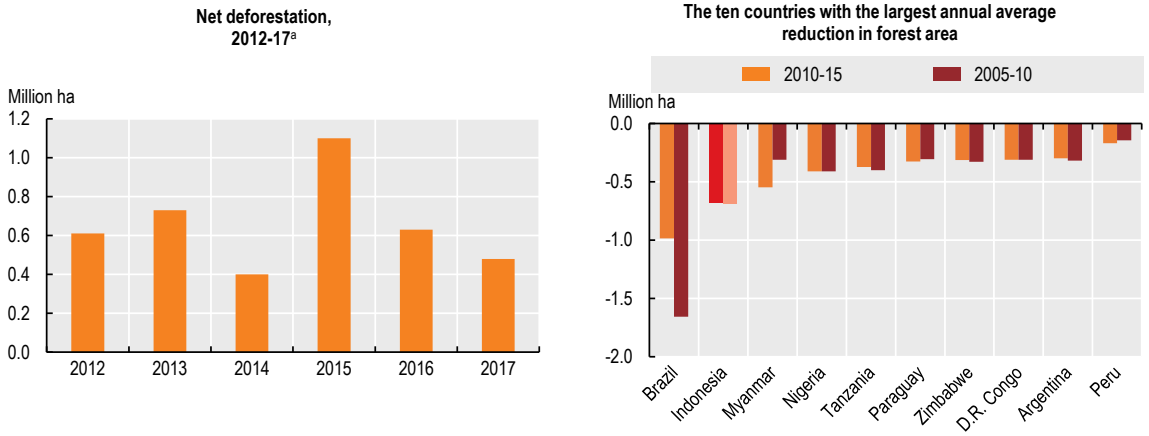
The government's perspective on land use increasingly emphasises the need to balance social, environmental and economic developmental values. This is reflected by its commitment to democratise allocation of forestry resources and prevent deforestation and

forest degradation. Balancing the three values will require greater policy consistency, institutional strengthening and capacity development. In particular, there is a need to better align the legal classification of land with its physical characteristics, combined with strengthened enforcement efforts to ensure that policy goals are realised in practice.

Deforestation rates are decreasing, but remain high

Indonesia's forest cover has continued to decline since 2005, despite the introduction of strengthened policies to combat deforestation. However, deforestation rates have decreased considerably since a peak in 2015 (Figure 7). While there is limited quantitative information on the drivers of deforestation, expansion of agricultural production into forests is a particular concern. Growth in production of some commodities, notably palm oil, has mainly been achieved by expansion of planted areas. Rapid expansion of industrial timber concessions has also increased use of primary forest and peatland. The islands of Sumatra and Kalimantan, where oil palm and timber plantation has been highest, registered the most forest loss over the past decade. Illegal activities are likely to be a driver of deforestation.

Figure 7. Deforestation has declined since 2015, but remains high



a) Net deforestation includes regrowing of secondary forest, both natural and human induced, including for timber production, and rehabilitation of forested area.
Source: FAO (2018), *FAOSTAT* (database); MoEF (2018), *The State of Indonesia's Forests 2018*.

StatLink http://dx.doi.org/10.1787/888933930974

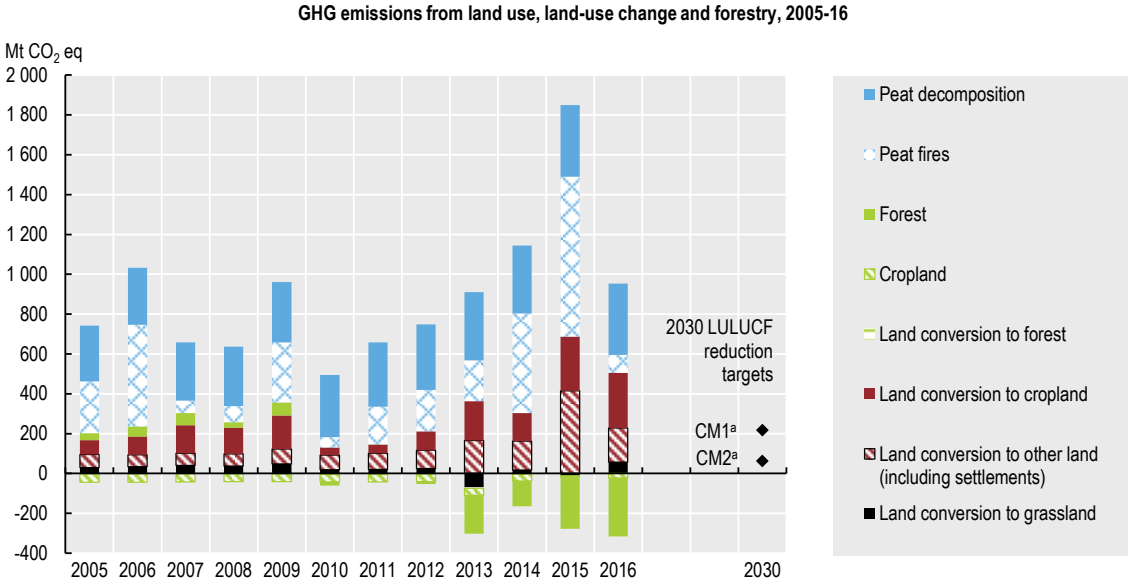
Peat fires and peat decomposition are driving GHG emissions

Land conversion and fires involved in that process are a significant source of GHG emissions. While emissions vary significantly from year to year, the land-use sector accounted for about half of Indonesia's total GHG emissions over the past decade (Figure 1) (MoEF, 2018a). The majority of emissions stem from drainage or burning of peatlands (Figure 8), which is both rich in carbon and subject to extensive land-use change. Peatlands are drained and set aflame for clearing. Peatland drainage leads to direct emissions as the peat decomposes until the carbon stock has been released. Dried peatland is combustible and the fires are hard to extinguish, meaning land can burn for weeks, particularly in dry years. In 2015, a notably dry year, peat fires emitted 800 Mt CO_2 eq (MoEF, 2016b), 33% of Indonesia's total GHG emissions. The economic and health costs associated with the fires were estimated at USD 16 billion (World Bank, 2016).

Intact natural forests are essential for sustaining ecosystem services

The sustainable management of Indonesia's forest and peatlands is of global importance. Indonesia is one of the world's most biodiverse countries, but also home to two of its 25 biodiversity hotspots. Land-use change, notably deforestation, and pollution from agriculture and mining have reduced biodiversity and hindered the functioning of ecosystem services. For example, 14% of Indonesia's watersheds are in a critical state, largely due to land-based sectors' activities, increasing flood frequency in downstream communities (BPS, 2014). Around one-third of birds and nearly half of mammals in peat swamp forest are endangered (Posa, Wijedasa and Corlett, 2011). Habitat loss included replacement of natural habitats with monoculture plantations, which support lower species diversity than natural forest and attract pests that affect surrounding habitats and plantations (Petrenko, Paltseva and Searle, 2016; Meijaard et al., 2018).

Figure 8. Peat decomposition and fires are the main sources of land-based emissions



a) CM1 - Unconditional mitigation scenario; CM2 - Conditional mitigation scenario (international support available).
Source: MoEF (2018), *Second Biennial Updated Report under the United Nations Framework Convention on Climate Change*.

StatLink http://dx.doi.org/10.1787/888933930993

Coherence between policy objectives could be improved

Indonesia has made a number of national-level commitments with implications for land use. For example, actions in the LULUCF sector are expected to deliver more than half the GHG emission reductions in the NDC. At the same time, land management is expected to support food security, agricultural production, access to land for the poor, energy security and protection of Indonesia's rich biodiversity, along with contributing to sustained economic growth. The 2015-19 RPJMN explicitly recognised the importance of sustainable development and the role of spatial planning, and adopted targets from the NDC and the RAN-API. The elaboration of sector targets in the RPJMN, however, does not appear to have fully considered interaction between objectives, particularly given competition for finite land (Bellfield et al., 2017).

The 2020-24 RPJMN provides an opportunity to support greater alignment of sector targets affecting land use. Setting credible land-use targets, combined with strengthened enforcement and technical assistance for smallholders, could help provide longer-term clarity. The targets would give a signal to the public and private sectors to invest in improving productivity on existing land rather than expanding production into forest. BAPPENAS has developed sophisticated modelling capacity that will help in understanding the relevant links and analysing the consequences of various development choices for natural capital.

Land allocation, permitting and enforcement are improving

Progress has been made with respect to addressing historical challenges in the enabling environment for land management. This includes efforts to clarify the legal status of land, strengthen permitting arrangements and improve monitoring and enforcement.

Streamlining the issuance of land-use permits

Permits are the main regulatory tool used to control land use and land-use change. However, responsibility for issuing permits is spread among national ministries and government levels. As a result, transaction costs for applicants are high and there is confusion about which permits are required for which activities. There are widespread challenges concerning improper issuance of permits, as well as activities taking place without the required permits. The government is streamlining the process of issuing permits and enhancing efforts to verify that existing permits were issued correctly. In 2015, the president called for a simplified permitting process, and an online submission system was introduced in 2018. The switch to online databases can facilitate cross-checking to help identify potential irregularities. The MoEF is reviewing and evaluating permits in the forestry sector in accordance with the Presidential Instruction on Moratorium in Primary Forest and Peatland, Government Regulation No. 57/2016 on peatland management and the Presidential Instruction on Moratorium for new oil palm plantation permits.

One feature of the permitting process complicates protection of areas with high ecological value. Holders of permits for agricultural use are required to clear the area covered by the permit. Those wish to leave some forest land remaining risk having their concession permit revoked and transferred to another party (Daemeter Consulting, 2015). Expanding the legal mechanisms for protecting land of high conservation value would help address this challenge.

Clarifying the legal status of land

Land is managed according to a legal classification that is supposed to be based on the land's function. In practice, this legal status was often ambiguous due to the existence of conflicting maps. Land's legal status could also differ from its physical condition or ecological value, hampering efforts to direct production towards areas of lower ecological value. For example, land that is legally classified as forest (known as state forest) may lack trees, while forested land exists outside state forest areas.

Indonesia has made significant progress in addressing inconsistencies in spatial planning through the One Map initiative. The initiative aims to create a unified map, with 85 thematic layers specifying the status of land throughout Indonesia, at a scale of 1:50 000. It is also expected to present development objectives in consistent spatial maps. The process of creating the map has revealed overlapping claims and thus raises the need to correct and harmonise geospatial information in relation to the situation on the ground. To facilitate

transparency, in line with the objectives of One Data, the new government data policy, the government is providing increased access to mapping data online. Maximising public access to mapping information will support transparency, facilitate research into deforestation drivers and aid in detection of illegal activities.

Developers of spatial plans are required by law to consider land's ecological capacity in terms of water, ecosystems and agriculture. However, there is a need for further guidance and targets to help national, provincial and district governments put the law into practice. Efforts to better understand the value of natural capital would help in this process. The Global Green Growth Institute has trained local officials to better understand the role of natural capital. In addition to such capacity development, it would be helpful to have greater use of SEA at the local level and further research into the ecological and economic value of different types of land.

The One Map initiative makes it possible to create a unified land registry, which in turn will complement efforts to reallocate land to landless communities (notably through agrarian reform and social forestry, described later in this section). There is also a potential to better align the legal and physical characteristics of land by streamlining the land swap process, in which degraded state forest land can be exchanged for standing forest elsewhere. Administrative complexity has hindered the use of land swaps (Rosenbarger et al., 2013), limiting the ability to direct production to degraded land rather than high conservation value areas (Daemeter Consulting, 2015).

Peatland mapping remains a challenge

In addition to delineation of administrative boundaries, accurate physical mapping of peatlands remains a significant technical challenge. Land with deep peat is particularly important in ecosystem service provision. For example, carbon stocks below ground can be an order of magnitude higher than those above ground. Areas of deep peat are a useful proxy for the areas with the greatest carbon sequestration (Law et al., 2015). Regulations, guidance and methodologies exist for mapping peat, but there is a need for a detailed and comprehensive peatland map to guide policy decisions. Indonesia's mapping agency has used a USD 1 million prize fund to encourage domestic and international researchers to find cost-effective, reliable approaches to enhance peatland mapping. The award will go to the group that develops the best methodology.

Strengthening compliance monitoring and enforcement is a government priority

Weaknesses in monitoring and enforcement of compliance with land-use regulations have led to substantial losses of state revenue, encroachment into state lands and non-compliance with environmental regulations (KPK, 2015). Barriers to enforcement include lack of resources on the part of enforcement agencies and difficulty in securing convictions due to corruption and ambiguity over the legal status of land.

As a result of insufficient enforcement, designation of land as protected has been of limited effectiveness in preventing deforestation (Gaveau et al., 2012). Indeed, land under strict protection suffered increased deforestation rates over 2000-10 (Brun et al., 2015). This can be attributed to insufficient funding, capacity gaps and increasing economic and development pressure (Waldron et al., 2017). Providing local communities with a stake in the sustainable use of these areas will be essential for increasing the effectiveness of protection measures.

Indonesia is taking steps to strengthen enforcement of laws related to environment and forestry. The institutional capacity of the MoEF's Directorate General of Law Enforcement

(DGLE) is being increased. In addition to its 16 existing provincial law enforcement offices, the DGLE recently established 19 new offices, so it is now present in all provinces. It then hired additional forestry police, civil investigators and inspectors. Use of technology, such as satellite monitoring, is being increased to facilitate detection of illegal activities.

The government has strengthened co-ordination among ministries to improve enforcement. In 2015, the Corruption Eradication Commission (KPK), along with MoEF and other ministries with natural resource portfolios, established the National Movement to Save Natural Resources. It serves as a platform for reviews and supervision regarding natural resource management in particular provinces (e.g. Papua). It is also used by the DGLE to co-ordinate law enforcement activities. In addition, the MoEF and KPK conduct regular monitoring. The ministry has set up a law enforcement intelligence centre for co-operation in the use of data and information from other bodies, such as the Ministry of Law's Directorate of General Law Administration.

The government is setting up a unified database for forestry, the Sustainable Production Forest Management Information System. Combining data on tax revenue, forest legality and forestry management, it is a valuable tool for identifying illegal and unreported activities and can help reduce the high rates of illegal activities in the forestry sector. Once such activities are identified, a "multi-door" approach is adopted for enforcement action –the relevant agencies co-ordinate prosecution on multiple charges related to environmental crimes, including violations of laws on corruption, money laundering, conservation and forestry.

The contribution of Forest Management Units

The establishment of Forest Management Units (FMUs) is helping strengthen capacity for improved forest management at the site level. FMUs are dedicated organisations responsible for implementing forestry policies within a local area. Acting as intermediaries between local communities, plantations and the local and national governments, they have the potential to work with affected parties to find solutions to land conflicts. They also help address the capacity and resource constraints that have limited the scope for land-use reform. They facilitate reporting and help establish ecological corridors between protected areas and other land use within state forest areas. Multilateral and bilateral development co-operation provides technical and financial support for the establishment of FMUs.

The policy mix relies heavily on regulatory tools

Land management in Indonesia has relied heavily upon regulatory instruments. The improvements to the enabling environment discussed above have the potential to increase the effectiveness of such instruments. However, more use of market instruments, such as biodiversity offsets and tradable quotas, could increase flexibility and efficiency.

Restoring peatlands and preventing fires

Improved peatland management is a focus of the government agenda for controlling deforestation and degradation, peat decomposition and peat fires. Strengthened regulations and supervision of peatland recovery have been in effect since late 2015. They aim to prevent degradation and fires by keeping peatland wet, both in private concessions and on community land. The Peatland Restoration Agency was established in 2015 with a target of restoring 2 million ha of degraded peat by 2020. Progress towards this target, which will be essential in tackling GHG emissions from peatland, has been hampered by capacity constraints. Measurement, reporting and verification are essential to monitor progress of

restoration efforts and their contribution towards GHG emission reduction targets. It will be important to have measures in place to continue the agency's work after 2020.

In addition to peatland restoration, a broad package of policy measures has been implemented to reduce the incidence of peat fires. The main measures include establishment of fire task forces at the provincial and district levels, including with community involvement, to provide a co-ordinated response to forest fires (MoEF, 2018b). Detection has also been improved, including through satellite monitoring to identify current hotspots and map areas of burnt land. Improved law enforcement helps strengthen the prohibition against using fire to clear land.

Accelerating implementation of certification to reduce illegal land conversion

Certification and legality assurance are being used to encourage more sustainable natural resource management practices. In the mining sector, business licences are revoked if operators do not meet legal obligations. For forestry, Indonesia's timber assurance legality system (SVLK) aims to ensure that timber is produced legally. It has won acceptance from the European Union, with SVLK registration now qualifying exporters for Forest Law Enforcement Governance and Trade licences.

The Indonesian Sustainable Palm Oil (ISPO) standard is mandatory for larger producers. About 17% of Indonesian palm oil output is certified under the ISPO. The government plans to make certification mandatory for smallholders in 2022. ISPO certification requires meeting a range of environmental standards throughout the palm oil production process. Although it does not guarantee that production is consistent with meeting climate change targets and reducing ecosystem degradation, it can help improve the baseline standard of environmental performance by ensuring compliance with minimum legal and regulatory requirements.

For the certification programmes to be effective, it will be important to build capacity throughout the supply chain for compliance and to support enforcement (Pacheco et al., 2018). The programmes focus on examining whether operators can provide correct paperwork, but this needs to be complemented with greater verification of activities on the ground. Key actors in supply chains, including financial institutions, can play a major role in facilitating the process by performing due diligence on suppliers' activities.

Improving community access to land through social forestry and agrarian reform

Access to land in Indonesia has been very unequal. In 2014, only 60% of the households exerting control over state forest land had permits to do so (BPS, 2014). Prior to 2007, almost all permits for state forest land use were held by private concessions rather than communities. Thus communities lacked collateral for investment, which impeded their livelihoods, reduced productivity per hectare and provided an incentive for land clearing as a way to claim land. The lack of formal arrangements for land recognition, and of clarity over the legal status of land, has also brought communities into conflict with industrial concessions.

The government is committed to providing more equal access for communities living in or near forests through social forestry and agrarian reform. Agrarian reform provides a framework for recognising tenure claims by local and traditional (*adat*) communities. The government aims to provide title to 9 million ha of agricultural land, providing legal security for farmers. Some 4.1 million ha – predominantly convertible production forest that is no longer productive – is land that will be removed from the state forest and given

to smallholders (MoEF, 2018b). The social forestry programme provides local communities with 35 years of access and usage rights. The MoEF is using social forestry to promote sustainable use of state forest land by encouraging activities such as agroforestry and agro-silvopasture instead of clearance for plantations.

The initial goal was 12.7 million ha of land for social forestry by 2019. The land has been allocated and 2.5 million ha has been distributed to communities, involving nearly 600 000 households in more than 5 300 locations. In an attempt to speed up the allocation, the MoEF created ad hoc Social Forestry Acceleration teams for areas that had yet to receive social forestry permits. Extension services are provided in every social forestry area to ensure that the permit is ecologically beneficial (increasing forest cover), economically beneficial (increasing income) and socially beneficial (reducing conflict). A mobile application has been developed to collate monitoring information from social forestry areas.

Resolving tenure conflicts to ensure legal protection through control and oversight

The MoEF established a Directorate of Tenurial Conflict Resolution and Customary Forests to help with conflict resolution and speed up acknowledgement and legal protection of customary forest (*hutan adat*). The president issued nine decrees acknowledging customary forest areas in 2016, nine in 2017 and 17 in 2018. In all, 28 200 ha of customary land has been legally recognised. By comparison, 369 000 ha of state forest is recognised as customary land through local regulations. This land cannot be included in the customary land total until local regulations for recognising it as *hutan adat* are issued and disputes with rights holders resolved.

To accelerate registration of customary forest, the MoEF established a team in 2018 consisting of academics, government officials, lawyers and representatives of non-government organisations (NGOs). The team provides technical assistance to local governments on local customary forest regulations and facilitates mediation of tenure conflicts affecting customary forest. Enhanced legal access to land and security of tenure could encourage greater investment and the adoption of more sustainable management practices, including agroforestry. To help realise these benefits, the government is working with banks to facilitate access to microcredit and with state-owned enterprises to support marketing of non-timber forest products produced by social forestry programmes (MoEF, 2018b). Scaling up this support, including for sustainable forest management, will help reduce the financial incentive to clear land. There is also a need to monitor programmes to ensure that changes in tenure systems have no inadvertent social or environmental impact.

Evaluating the performance of moratoriums to curb deforestation

The government intends to improve forest governance, including that of peatland and primary forest. A basis for this was established in 2011 when a two-year moratorium was declared on the issuance of permits for new concessions on primary forest and on peatland of more than 3 metres' depth (Presidential Instruction No. 10/2011). The moratorium was extended three times, and in 2016 a moratorium on conversion of all peatland was adopted. In 2017, the government adopted a further policy to maintain peatland by defining protection and cultivation zones within peatland areas and revising spatial plans for affected companies (Government Regulation No. 57/2016). In 2018, an additional moratorium on new palm oil development was announced, along with a review of existing licences. These

moratoriums are key instruments for protecting ecosystems and meeting the government's climate change objectives. By 2018, moratoriums covered 69 million ha.

An encouraging sign regarding the moratoriums is that deforestation rates have decreased in recent years. Net deforestation in 2015 was 1.1 million ha, but the rate decreased to 0.63 million ha in 2016 and 0.48 million ha in 2017. This represents important progress, but deforestation remains a challenge. The environmental effectiveness of moratoriums has been constrained by a lack of penalties for non-compliance, a focus on the issuance of new permits and the fact that moratoriums are temporary by definition. The government has viewed their temporary nature as beneficial, providing flexibility as forest governance has developed. Firm legislation, informed by evaluation of lessons learned from these temporary measures, would provide greater predictability for the private sector and communities.

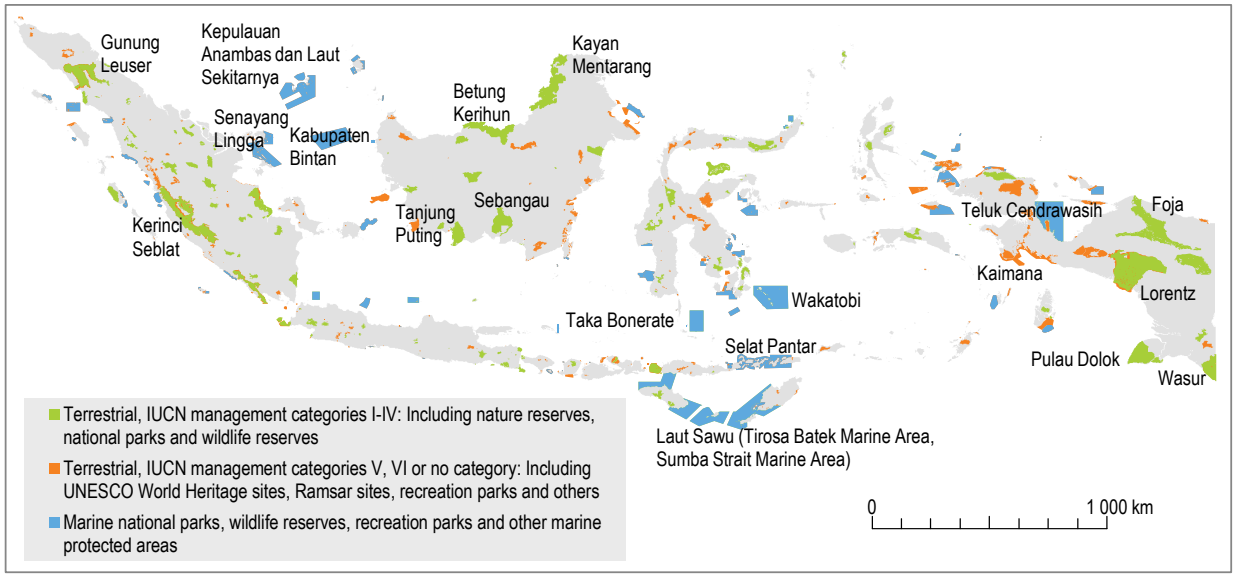
Improving connectivity of protected areas to protect biodiversity

As in many countries, protected areas are fragmented (Figure 9). Their total area covers 12% of land and inland waters (Section 1), but they are not well connected to each other. The development of ecological corridors, as implemented in East Kalimantan, would increase the effectiveness biodiversity protection. Effective biodiversity conservation in protected areas is hampered by insufficient funding and capacity gaps.

Outside of protected areas, the designation of essential ecosystem areas is being used to safeguard ecosystems, supporting connectivity between habitats. These areas can be established upon application to local governments. They are managed collaboratively by local communities, businesses, government and NGOs. Land designated as an essential ecosystem area can still be used for productive activities, provided those do not interfere with ecosystem health.

Figure 9. Protected areas could be expanded to protect and sustainably use biodiversity

Protected areas in Indonesia, 2018



Source: IUCN and UNEP-WCMC (2018), *World Database on Protected Areas*, www.protectedplanet.net.

Realising the value of ecosystem services

Statistics Indonesia (BPS) has taken a pioneering role in valuing the ecosystem services provided by land through its System for Environmental-Economic Accounting (SEEA). These efforts have been undertaken with the support of the WAVES partnership. The accounts recognise the value of ecosystem services, such watershed protection, carbon sequestration and biodiversity, and provide a useful basis for well-informed decision making about alternative land use. They could also be used to inform the development of payment for ecosystem services (PES) by identifying priority areas for natural capital conservation. Indonesia is continuing to develop the SEEA to better capture changes in the value of natural capital. Pilot studies have been undertaken in several provinces and the government is aiming to link land accounts with ecosystem accounts. Those efforts can provide a model for other countries. Continuing work to improve data coverage and quality will facilitate use of the accounts to inform policy development and development planning.

PES is increasingly used to provide a financial incentive for safeguarding natural capital. However, the vast majority of programmes are not operational: less than 10% of projects had made payments for results by 2016 (Suich et al., 2017). PES projects have tended to rely on external funding, limiting their potential for scaling up activities. In addition, unclear land rights and complex permitting processes resulted in high transaction costs, preventing programmes from being financially self-sustainable. In 2017, the Government Regulation on Environmental Economic Instruments was issued. It provides a strengthened legal framework, enabling government support for PES and reducing transaction costs. Additional measures will be needed to ensure that services provided by local governments are recognised and compensated.

Ecosystem Restoration Concessions (ERCs) provide a legal framework for NGOs, communities and the private sector to safeguard ecosystem services in production forest. ERC holders can generate revenue through non-timber forest products and PES, provided they protect the area's "biological balance". Sixteen ERCs were issued between 2015 and 2018. The Katingan ERC has generated revenue of USD 7.5 million annually. The main challenge in scaling up the use of ERCs lies in creating sufficient demand for them through carbon markets and PES.

Further strengthening REDD+

The government estimates that a programme for reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) could cut emissions from land-use change by up to 70% compared to BAU (MoEF, 2017). REDD+ provides financial incentives in exchange for verified emission reductions from deforestation and forest degradation. International finance flows are helping put the infrastructure in place for REDD+, including the commitment of USD 1 billion from Norway to disburse funds for demonstrated results in reducing emissions (and for preparatory activities). In addition, around USD 200 million has been committed from the Carbon Fund of the Forest Carbon Partnership Facility and the BioCarbon Fund of the World Bank's Initiative for Sustainable Forest Landscapes.

Many of the elements required to gain access to the funding are being developed and expected to be in place in 2019. Indonesia's National Registry System and its monitoring, reporting and verification arrangements have been accredited by the UNFCCC Secretariat and are fully operational. There has been significant improvement in forest resource monitoring, which now is done annually and recorded in the National Forest Monitoring

System. Further strengthening of this system will be needed to monitor levels of degradation in secondary forest, which makes up the majority of forest area in Indonesia.

The final element required for access to financing for REDD+ is a suitable disbursement mechanism. The government recently established the Environmental Fund Management Agency to host the funding mechanism at the national level. However, the REDD+ mechanism still needs to finalise rules for disbursing funds to potential beneficiaries at the subnational or project level. The operating procedures and guidelines need to be consistent with international good practice if the agency is to be a viable mechanism for receiving international funding for REDD+. Indonesia is developing a benefit-sharing mechanism at subnational level as a pilot for distributing funds to potential beneficiaries of REDD+. The government proposes to use the agency as a mechanism for aggregating the carbon credits generated by smaller-scale conservation programmes. This would build upon the elements of the REDD+ framework discussed above.

Box 4. Recommendations on the land-use, ecosystems and climate change nexus

Knowledge base

- Maintain and strengthen work to value ecosystem services consistent with the SEEA, including ecosystem accounts. Ensure that the potential to identify priority areas for policy action is exploited to contribute to a coherent policy framework informed by natural capital.
- Finalise the remaining elements of the One Map, including the development of thematic layers and larger-scale (e.g. 1:50 000) maps. Use the One Map to develop and refine a long-term land-use strategy. Provide public access to the mapping information to facilitate transparency and detection of illegal activities. Provide technical support and capacity building to facilitate participatory mapping of customary (*adat)* lands.
- Continue to improve the measurement and mapping of peatlands and forests to more accurately identify areas that are particularly valuable for providing ecosystem services. Enhance public access to information by providing open data where possible.
- Continue efforts to monitor, evaluate and disclose data on deforestation and drivers of land-use change.

Policy and institutional framework

- Set specific, realistic targets for overall land use in the 2020-24 RPJMN, including targets for reducing deforestation. Ensure that the targets are agreed by all relevant ministries (especially those for environment and forestry, agriculture, and energy and mineral resources), included in sector work plans and monitored by BAPPENAS.

Clarifying land rights

- Ensure that the system for land allocation and permitting redirects development towards land of lower ecological value. Allow concession holders to leave standing land of high conservation value within their concession area. Simplify the

administrative processes governing land swaps between degraded state forest land and standing forest that is permitted for clearance.

Social forestry and agrarian reform

- Provide additional resources to accelerate registration of social forestry and recognition of customary forests. Encourage peer learning between communities to improve access to the social forestry programme. Disseminate guidance and encourage use of the mobile application for submitting monitoring information for social forestry.
- Accelerate agrarian reform by using the land redistribution programme to recognise community tenure claims, transparently delineate and register state lands and assets, and provide legal access for communities to co-manage state lands and forest resources.

Enforcement

- Accelerate efforts to deter, identify and penalise illegal land use by providing additional resources for enforcement agencies and increased investment in satellite monitoring systems. Provide additional training for law enforcement officials to increase their capacity for investigation of environmental crimes.
- Further develop online systems for managing land-use permits. Cross-reference databases governing permits, tax receipts and regulatory compliance to target illegal logging and agricultural activities.
- Consolidate and streamline the set of permits required for land-use activities. Develop clear guidance for ministries and subnational governments on the legal requirements for various land-based activities. Audit existing permits for land-based activities to ensure that they were issued following the required processes.
- Strengthen capacity of FMUs through recruitment, training and peer learning. Identify potential sources of private-sector funding to complement resources from public budgets.
- Undertake voluntary agreements with supply chain nodes (traders, consumers, banks) to reinforce the effectiveness of the SVLK.

Policy instruments

- Evaluate the effectiveness and ancillary impact of forest moratoriums. Replace the use of time-limited moratoriums with legislation that provides a predictable legal framework governing sustainable development of primary forests and peatland.
- Expand the terrestrial protected area network and establish mechanisms to encourage effective conservation and sustainable use inside these areas, working with the FMUs and local communities.
- Continue progress towards the target of restoring 2 million ha of degraded peatland. Put in place arrangements to continue restoration activities after the Peatland Restoration Agency deadline of 2020.

- Raise yields per hectare of agricultural commodities through increased investment in agricultural extension programmes, including increased training for agricultural extension works.
- Review support measures to the forest sector with a view to phasing out subsidies that encourage deforestation and propose alternative options for social considerations. Use the system of support measures to incentivise the provision of ecosystem services, such as those provided through sustainable forest management.
- Ensure that the Environmental Fund Management Agency starts operating on time and follows international good practice regarding governance, fiduciary responsibilities and environmental and social safeguards. Explore opportunities for this REDD+ financing mechanism to mobilise additional public and private resources.

Notes

[1] Total GHG emissions (including from land use, land-use change and forestry) per unit of GDP.

[2] As of December 2018, 30 countries had signed the Powering Past Coal Alliance Declaration, committing to phase out unabated coal power.

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Chapter 1. Environmental performance: Recent trends and developments

This chapter provides a snapshot of key environmental trends in Indonesia, highlighting some of the main achievements, remaining challenges and key policy responses. Beginning with an overview of the main socio-economic developments, the chapter presents Indonesia's progress in moving towards i) an energy-efficient and low-carbon economy; ii) sustainable waste management and resource efficiency; and iii) sustainable management of its natural capital, such as biodiversity, forests and water resources.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1.1. Introduction

Indonesia is the world's largest archipelagic country, and the fourth most populated one. It is one of the most biodiversity-rich countries worldwide, with extensive tropical rainforests, and possesses vast energy and mineral resources. The country has made great strides in improving its economic and social outcomes – it has enjoyed continuously strong economic growth since the end of the 1997-98 Asian financial crisis, reduced poverty and increased living standards. It has stabilised its democracy and devolved far-reaching decision-making and budgetary power to the local level.

Economic success has, however, come at high environmental costs. The expansion of agriculture to forests and peatlands, overuse of resources and pollution are putting serious pressure on Indonesia's natural capital. Deforestation and forest degradation, combined with strong reliance on fossil fuels for energy generation, make Indonesia one of the world's largest greenhouse gas (GHG) emitters. The rate of biodiversity loss is among the highest in the world and air pollution exceeds international guidelines. Infrastructure and service provision in the areas of waste, water and transport are not sufficiently developed to manage the pressures associated with population growth and urbanisation.

This chapter provides a snapshot of Indonesia's main environmental achievements as well as remaining challenges on the path towards green growth. Based on the OECD green growth indicators as well as indicators from national and other international sources, the chapter reviews progress against national policy goals and international commitments, focusing on the period since 2005. To the extent possible, it compares environmental indicators with those of OECD member countries, other emerging economies and regional peers. The chapter summarises major policy developments in the main environmental sectors, including climate change, air, waste, water, and biodiversity and ecosystems.

1.2. Main economic and social developments

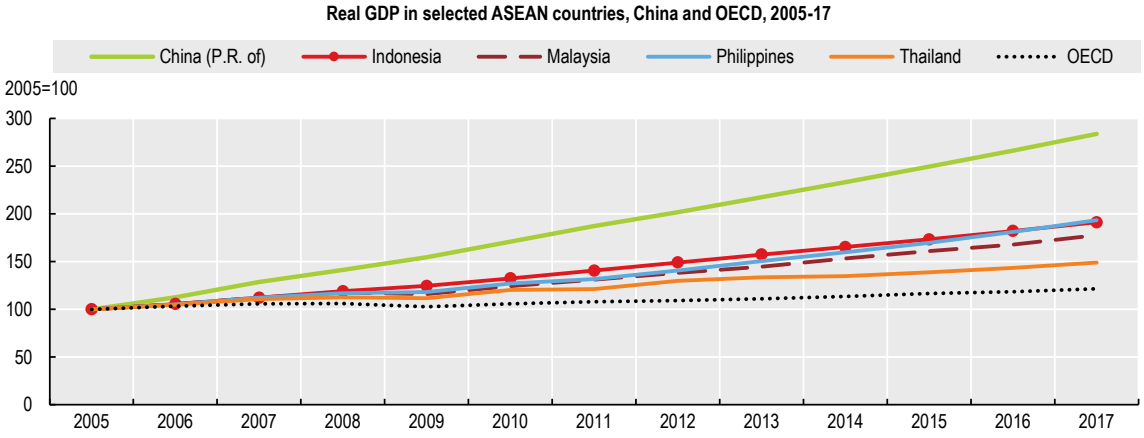
1.2.1. Economic performance

Indonesia is the largest economy in Southeast Asia and the 16th largest globally. Real gross domestic product (GDP) grew by 5.6% per year, on average, between 2005 and 2017, well above the OECD average and those of some regional peers (Figure 1.1). Growth was driven by a rising consumer base, improved labour market conditions, wage gains and effective poverty-alleviation programmes. As a natural resource-rich country, Indonesia also greatly benefited from the 2003-11 commodity boom (OECD, 2015). Relatively low dependence on international trade helped it weather the 2008-09 global financial crisis well. Growth decelerated to 4.9% in 2015 due to the commodity price slump, but edged back up to above 5% in 2016-18, aided by efforts to improve the business climate and public infrastructure investment.

The growth outlook is positive. Dynamic domestic consumption and continuously robust investment are expected to keep GDP growth above 5% in the years to come (OECD, 2018a; World Bank, 2018a). The main growth barriers include labour skill shortages, trade restrictions, infrastructure bottlenecks and a high (albeit declining) administrative burden. Reforms to fight corruption remain crucial to sustain strong growth (OECD, 2018a). OECD long-term projections suggest GDP growth will gradually flatten to just below 4% by 2030 and about 2.5% by 2050.[1]

Indonesia's monetary and fiscal frameworks are strong. Monetary policy is supporting growth, and annual inflation is projected to remain stable. The government's debt (28% of GDP) and fiscal position (2.5% of GDP) are below the constitution-set 60% and 3% ceilings and the respective OECD averages (see Basic statistics). Public spending is persistently low, constrained by low tax revenue. In 2014, Indonesia began to make the public spending mix more growth enhancing and efficient by reallocating expenditure from fossil-fuel subsidies towards investment in infrastructure, health and education (Chapter 2).

Figure 1.1. Indonesia's economy has grown rapidly over the past decade



Note: GDP at 2010 prices and purchasing power parities.
Source: OECD (2018), *OECD National Accounts Statistics* (database); World Bank (2018), *World Development Indicators* (database).

StatLink http://dx.doi.org/10.1787/888933931012

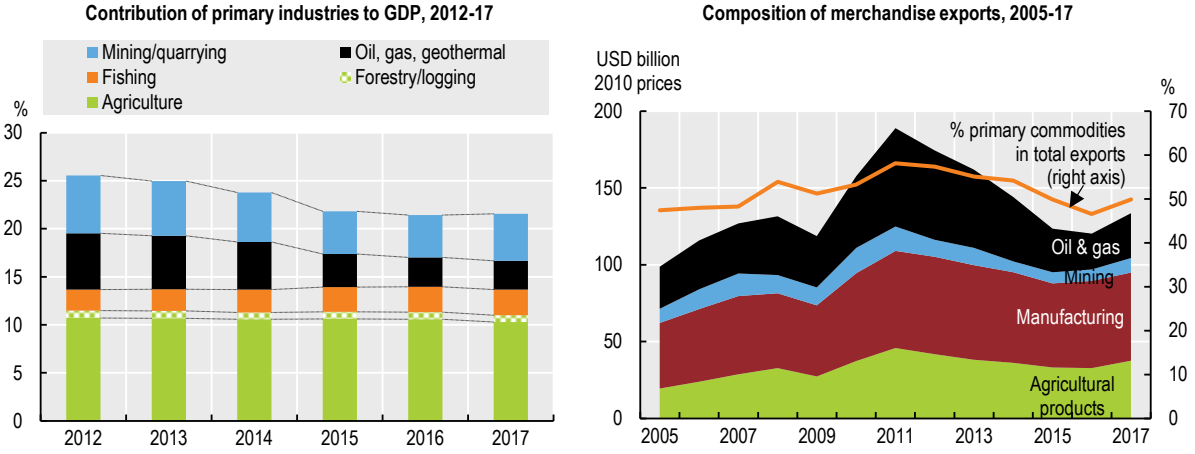
1.2.2. Structure of the economy and employment

Following the Asian financial crisis, Indonesia gradually moved away from an economy based on agricultural production to one based on manufacturing and services. The service sector has been the main growth engine and is now the largest contributor to the economy, accounting for 45% of GDP, with most value added coming from wholesale and retail trade, transport, communication and the finance, insurance and real estate sector. Tourism, at 4%, contributes a modest share by OECD standards but is growing fast, with an increasing number of visitors coming from China. Industry is the second-largest sector, accounting for 41% of GDP, with most value added coming from manufacturing, construction, and mining and quarrying. The agricultural sector accounts for 14% of GDP, which is high by international comparison, and it employs 30% of the population (compared to 17% in China or 43% in India). The service sector employed 48%, while manufacturing (14.1%), construction (6.7%) and mining (1.2%) accounted for the remainder (BPS, 2017; OECD, 2018a; World Bank, 2018b). According to OECD projections, the service sector will continue to expand to reach 57% in 2050, while the shares of industry and agriculture will decline to 38% and 5%, respectively.

Natural resources are a pillar of the economy. The country is a major producer and exporter of minerals (e.g. nickel ore, bauxite, tin and copper), energy resources (steam coal, natural gas and crude oil) and agricultural products (crude palm oil, rubber, seafood, rice and spices). Taken together, natural resource-based activities accounted for 21.5% of value added in 2017 and made up half the country's exports (Figure 1.2). Some provinces, including East Kalimantan, Riau and Papua, derive half their economy from natural

resource-based activities. The contribution of extractive industries to GDP has declined since 2011 due to the fall in global commodity prices as well as legal and regulatory uncertainty, high administrative barriers, global competition and depletion of known reserves (particularly of tin, oil and gas). Non-oil and gas mining edged back up in 2017, however, aided by the recovery of global prices.

Figure 1.2. Natural resources account for more than 20% of GDP and half of exports



Source: BPS (2018), "Gross Domestic Product (Industrial Origin)", *Statistics Indonesia* (database); United Nations (2018), *UN Comtrade* (database).

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Indonesia is less integrated in the global economy than its regional peers. Trade accounts for a smaller share of GDP (42% in 2015) than in neighbouring Thailand, Malaysia and Viet Nam, and its share has been declining steadily since the Asian financial crisis. Restrictions on trade and foreign direct investment are relatively high, although some have been eased in recent years. For example, Indonesia imposed an export ban on unprocessed minerals in 2014, in a bid to support the domestic smelter industry, but later eased it in the face of dwindling revenue from mineral exports (Reuters, 2017; OECD, 2016a). Foreign direct investment remains constrained by foreign equity restrictions in several sectors, including energy and transport. Indonesia's engagement in the ASEAN economic community since 2015 and the finalisation of pending free trade agreements (e.g. with Australia and the European Union) could help alleviate some of the pressures on trade (OECD, 2018a). Efforts to reduce burdensome administrative costs and increased investment in infrastructure should also help in this regard.

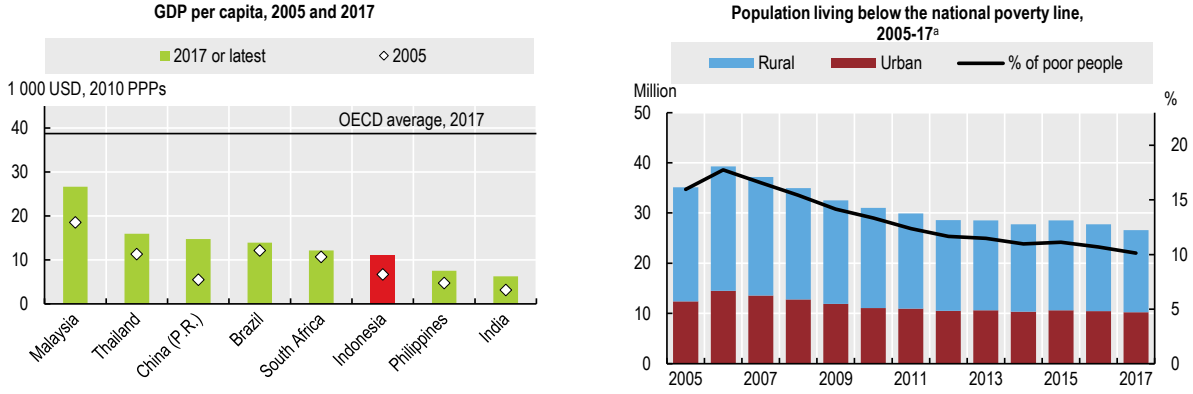
Labour market conditions have improved. The unemployment rate halved from 11.2% in 2005 to 5.5% in 2017 while real wages increased steadily, partially driven by rising minimum wages (BPS, 2017). However, stringent labour market regulations are curtailing formal-sector employment, particularly of low-skilled workers. An estimated 93% of firms and 70% of employment are informal (OECD, 2018a). Regional disparities are large, with unemployment ranging from 8.5% in Banten to 1.4% in Bali (Annex 1.A). The gender gap in the labour market has slowly improved but remains high, even by regional comparison. Youth unemployment stood at 19.4% in 2017, which is considerable given that half the population is under 30. Reaping the benefits of Indonesia's youthful demographics will require shifting the job mix towards high-quality, high-productivity jobs in the formal sector (BPS, 2017; OECD, 2018a; ILO, 2017).

1.2.3. Inclusiveness of growth

Robust economic growth was accompanied by a 64% increase in real GDP per capita over 2005-17, narrowing the income gap with other emerging economies, such as South Africa and Brazil (Figure 1.3). The share of people living in poverty declined from 16% from to 10% over the period, lifting 8 million people out of poverty (Figure 1.3). The middle class has rapidly expanded and now numbers more than 50 million people (World Bank, 2018c). Poverty remains more acute in rural areas, where access to income-generating opportunities is more limited. The government provides income support to poor households, including through cash transfers, a food subsidy programme, subsidised health insurance and a Village Fund, which aims to foster rural economic development. Public expenditure on social assistance more than tripled in real terms over 2005-16 (World Bank, 2017), strongly benefitting from a reduction in fossil-fuel subsidies (Chapter 2).

Income inequality, as measured by the Gini coefficient, has increased significantly over the last two decades, but started declining in 2015. It remains higher than the OECD average (see Basic statistics) but lower than in many neighbouring countries, including China, the Philippines, Malaysia, Singapore and Thailand. Fiscal policy has not been very successful in sharing the benefits of growth more widely: it is estimated that taxes and public expenditure reduce Indonesia's Gini coefficient by only 0.04 points, compared to 0.18 points in South Africa (World Bank, 2018d). Regional income disparities are large, with per capita GDP in Jakarta and resource-rich provinces like East Kalimantan, Papua and Riau being significantly above the national average (Annex 1.A). High income levels in resource-rich provinces have not yet translated into lower poverty rates and higher household consumption, as a large portion of commodity revenue flows outside provinces (World Bank, 2016a; OECD, 2015; OECD, 2016a).

Figure 1.3. Income levels have increased substantially, while poverty is declining



a) As of March 2017, the national poverty line was defined as a monthly per-capita income of IDR 375 000 (USD 28).
Source: BSP (2018), "Poverty and Inequality", *Statistics Indonesia* (database); OECD (2018), *OECD National Accounts Statistics* (database); World Bank (2018), *World Development Indicators* (database).

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1.2.4. Administrative structure

Indonesia has 34 provinces, 410 districts (known as regencies) and 98 cities. Each province, district and city has its own administration,[2] which has the right to establish local regulations. Subnational administrations have wide autonomy except on matters reserved for the central government.

Since 2001, Indonesia has undergone far-reaching political, administrative and fiscal decentralisation. As a result of this reform, provincial and local governments have gained more authority, including for natural resource management. The number of provincial and local regulations and policies have since increased significantly. The 2014 Law on Local Government strengthened provinces' role in development, spatial planning and land administration. However, environmental management at the provincial and local levels is inconsistent. The 2009 Law on Environmental Protection and Management (LEPM) increased the power of the environment ministry to oversee compliance monitoring and enforcement activities by provincial and local governments. In recent years, the Ministry of Environment and Forestry (MoEF) has increasingly used such "second-line" enforcement, particularly in the environment sector. In 2015-16, 231 administrative sanctions were imposed as a result of these activities.

1.2.5. Population and urbanisation

With a total population of 264 million, Indonesia was the world's fourth most populated country in 2017. Annual population growth has declined since the mid-2000s, but remains above 1%. The population is projected to reach 305 million in 2035 (MoEF, 2017a) and 319 million in 2050, according to OECD estimates. The population density is higher than in the OECD (see Basic statistics), although there are wide regional variations (Annex 1.A). The island of Java alone has 56% of the population, and the island of Sumatra a further 22%. Indonesia continues to urbanise at a steady pace. In 2017, 55% of the population lived in urban areas, up from 45% in 2005 (World Bank, 2018b). Urban areas face strong and mounting congestion costs, as evidenced by unmet demand for affordable housing and high traffic congestion levels (World Bank, 2018c). Access to basic facilities such as clean water, sanitation and electricity remains poorer in rural, especially remote and hard-to-access areas. An estimated 50 million to 70 million Indonesians live in customary or traditional (*adat*) communities (IWGIA, 2018).

Public health has improved markedly. The development of health care centres has made health services more accessible to the poor. Life expectancy at birth has increased by two years since 2005, while infant mortality has declined by 36% (World Bank, 2018b). Other health indicators are yet to improve, though: the maternal mortality ratio remains high at 126 deaths per 100 000 live births, and about one under-5 Indonesian out of three is affected by stunting (the world's fifth highest prevalence rate). This is mostly due to malnutrition and limited access to improved sanitation and drinking water sources. Public spending on health, at 1.4% of GDP, is low compared to other middle-income countries. The gradual deployment of health insurance to attain universal cover by 2019 should further improve health outcomes (OECD, 2018b).

A massive increase in public education expenditure has helped boost primary school attendance to nearly universal education, as well as double teachers' salaries and lower the teacher/student ratio. Still, expenditure remains low and inefficient by international standards. Improving teaching quality remains a challenge (World Bank, 2018d). The 2015 Programme for International Student Assessment (PISA) and a 2016 national test showed that three-quarters of 15-year-olds lacked basic science, mathematics and reading skills. PISA scores are similar to other developing countries, but show wide differences between cities and villages and between income groups (OECD, 2016a). Overall, half of 25- to 34-year-olds have not attained upper secondary education, which is twice the G20 average, although below Mexico (52%), China (64%) and India (64%) (OECD, 2018c).

1.2.6. Progress towards the Sustainable Development Goals and environmental quality of life

Indonesia has integrated Sustainable Development Goals (SDGs) into its national development vision, plan, policies and programmes (Chapter 2). It enacted a presidential regulation aimed at meeting the country's SDG commitments and established a national co-ordination team within the Ministry of National Development Planning (BAPPENAS). On the Sustainable Development Solutions Network's SDG Index, Indonesia performs well on poverty reduction and some per capita-based environmental indicators such as CO_2 and SO_2 emissions; it performs worse on access to water, sanitation and clean energy, as well as biodiversity-related metrics such as deforestation and species loss. Overall, the index ranked Indonesia 100th out of 157 countries in 2017, below peers such as Malaysia (54th), Thailand (55th), Singapore (61st), Viet Nam (68th) and the Philippines (93rd) (Bertelsmann Stiftung, 2017).

Indonesia's Happiness Index ranking indicates that Indonesians are satisfied overall with their lives (BPS, 2018a). Education and household income are the two biggest areas of concern. Satisfaction with the state of the environment has marginally increased since 2014 and is high in all provinces, including those where environmental pressures are high. The Gallup World Opinion survey also revealed that a large majority of Indonesians were satisfied with air and water quality in 2014. This is at odds with the actual state of air and water bodies, and water-related infrastructure, in some areas.

The main indicator Indonesia uses to evaluate overall environmental performance is the Environmental Quality Index (EQI), introduced in 2009. A composite index with a value ranging from 0 (worst) to 100 (best), determined for both the provincial and national levels, it is based on a weighted average of three other indices: those for land cover (40%) and air and water quality (30% each). The national EQI oscillated around 64 points in 2013-16 (with a peak of 65.5 in 2015), a level classified as "bad" and below the target of 65.5 to 68.5 points set in the 2015-19 National Medium-term Development Plan (RPJMN). It has improved since 2016, but a change in methodology complicates comparisons with previous values or the 2019 target (BAPPENAS, 2017).[3] Aggregate indices such as the EQI have the benefit of conveying a clear and simple message. However, condensing information about complex and multidimensional issues such as environmental quality increases the sensitivity of data deficiencies and risk of misinterpretation. It is important for Indonesia to complement EQI statistics with more disaggregated and accessible data, which could include environmental headline indicators.

Stronger efforts appear to be needed to raise the level of public environmental knowledge and awareness. Indonesia committed to providing environmental education in Law No. 32/2009 on Environmental Protection and Management. It also joined in the UN Decade of Education for Sustainable Development (2005-14). Law No. 32/2009 also includes the right to environmental information. In practice, however, many key company-level environmental data are not systematically and proactively disclosed (or reactively made available upon request) (WRI, 2017a). State of Environment reports used to be published almost annually but stopped in 2013 with the merger of the environment and forestry ministries. The MoEF still publishes an annual statistical report, but it does not cover all environmental media and lacks historical information. Regular publication of national and provincial State of Environment reports could help raise public environmental awareness. To enhance environmental education among the young, the MoEF launched the Adiwiyata eco-school programme in 2006, aiming to encourage schools to develop environment-friendly policies, integrate environmental issues into curricula and encourage participation-based environmental activities.

1.3. Transition to a low-carbon and energy-efficient economy

1.3.1. Energy structure, use and intensity

Indonesia has abundant energy resources and is among the world's major energy producers and exporters. In 2016, it was the world's fifth largest coal producer (and second largest exporter, after Australia), twelfth largest natural gas producer (and eleventh largest exporter) and second largest biodiesel producer after the United States (IEA, 2018). Nearly half of domestically produced energy is exported. Formerly a large crude oil exporter, Indonesia became a net oil importer in 2004, reflecting resource depletion and rapidly growing domestic demand. Net oil imports have more than doubled since 2000. Energy policy thus has a strong focus on energy security and self-sufficiency.

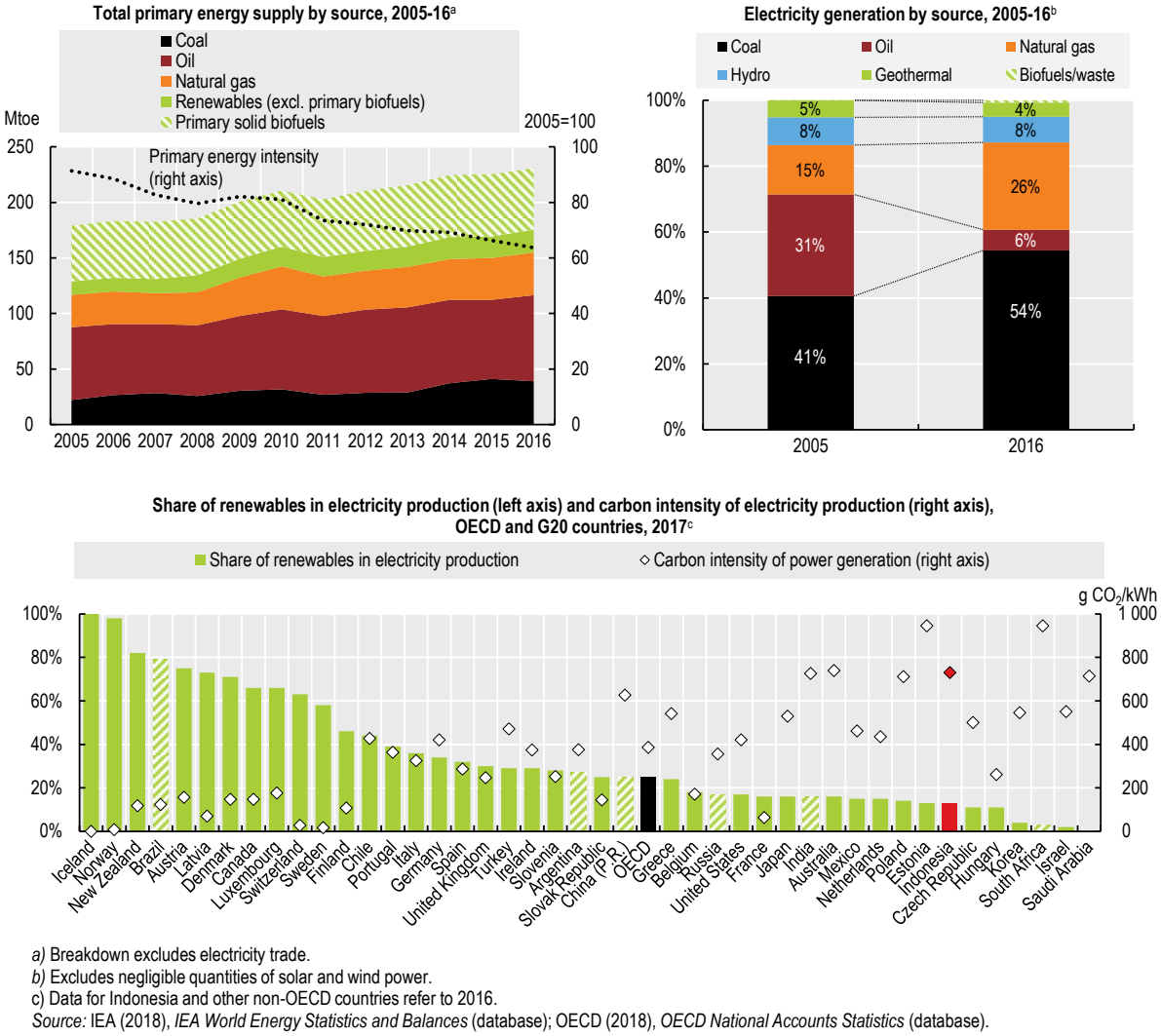
Energy mix

Indonesia's energy mix relies on fossil fuels. They accounted for more than two-thirds of total primary energy supply (TPES) in 2016, including oil at 33% and coal and natural gas at 17% each (Figure 1.4). Renewable energy sources make up the remaining third, with primary solid biofuels (such as firewood for cooking) accounting for 24% of TPES. Modern renewables, excluding primary biofuels, accounted for 9.6%, mostly geothermal (8%), liquid biofuels (1%) and hydro (0.7%); energy from wind, solar and waste is negligible (0.001%). Since 2005, the use of modern renewables has increased only moderately (by 8.3 Mtoe), while fossil-fuel use has expanded nearly five times as much (by 38.1 Mtoe), driven by an increase in the use of coal (+77%) and natural gas (+32%) (IEA, 2018).

Indonesia's carbon intensity of electricity generation is among the world's highest. Electricity production relies almost exclusively on fossil fuels (87% of generated power in 2016). The use of coal has more than doubled since 2005 in absolute terms, increasing its share in total power generation to 54% in 2016 (Figure 1.4). Most coal-fired power plants use subcritical technology, i.e. the least efficient and most polluting form of coal-fired generation. The use of natural gas, which emits significantly less CO_2 than coal per kilowatt hour, has nearly tripled, increasing its share to 26% of generation. The share of renewables in power generation decreased to 12.8% in 2016, one of the lowest values among OECD and G20 economies (Figure 1.4).

Aligning Indonesia's energy policies with GHG emission reduction targets will be essential for achieving the country's green growth objectives. The 2014 National Energy Policy (Kebijakan Energi National, or KEN), Indonesia's overarching energy policy document, focuses on re-establishing Indonesia's energy independence, which means minimising oil consumption while increasing exploitation and consumption of domestic coal, natural gas and renewables. KEN aims to reduce the share of oil in TPES to 25% by 2025 and source at least 30% from coal, 22% from natural gas and 23% from "new and renewable energy"[4] (GoI, 2014a). In absolute terms, this means nearly doubling coal use (compared to 2015 levels), almost doubling natural gas use and increasing the use of renewables more than sixfold. The government justifies the continued focus on coal by citing a need to provide to affordable electricity for all. While most new coal-fired power plants are expected to be more efficient than the current fleet (based on supercritical or ultra-supercritical technology), the strong focus on coal for power generation puts into question the coherence of energy policy with climate change objectives (Section 1.3.3). Indonesia plans to review its targets in the new energy policy to better balance the goals of energy self-sufficiency and low-carbon development.

Figure 1.4. Energy supply depends to a large degree on fossil fuels



a) Breakdown excludes electricity trade.
b) Excludes negligible quantities of solar and wind power.
c) Data for Indonesia and other non-OECD countries refer to 2016.
Source: IEA (2018), *IEA World Energy Statistics and Balances* (database); OECD (2018), *OECD National Accounts Statistics* (database).

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Deployment of renewable energy sources

Indonesia has some of the world's greatest potential for geothermal energy and hydropower, as well as abundant biofuel, tidal, solar and wind power resources. However, less than 2% of its renewables potential has been developed (Table 1.1). By national definitions,[5] renewables excluding biomass accounted for 6.2% of TPES in 2017, up from 4% in 2007 (MoEMR, 2018). The increase was driven by liquid biofuels, supported by subsidies and ambitious blending mandates (Chapter 2), as well as additional hydropower and geothermal energy generation. Small wind and solar capacity started to be developed in the late 2000s, but their share in power generation remains negligible. In July 2018, the president inaugurated the country's first large-scale wind farm (75 MW) in South Sulawesi.

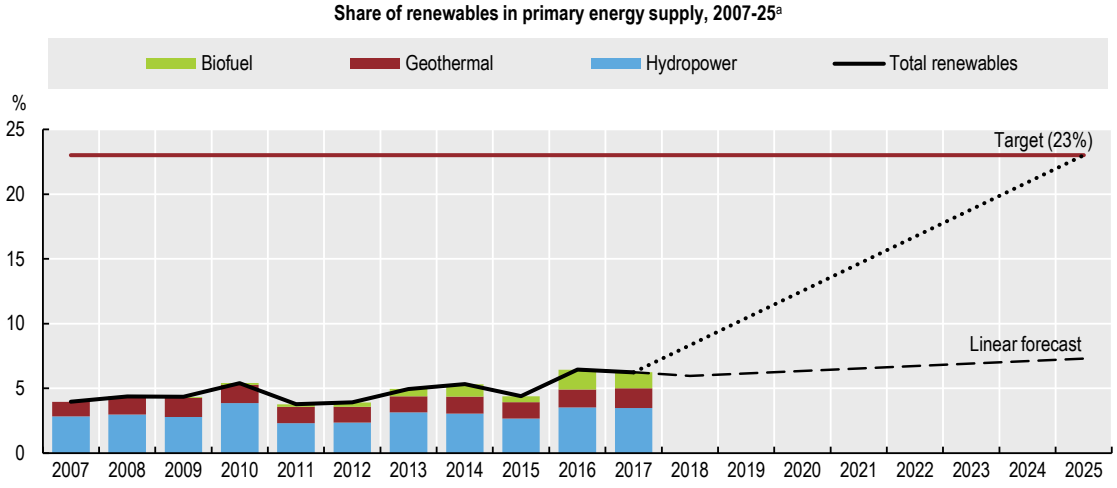
Table 1.1. Renewable energy resources are underutilised

	Potential power	Utilisation	Utilisation rate
Geothermal	29 GW	1.4 GW	4.9 %
Hydropower	75 GW	4.8 GW	6.4 %
Small and micro hydro	19 GW	197 MW	1.0 %
Bioenergy	32 GW	1.6 GW	5.1 %
Solar	207 GW	78 MW	0.04 %
Wind	60 GW	3 MW	0.005 %
Marine	17 GW	0.3 MW	0.002 %
Total renewables	439 GW	8.1 GW	1.8 %

Source: GoI (2017), *Presidential Regulation No. 22/2017 Concerning General Planning for National Energy*.

Achieving the ambitious target of sourcing 23% of TPES from new and renewable energy sources by 2025 will require more effective policies. If renewables' share in TPES increases at the same pace as over 2007-17, Indonesia will fall far short of its target (Figure 1.5). In the power sector, the share has actually decreased in recent years. The government has put in place several incentives to encourage renewables development, including feed-in tariffs, tax breaks and technology-specific funds, but these have not brought about investment as hoped due to financial, regulatory and technical barriers. Frequent policy changes around supportive measures and lack of strong political commitment have depressed investor confidence. While fossil-fuel subsidies have been markedly reduced (to 1.2% of GDP in 2017), they continue to disadvantage renewables vis-à-vis fossil fuels, coal in particular (Chapter 2).

Figure 1.5. Renewables targets will be hard to achieve



a) Indonesian energy balance data excluding energy supply of biomass (mainly firewood and charcoal) and negligible quantities of solar and wind energy.
Source: MoEMR (2018), *2018 Handbook of Energy & Economic Statistics of Indonesia*.

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Energy demand and intensity

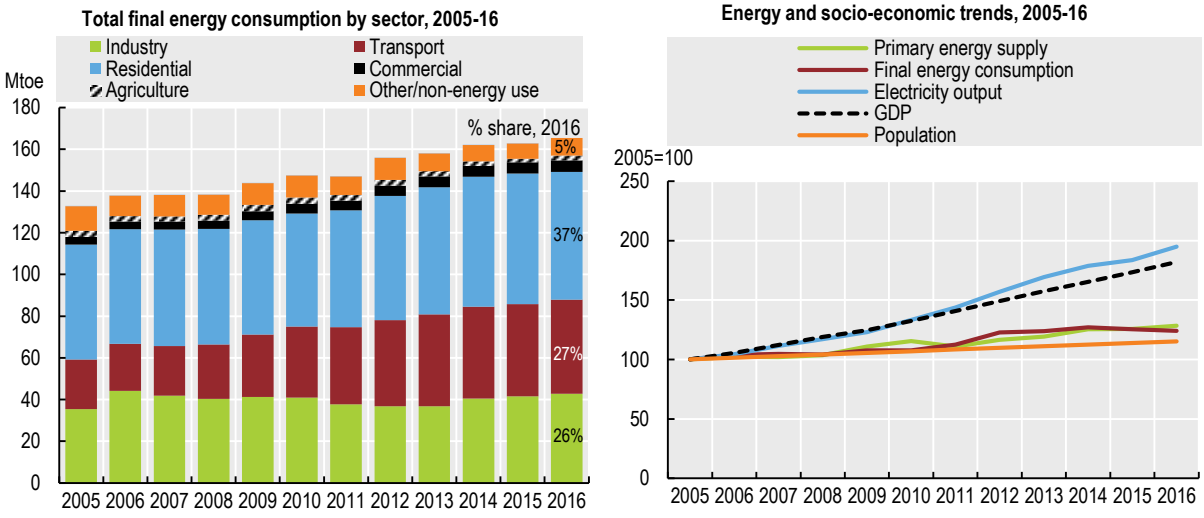
Strong economic growth, rising living standards, population growth and rapid urbanisation have led to a continuous increase in energy consumption. Electricity consumption has nearly doubled since 2005, outpacing GDP and population growth (Figure 1.6). Most

energy is consumed by the residential sector, followed by transport and industry (Figure 1.6). According to OECD projections, energy demand will double by 2040 and triple by 2060. Electricity demand is projected to double by 2030 and quintuple by 2060.

Energy intensity remains relatively low by international comparison. Energy supply per unit of GDP is 20% below the OECD average and lower than in China, India, Malaysia, Thailand and Brazil, for example (IEA, 2018). Energy supply per capita is 80% below the OECD average and considerably lower than in China, Malaysia, Thailand and Brazil (although not India). Per capita supply has increased by 11% since 2005, in part reflecting government efforts to improve energy access across the archipelago.

As GDP growth outpaced that of energy use, Indonesia's energy intensity has improved by 27% since 2005 (3% annually, on average). This means the country is on track to surpass its target of decreasing energy intensity by 1% annually to 2025, set in 2005 in the Energy Conservation Master Plan. Further improving energy efficiency would bring large economic and environmental benefits, reducing the need to expand energy supply and curbing rising GHG emissions from energy use. Reaping these benefits will require better enforcement, greater stringency and broader scope of energy efficiency measures (Chapter 2). The manufacturing, service and transport sectors still show considerable potential for higher efficiency, as they lag behind international best practice benchmarks and often regional comparative benchmarks (Mersmann, Wehnert and Andreeva, 2017). The city of Jakarta has set a target of reducing energy consumption by 30% by 2030, compared to business as usual.

Figure 1.6. Energy demand in transport and industry has risen rapidly



Source: IEA (2018), *IEA World Energy Statistics and Balances* (database); OECD (2018), *OECD National Accounts Statistics* (database).

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Access to energy

Indonesia has made major strides in increasing access to electricity and cleaner energy sources. The electrification rate rose from 53% in 2000 to over 91% in 2016 (BPS, 2018b), driven by government financial support to expand the electricity grid and disseminate solar-powered lamps (IEA, 2017).[6] Wide regional disparity remains, with electrification being virtually universal in western Indonesia (e.g. in Jakarta) but as low as 42% in Papua

(Annex 1.A). Countrywide, more than 10 million people still lack electricity access. Renewables have great potential for enhancing energy access in isolated and rural off-grid areas while providing co-benefits in the form of reduced air pollution and GHG emissions (for example, by displacing cooking wood, kerosene and diesel).

Access to cleaner cooking fuels has also improved considerably. The number of people without such access has declined by 55% (more than 100 million people) since 2000. This was driven by both urbanisation and policy efforts promoting a switch to liquefied petroleum gas (LPG), natural gas and electricity, including through the Kerosene-to-LPG Conversion Program (Chapter 2). The impact of these programmes has been more limited in rural areas, however, and about 25 million households (40% of all households) still rely on traditional biomass, especially wood, for cooking. Indoor air pollution caused by the use of solid cooking fuels is estimated to have resulted in over 45 000 premature deaths in Indonesia annually, with women and children particularly affected (WHO and UNDP, 2009). Other estimates are as high as 165 000 premature deaths per year (IRENA, 2017), more than double the estimated annual deaths from outdoor air pollution (Section 1.3.4).

1.3.2. Transport

The transport sector is defined by geography: the Indonesian archipelago is spread out over vast distances, making several areas difficult for movement of people and goods and costly to access. Improving connectivity across the country and integrating remote and frontier regions is therefore a government priority, with development of maritime transport being a key component.

The transport sector is the second biggest energy consumer, accounting for 27% of final consumption in 2016 (IEA, 2018). Transport fuel consumption is rising fast (+86% over 2005-15), as are CO_2 emissions (+82%). Road is the dominant transport mode for both freight and passengers (Table 1.2), accounting for nearly 90% of both energy use and CO_2 emissions from transport. Air and rail passenger transport is gaining in importance, with air growing from 27 million passengers in 2006 to 96 million in 2016, and rail from 12 million to 35 million (World Bank, 2018; BPS, 2018c). Sea transport is important for freight and is relatively well developed, while inland waterway transport is limited to parts of eastern Sumatra and Kalimantan (Cekindo, 2018a). The RPJMN aims for a shift from road to rail and shipping.

Table 1.2. Road is the dominant transport mode

Transport mode	Passenger (%)	Freight (%)
Road vehicle	84.1	91.3
Rail	7.3	0.6
Maritime	6.6	8.0
Air	1.5	0.05
Waterways	0.4	0.01

Source: Cekindo, 2018a.

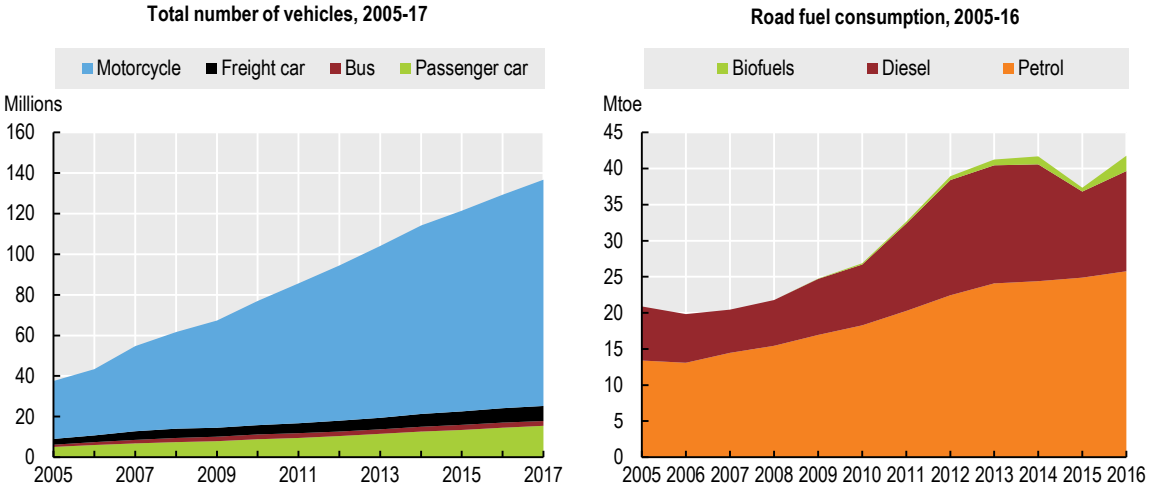
The number of vehicles on the streets has increased massively. The average annual growth in passenger car numbers was above 10% between 2005 and 2016, while motorbike numbers rose by 12% annually (Figure 1.7). With 55 cars per thousand inhabitants, Indonesia's vehicle ownership remains below the OECD average, although the gap is much narrower when motorbikes are included. Petrol is the dominant fuel in road transport,

accounting for 64% of fuel use in the sector, while diesel accounts for 34% and biofuel for 3% (Figure 1.7). Ambitious biofuel blending requirements (Chapter 2) and a series of fiscal incentives will raise this last share further. The government aims to increase the number of electric vehicles, but development of the market has been slow (Chapter 2).

The rapid growth of the vehicle fleet, coupled with insufficient road infrastructure expansion and limited spending on public transport and transport demand management, has caused crippling congestion in cities. Jakarta was considered the world's third most congested city in 2017, after Mexico City and Bangkok (TomTom, 2018). The capital's traffic congestion was estimated to have caused economic losses of IDR 67 trillion (USD 5 billion) that year, or IDR 100 trillion (USD 7 billion) for the greater metropolitan area (BPTJ, 2017). Road occupancy, measured as vehicle kilometres per paved lane kilometre, is estimated to be the world's second highest. As a consequence, about one-third of Indonesian fuel use is wasted in stationary traffic (IEA, 2015).

Recent increases in public infrastructure investment (e.g. in mass rapid transit and light rail transit) in Jakarta and a few other major cities is showing some positive impact in reducing congestion and logistics costs. Jakarta is also implementing an odd-even licence plate rule to limit the number of cars on the roads, although the policy risks encouraging the purchase of a second car by those who can afford it. As Chapter 2 notes, vehicle taxes are high, but are not an incentive to buy lower-emission vehicles. There is scope to strengthen standards for fuel efficiency and vehicle emissions, especially for trucks, to reduce GHG and air pollutant emissions.

Figure 1.7. Road vehicles and fuel consumption are expanding fast



Source: BPS (2018), "Transportation", *Statistics Indonesia* (database); IEA (2018), *IEA World Energy Statistics and Balances* (database); OECD (2018), *OECD National Accounts Statistics* (database).

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1.3.3. Climate change

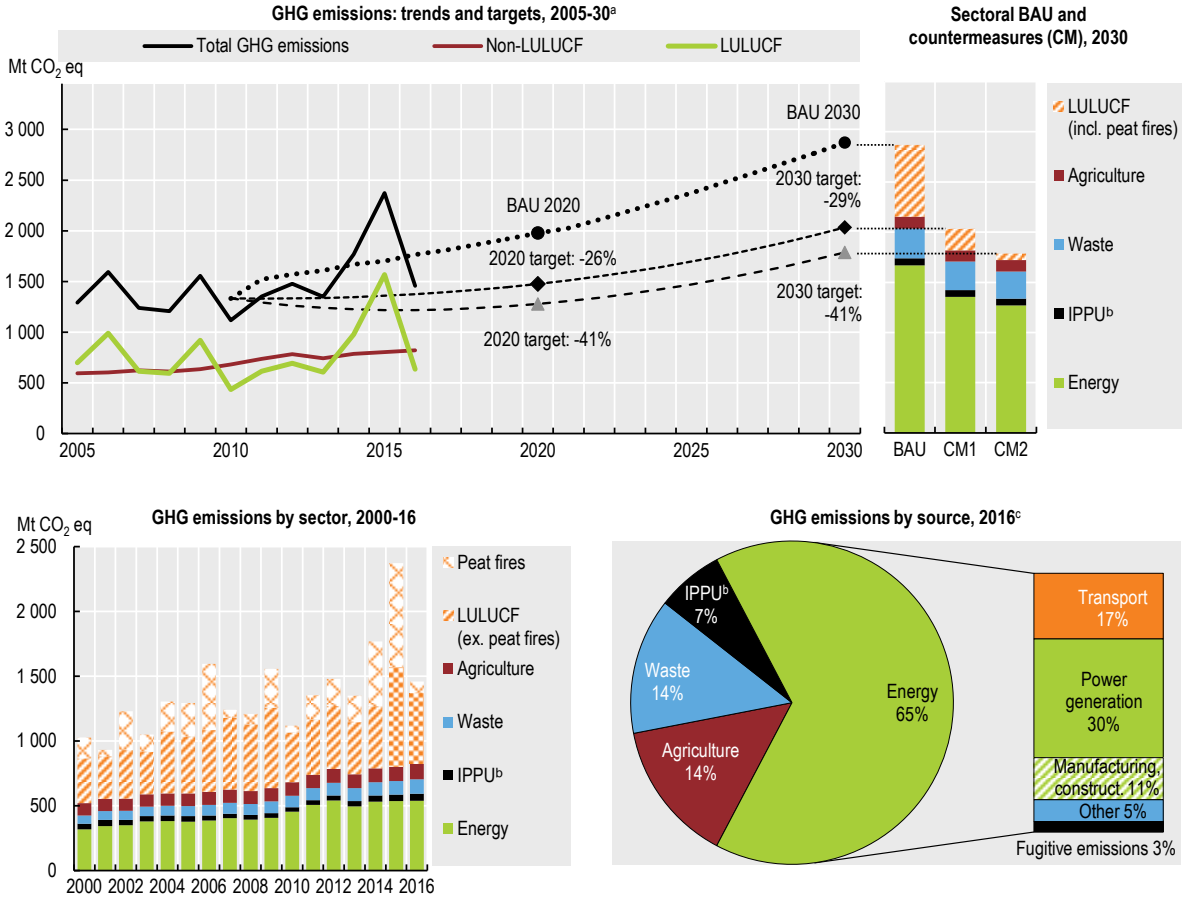
GHG emission profile

The latest available national GHG inventory reported that GHG emissions, including land use, land-use change and forestry (LULUCF), reached 1 458 million tonnes of CO_2

equivalent (Mt CO_2 eq) in 2016 (MoEF, 2018a). This makes Indonesia one of the world's ten largest emitters (WRI, 2018a). GHG emissions increased by 42% between 2000 and 2016, or 2.2% per year, on average. OECD countries reduced emissions by 6.7% over the same period (OECD, 2018d). CO_2 is the main GHG, contributing 82% of total emissions, while methane contributed 13% and nitrous oxide 4.3% (MoEF, 2018a).

LULUCF emissions dominate Indonesia's GHG emission profile, although levels of CO_2 emitted and sequestered by the sector fluctuate significantly from year to year (Figure 1.8). LULUCF emissions are mainly caused by conversion of carbon-rich forest and soil to agriculture (particularly oil palm plantations) and logging (particularly timber harvesting), as well as forest and peat fires. Peatland burning and decomposition have a double effect on climate change, as these areas hold significant carbon stocks (Chapter 3). In 2015, a year with an extremely dry rainy season connected to a strong El Niño event, LULUCF emissions reached 1 569 Mt CO_2 eq, more than Indonesia's total emissions in 2016 (and more than Germany's or Japan's emissions). On average, Indonesia's LULUCF emissions are among the highest in the world, although data are difficult to compare.

Figure 1.8. Indonesia needs to curb GHG emissions to reach its 2030 target



a) Business-as-usual (BAU) projections and countermeasures (unconditional and conditional mitigation scenarios, CM1 and CM2) from the First Nationally Determined Contribution and the Second Biennial Updated Report by Indonesia to the United Nations Framework Convention on Climate Change.
b) Industrial processes and product use.
c) Excluding LULUCF.
Source: MoEF (2018), *Second Biennial Updated Report under the United Nations Framework Convention on Climate Change.*

StatLink http://dx.doi.org/10.1787/888933931145

Aside from LULUCF, energy is the largest sector for GHG emissions, accounting for 37% of total GHG emissions in 2016 (or 65% of emissions excluding LULUCF). The remainder is from agriculture (14%), waste (14%) and industrial processes (7%) (MoEF, 2018a). Emissions from the energy sector increased by nearly 70% between 2000 and 2016 (Figure 1.8). Energy-related emissions mainly come from fuel combustion for power generation (which accounted for 30% of emissions excluding LULUCF in 2016), transport (17%) and manufacturing and construction (11%); smaller shares come from the residential sector, petroleum and gas refining, fugitive emissions and other sources (Figure 1.8).

Indonesia has achieved a relative decoupling of economic growth from GHG emissions: emission intensity declined between 2005 and 2016, both including and excluding LULUCF emissions (-38% and -24%, respectively). Excluding LULUCF, the emission intensity is similar to the OECD average; including LULUCF it is nearly twice the OECD average. Emissions per capita have increased by 29% since 2005, but are still low by international comparison (OECD, 2018d). Per capita emissions are expected to continue to grow to 2030, according to government projections.

Indonesia has strengthened its GHG emission inventory arrangements through regulations and other measures.[7] Continued efforts are needed to synchronise provincial GHG emission data and improve their quality. Official data on provincial GHG emissions are collected through a system called SIGN SMART but not synchronised, monitored, or linked with national targets. Data compiled by the World Resources Institute (WRI) suggests most emissions originate in North Sumatra province (likely due to significant deforestation), followed by Riau, East Java, Central Kalimantan and Lampung. Deforestation is the largest emission source in most provinces, but energy-based emissions dominate in at least ten provinces, including several in Java (WRI, 2018c). Central Kalimantan registers the highest emissions relative to population and GDP.

Indonesia's online monitoring, evaluation and reporting system, PEP online, provides data and monitoring and evaluation processes for mitigation and adaptation action plans. It includes a provincial breakdown for potential emission reductions from implementation of mitigation activities. In addition, the National Registry System compiles climate action, resources and potential emission reductions from climate action conducted by national and subnational government as well as private and civil society actors. These systems could be integrated and synchronised to monitor progress against Indonesia's climate targets.

Mitigation targets

In 2009, Indonesia adopted a voluntary target of reducing emissions by 26% from a business-as-usual (BAU) scenario by 2020 using domestic efforts. A further 15% reduction target (taking total reduction to 41%) is conditional on receipt of adequate international support. This pledge was confirmed in Presidential Regulation No. 61/2011 on the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK). Indonesia's Nationally Determined Contributions (NDC) set an unconditional reduction target of 29% of BAU by 2030 and a conditional reduction target of up to 41%, subject to international assistance for finance, technology transfer and capacity building. Indonesia ratified the Paris Agreement in October 2016. Work is ongoing with respect to development of mitigation scenarios beyond 2030.

The latest BAU scenario, reported in the second Biennial Update Report under the United Nations Framework Convention on Climate Change (MoEF, 2018a), projects emissions in 2030 at 2 869 Mt CO_2 eq, more than 1 000 Mt CO_2 eq above current levels. This scenario translates into unconditional maximum emission targets of 1 581 Mt CO_2 eq for 2020 and

2 035 Mt CO_2 eq for 2030 (Figure 1.8). The steep increase in the baseline is driven by emissions from energy use, which are projected to more than triple over 2016-30, replacing LULUCF as the largest emitting sector by the mid-2020s. Even in the most ambitious mitigation scenario (the -41% target), energy emissions would nearly double from current levels (Figure 1.8). This has caused criticism of Indonesia's NDC ambition as "highly insufficient" in terms of the global goal of limiting warming to 2°C (CAT, 2017). Indeed, the BAU scenario can be considered conservative, as it assumes there would be no additional renewables capacity after 2010 and no energy efficiency improvements, for example (Mersmann, Wehnert and Andreeva, 2017; IRENA, 2017).

The government reported that annual emissions in 2010-16 were below BAU except in 2014 and 2015, when emissions from peat fires peaked. In 2016, emissions were 14% below BAU, meaning Indonesia was about halfway to achieving its 2020 target (MENKO, 2018). At the same time, the government acknowledged that more effort was needed to bring emissions from forestry and energy on track to meet the 2030 target (MENKO, 2018). This is in line with WRI projections (2017b), which suggested that emissions from the land-use and energy sectors alone were likely to miss the 29% reduction target for 2030 if existing policies (as of late 2017) were not strengthened.

Climate policy

The RAN-GRK forms the cross-sector framework for Indonesia's climate strategy. Formulated by BAPPENAS, in co-operation with other ministries, it includes 50 mitigation plans for five sectors: agriculture, forestry and peatland, energy and transport, industry, and waste. Provincial action plans were also developed, with BAPPENAS mandated to co-ordinate their evaluation and review, in collaboration with the Ministry of Home Affairs and the MoEF. The government is reviewing the RAN-GRK in the context of the 2030 commitment in the NDC, which sets the framework for climate action after 2020. The government plans to mainstream the 2030 target into the 2020-24 RPJMN, which is expected to become the country's first low-carbon plan (Chapter 2). Indonesia has made progress with respect to the regulatory and planning framework for climate finance, for example with the development of climate budget tagging, green budgeting and planning, and the issuance of green bonds (Chapter 2).

Mitigation policy is chiefly focused on land use. The RAN-GRK allocated 88% of emission reduction to 2020 to the forestry and peatland sector (and only 5% to energy and transport), while the NDC expects land use and forestry to deliver about 60% of the 2030 target (MoEF, 2015a; MoEF, 2017a). Indonesia has taken important steps in addressing land-based emissions, such as updated forest and peatland regulations (including a moratorium on new peatland conversion permits), better law enforcement, a new focus on social forestry and enhanced efforts to control forest and peat fires (Chapter 3). The government committed to reduce deforestation and to restore 12 million ha of degraded land and 2 million ha of peatland. Thanks to these measures, the forestry sector was the biggest contributor to emission reduction in 2016 and 2017. Still, the 2030 mitigation target for the forestry sector appears quite ambitious, requiring almost zero net emissions by 2030 under the 41% reduction scenario (Figure 1.8). Reaching this target will require strengthened forest governance and compliance with land-use regulation. Extending and strengthening the forest and peat moratoriums (which prohibit issuance of new licences on primary forest and peatland) is widely recognised for its large, cost-effective mitigation potential (WRI, 2017b; JICA/DNPI, 2014).

Efforts to decarbonise the energy sector need to accelerate. The focus of mitigation has been on fuel switching, energy efficiency and public transport (MoEF, 2017a). At the same time, plans to expand coal-fired power generation potential drastically reduce the sector's mitigation potential and risk locking-in high-carbon infrastructure on a large scale and for decades to come. The Intergovernmental Panel on Climate Change (2018) noted that investment in unabated coal would need to halt by 2030 to be consistent with the 1.5°C scenario; its use in power generation would need to stop by 2050. Setting targets for energy sectors (power generation, transport, etc.), broken down into short-term goals and clear responsibilities for different actors, could help structure and accelerate the energy transition. Phasing out fossil-fuel subsidies and pricing carbon emissions from energy use would contribute to better alignment of energy and climate policy objectives (Chapter 2).

Indonesia established the National Council on Climate Change in 2007 as an inter-ministerial co-ordination body for climate change policies and positions, headed by the president. In 2015, it became part of the Directorate General of Climate Change in the newly established MoEF, along with Indonesia's REDD+ body, the aim being to make climate policy co-ordination more effective. As in many countries, climate policy is fragmented across institutions, including the MoEF, BAPPENAS (which retains the legal mandate to co-ordinate the RAN-GRK), the Ministry of Finance (which oversees climate finance) and line ministries.

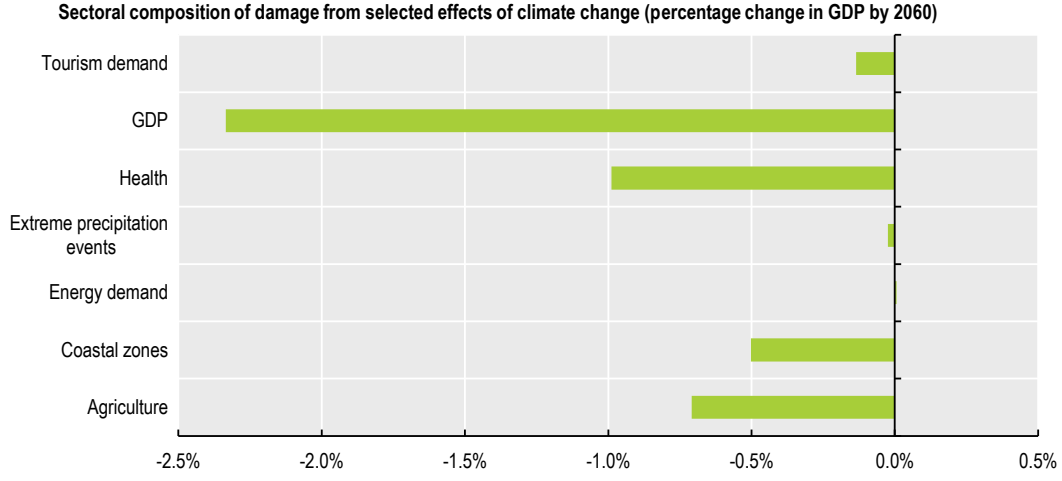
Continued efforts are needed to build a strong monitoring, reporting and verification (MRV) system. The MoEF has developed a national carbon accounting system that can provide the basis for a strong MRV system. Efforts are underway to enhance the flexibility of this system to fit policy requirements, produce UNFCCC-compliant reports, develop projections to support NDCs, and support broader land-use planning and tracking of policy outcomes, including co-benefits. The government recognises the need to improve the calculation of GHG emissions, the annual baseline and sectoral reduction targets to provide a credible reference making it possible to track progress and assess climate policies' effectiveness (MENKO, 2018). Tracking progress towards the reduction targets has not been straightforward because the BAU scenario, on which the mitigation targets are based, has been updated several times. Hence the sectoral mitigation targets do not match the legal target of 41% but add up to 38% instead. Work to address this discrepancy is ongoing.

Climate change vulnerability and adaptation policy

Indonesia's geographical and socio-economic conditions make it vulnerable to natural disasters, including extreme weather and climate change (MoEF, 2017a). While its climate has historically been affected by decadal variability, influenced by the El Niño and El Niña Southern Oscillation, long-term temperature and rainfall trends are rising. Climate-related disasters, such as floods and landslides, have increased, especially on the islands of Sulawesi, Kalimantan and Sumatra. Projections indicate that surface temperatures will continue to increase until 2100; rainfall will become lower during dry season and stronger during rainy season and transition periods.[8] Extreme climate-related events are therefore expected to become more frequent and intense. The OECD projects that overall climate change damage will reach about 2.3% of GDP by 2060. Most of the damage is expected to stem from the impact on health, agriculture and coastal zones (Figure 1.9). Sea level is projected to rise between 0.6 cm and 1.2 cm per year, which could cause flooding of productive coastal zones that are home to more than 180 million Indonesians (MoEF, 2017a; World Bank, 2018e).

The 2014 National Action Plan for Climate Change Adaptation (RAN-API) is under review. It identified 43 adaptation programmes in four areas: economic resilience (food resilience and energy independence), livelihood resilience (health, residential areas and infrastructure), ecosystem resilience and resilience of specific locations (cities, coastal areas and small islands). It also aims to strengthen support such as capacity building, planning and budgeting, and monitoring and evaluation. Like the RAN-GRK, the RAN-API is co-ordinated by BAPPENAS. Provinces are expected to develop their own action plans, but uptake has been slow, with only eight provinces having adopted one so far. To accelerate the process, the MoEF issued a regulation in 2016 providing guidance on the formulation of local adaptation action plans. A vulnerability index, currently under construction, could be used to develop a comprehensive, evidence-based adaptation strategy that is based on vulnerability assessments, includes milestones and can be monitored and broken down subnationally.

Figure 1.9. Damage from climate change is projected to reduce GDP by 2.3% by 2060



Source: OECD (2015), *The Economic Consequences of Climate Change.*

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1.3.4. Air pollution

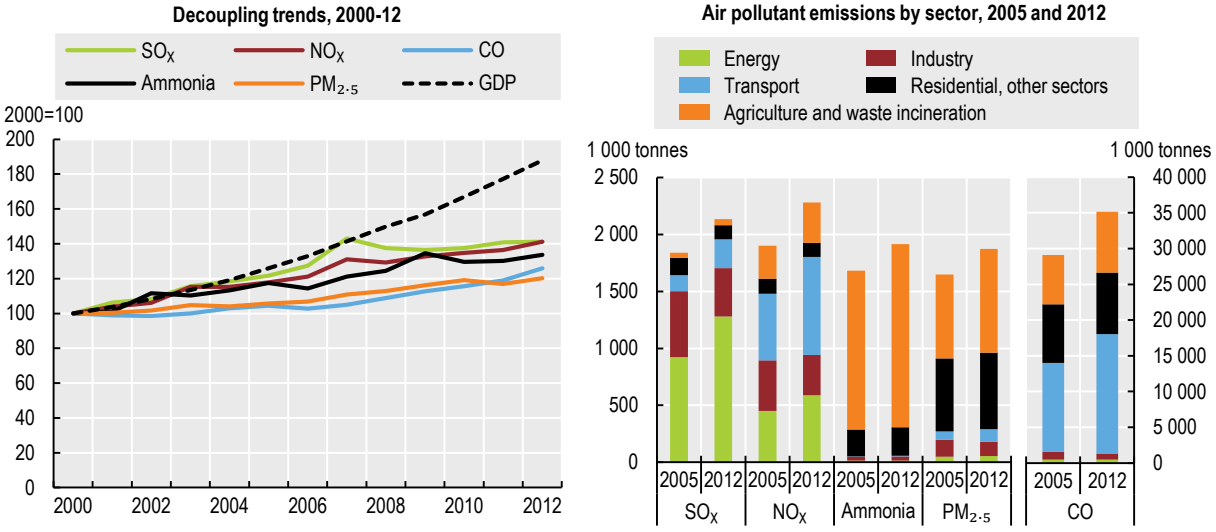
Emission of atmospheric air pollutants

According to the EDGAR global emissions model, local air pollutant emissions increased over the 2000s, although slower than GDP growth (Figure 1.10). Growth was strongest for emissions of nitrogen oxides (NO_X) and sulphur oxides (SO_X), reflecting vehicle fleet growth (as well as poor fuel quality and vehicle standards) for NO_X and expansion of coal-fired power generation for SO_X. Large forest and peat fires (neither of which are considered in the model) lead to pollution peaks in Indonesia and neighbouring Malaysia and Singapore, although efforts to reduce fires have started to bear fruit (Chapter 3). Peat fires are of particular concern, as they cause up to 90% of haze and release three to six times more particulate matter (PM) than fires on other types of soil (World Bank, 2016b).

National data on pollutant emissions are limited. Operators of large facilities (that are subject to emissions regulations) are obliged to equip their facilities with emission controls and report the results to the local government, with a copy to the MoEF. In practice,

however, the MoEF mainly relies on a voluntary performance assessment programme, PROPER (see Box 2.5 in Chapter 2), to assess and monitor air pollution from industry. The establishment of an electronic environmental reporting system for PROPER-participating companies in early 2018 is expected to improve data collection. It could build the basis for a comprehensive national inventory of stationary-source air emissions. In addition, emission inventories have been developed for 11 cities since 2010. Emissions from mobile sources are not collected systematically.

Figure 1.10. Emissions of air pollutants have been decoupled from economic growth



Note: Estimates based on the Emission Database for Global Atmospheric Research (EDGAR). The category "agriculture" comprises agricultural waste burning, which includes the burning of short-cycle biomass, e.g. burning of grassland and of crop residues, but excludes large-scale biomass burning (such as forest fires).
Source: European Commission, Joint Research Centre/PBL Netherlands Environmental Assessment Agency (2018*), Global Air Pollutant Emissions EDGAR v4.3.2* (database).

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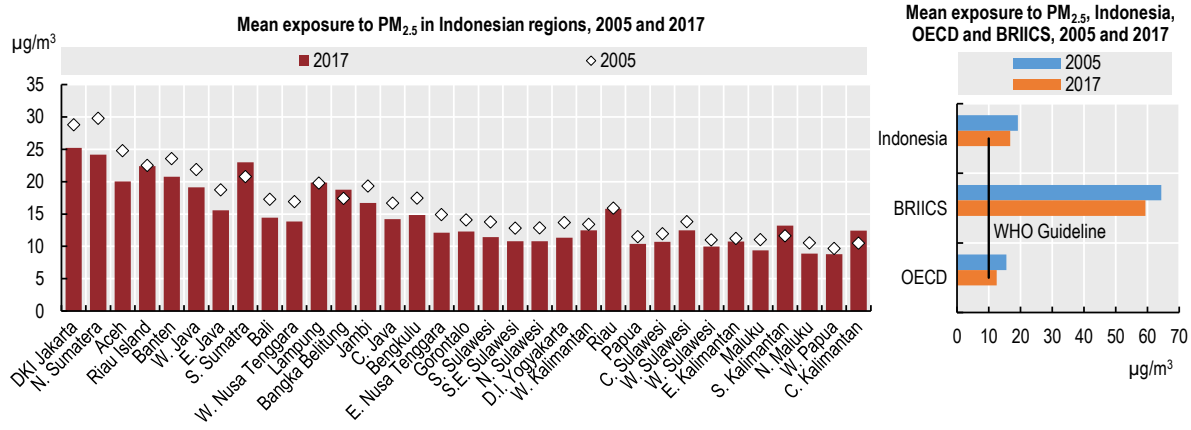
Ambient air quality

OECD data based on satellite observations suggest that 95% of the population is exposed to harmful levels of air pollution, i.e. more than 10 µg/m^3 of $PM_{2.5}$, which is the World Health Organization (WHO) guideline value (OECD, 2018e).[9] Exposure to air pollution varies significantly across the country (Figure 1.11). Jakarta has had the highest exposure rates over much of the past decade, and provinces on Sumatra and Kalimantan experience high peak exposures during forest fires. In 2017, national mean exposure to $PM_{2.5}$ reached 16.7 µg/m^3, above the OECD average, though much below those of other emerging economies such as India and China. The Indonesian Air Quality Index (AQI), the main domestic indicator of air quality (a 0- to 100-scale composite index), deteriorated in the early 2010s, but has improved in recent years. In 2017, it reached 87, above the government's target value of 84 for 2019 (MoEF, 2017b).[10]

Figure 1.11. Exposure to $PM_{2.5}$ is above international guidelines



Source: OECD (2018), "Air quality and health: Exposure to $PM_{2.5}$ fine particles - countries and regions", *OECD Environment Statistics* (database).

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The number of premature deaths related to ambient $PM_{2.5}$ and ozone pollution has risen steadily to reach more than 200 per million inhabitants in 2017 – a value that remains below the OECD average (380 premature deaths) and the ASEAN average (260 premature deaths) (OECD, 2018e). The associated health cost and economic consequences were valued at 1.2% of GDP. The World Bank (2016b) estimates that the large 2015 forest and peat fires alone cost Indonesia at least USD 16 billion (equivalent to 1.9% of GDP) and caused 500 000 cases of acute respiratory infection. Acid rain, an indicator of declining air quality associated with NO_X and SO_X pollution, is becoming a concern, affecting water ecosystems, soil and buildings (Yudha, 2017).

Indonesia's air quality monitoring system, run by the MoEF, has two components: i) the National Air Quality Monitoring System (AQMS), which continuously monitors CO, SO_2, NO_2, ozone, PM_{10} and $PM_{2.5}$ concentrations in 14 large cities; and ii) "passive sampling" at roadsides in about 50 cities.[11] The MoEF is increasing the number of cities in the AQMS, aiming to reach 45 cities by 2019. By early 2019, 49 stations had been installed in 40 cites. Other national, local and non-government institutions conduct air quality monitoring but do not always share the collected data (OECD, 2016b).

Main policies and measures

Government Regulation No. 41/1999 on Air Pollution Control, complemented by ministerial regulations, specifies ambient air quality standards for all major pollutants, as well as emission standards for industrial activities and motor vehicles. Air quality standards are generally less stringent than global WHO guideline values (OECD, 2016b) and some emission standards are more lax than international best practice. For example, PM standards for new coal-fired power plants are three times higher than in India, and ten times higher than in the EU (Table 1.3). Standards for the pulp and paper industry are also low by international comparison. In a welcome step, emission standards for the cement industry were raised in 2017 and the government plans to update standards for coal-fired power plants in 2019. In addition, in March 2017, the MoEF signed a long-awaited regulation stipulating Euro 4 emission standards for four-wheel vehicles. Since 2005, Indonesia had used Euro 2 for passenger cars and Euro 3 for motorcycles, one of only three Asian countries to do so. It is one of the few countries still using RON 88 petrol (locally

known as "premium"), a low-quality fuel that contributes to air pollution (Ompusunggu, 2017).

Table 1.3. Emission standards for coal-fired power plants are not stringent

Selected countries, in $\mu g/m^3$

	PM		SO_x		NO_x	
	Existing	New	Existing	New	Existing	New
Indonesia	150	100	750	750	850	750
Japan	100	50	-	200	410	200
India	100/50	30	600/200	100	600/300	100
China (P.R. of) (hourly)	30/20	10	200/50	35	100	50
US (daily)	18.5	12.3	185	136	135	95.3
EU (continuously)	20	10	200	150	200	150

Source: Zhang, 2016.

As part of its overall goal to improve air quality, Indonesia set a target of reducing air emissions by 15% between 2014 and 2019, to be achieved through reductions at both stationary and mobile sources. To support emission reductions by industry, the government issued technical guidelines and launched a Green Boiler Program to encourage companies to improve their boilers' performance. However, participation has been relatively low (MoEF, 2016). The MoEF reported that industrial emissions declined by 10% over 2014-16, but the assessment was based on a small sample of 66 companies in the PROPER programme (MoEF, 2016). The main strategy to reduce emissions from mobile sources has been the Green Transport concept, which supports cities in shifting towards sustainable transport. The concept was tested in three cities in 2016 and the MoEF aims to increase the number to 45 by 2019. As part of the strategy, the MoEF issued guidelines on air pollution control in residential areas and developed a website presenting regencies and cities' air quality status on a continuous basis.

To tackle air pollution in a comprehensive and integrated manner, Indonesia needs to continue improving its monitoring system for air emissions and ambient air quality. Information about emissions' source and location is a condition for development of targeted policies, assessment of policy effectiveness, and enforcement of standards. Given their weight in emissions, road transport, power generation and agriculture deserve more policy attention. While the issuance of the Euro 4 standard is welcome, vehicle testing and enforcement remain weak (IEA, 2015). Jakarta is stepping up action in this regard. The city furthermore holds air quality forums with stakeholders, restricts vehicle circulation through an odd-even system and car-free days, and is expanding public transport and electronic pricing on highways. This will bring lessons for other cities and provinces. Industrial emissions should be monitored carefully and not only among companies participating in PROPER. Emission standards for heavily polluting industries should be raised closer to international ones, particularly those of coal-fired power plants, given the additional capacity planned for the coming decades.

1.4. Transition to a resource-efficient economy

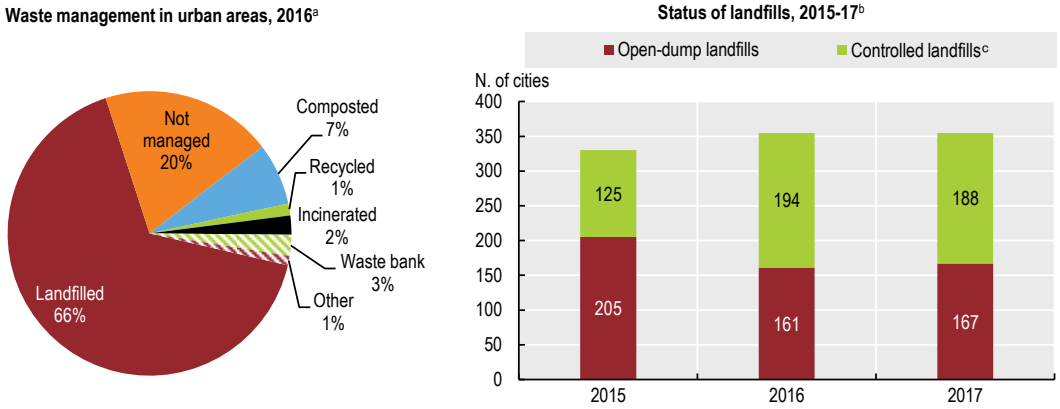
1.4.1. Waste management

Generation, collection and disposal of municipal solid waste

The MoEF estimates that 62 million tonnes of municipal solid waste (MSW) were generated in 2016 in Indonesian cities, roughly double the amount generated in 2006 (Cekindo, 2018b). This translates into 235 kg per capita per year, far below the OECD average of 520 kg, and roughly in line with other ASEAN countries, including Viet Nam and the Lao People's Democratic Republic (UNEP, 2017). Data on waste generation and management in Indonesia are limited, however, and not directly comparable internationally.[12] Households and offices account for half of MSW (26% and 24%, respectively), with the remainder coming from public facilities (15%) and commercial centres (14%). Waste is mostly composed of organic waste (50%), plastic (19%) and paper (11%) (MoEF, 2017a).

Waste collection services are often inadequate or inefficient. According to the MoEF, 20% of urban MSW is not managed (i.e. collected and disposed of at designated sites) but instead is burned, buried or dumped informally (Figure 1.12). As the share is much higher in rural areas, an estimated 33% of national MSW is not managed (MoEF, 2017c). Given the shortfall in waste collection, uncertainty remains as to how much waste is actually generated. Many Indonesians have no access to MSW collection; even in the biggest cities, only 70% to 85% of the area is served (MoEF, 2017). The resulting illegal burning and dumping have significant environmental, health and economic consequences from contamination of soil, air and water as well as clogging of rivers, ducts and drainage systems, which in turn exacerbates local flooding. In some cities the prevalence of unmanaged waste has become so acute that the army has been called to support cleanup (Shukman, 2018).

Figure 1.12. Two-thirds of collected waste is landfilled



a) Waste defined according to the Law 18/2008 and including household and household-like waste. Data refer to urban areas including14 metropolitan cities, 17 big cities and 73 medium-sized cities for the period 2015-16.
b) Data refer to the performance in the implementation of the Adipura programme for the reduction of open dump sites and refer to the number of cities/districts applying the minimum requirement of landfill control.
c) Landfills covered with land or other material.
Source: MoEF (2017), *Peran Pemerintah Daerah Dalam Pelaksanaan Mitigasi Emisi Gas Rumah Kaca Sektor Limbah* [The role of the regional government in the implementation of GHG reduction targets in the waste sector], presentation, Jakarta 24 August 2017.

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Appropriate waste treatment and disposal also remain a serious challenge. As in many emerging economies, landfilling is the dominant disposal type (Figure 1.12). There are a few hundred landfills across the country, nearly half of which operate as uncontrolled open dumps, although the number is decreasing. Many landfills operate near, or above, capacity limits; Jakarta's is expected to reach capacity between 2021 and 2023, for example. Relatively small shares of MSW are composted (7%) or incinerated (2%). A small yet increasing share is managed through "waste banks" (3%), where people can exchange household waste for small amounts of money (Box 1.1). Recycling is very limited (less than 2% of managed waste). It is largely an informal-sector activity, implying that government statistics do not adequately reflect data on recycling volume and economic benefit. In 2008, there were 1.2 million waste pickers nationally, working in poor conditions and without health protection (Cekindo, 2018b). In 2018, the MoEF encouraged local governments to register waste pickers in their waste management systems so as to improve their working conditions.

Box 1.1. Waste banks: Engaging households in sustainable waste management

Waste banks (*bank sampah* in Indonesian) are physical places where people can exchange waste for small amounts of money. Waste generated by households is sorted into organic and non-organic. Organic waste is composted, while non-organic waste is further sorted into three categories: plastic, paper, and bottles and metal. Households bring their sorted waste to a neighbourhood waste bank, where they make a "deposit". The waste is weighed and given a monetary value, based on rates set by waste collectors. This amount is deposited to households' accounts, from which they can withdraw funds as at a regular bank.

The relatively low costs associated with waste banks have enabled their rapid expansion across the archipelago. Unilever Foundation promoted one of the first waste bank initiatives in Surabaya with the installation of 20 banks in 2004 as a way to clean the city. By early 2019, there were almost 7 500 waste banks spread across 232 regencies/cities. The MoEF reports that they managed about 1.1 million tonnes of waste in 2018, or about 2% of total waste generated, up from 0.01% in 2014. Annual revenue from waste banks increased by nearly 50% since 2014, reaching IDR 30.1 billion (USD 2.1 million) in 2018. The revenue is being used to finance the operation and maintenance of the banks, although most also rely on local and/or provincial budget support. Data on how the collected waste is treated are not yet systematically collected.

The operation of waste banks has benefited from numerous innovations, including mobile waste banks that float across rivers and banks allowing trading of waste for rice or improved access to public health care programmes. Since 2018, participating households have been able to set up accounts with Bank Indonesia to save their earnings, promoting financial literacy among poorer households. In Jakarta, a regulation requires each neighbourhood to set up a waste bank. In Central Jakarta, waste volume has decreased by 35% thanks to the waste bank movement (*The Jakarta Post*, 2017). Many waste banks co-operate with the informal sector in sorting and processing waste. Hence it is important for local governments and neighbourhood organisations to be trained in, and enforce, labour and health standards for waste handling.

Source: World Bank (2013), *Waste Not, Want Not: "Waste Banks" in Indonesia*; country submission.

Marine plastic pollution

One study estimated that Indonesia was among the world's largest contributors to marine plastic pollution, with 0.5-1.3 million tonnes of marine plastic debris a year. About 80% of it was improperly disposed waste from land (Jambeck et al., 2015). During the rainy season, large amounts of waste enter rivers and waterways and are carried to Indonesia's coasts. With the issuance of Presidential Regulation No. 83/2018 on Marine Debris, Indonesia set a target of reducing marine waste by 70% by 2025 through awareness building, management of land-based waste, waste prevention on coasts and at sea, better financial and institutional capacity for waste management and investment in research and development. To this end, the government pledged to devote up to USD 1 billion. Achieving this goal will depend to a large extent on establishing well-functioning municipal waste collection and treatment services. The Ministry of Marine Affairs and Fisheries has already constructed waste handling facilities in ports and temporary shelters and recycling centres on small islands to reduce marine debris; the MoEF has established recycling centres in major cities and tourist destinations. Presidential Decree No. 15/2018, which aims to accelerate pollution and degradation control in the Citarum watershed, will provide valuable lessons for other priority rivers.

Main policies and measures

Indonesia has a good legal basis for waste management. The National Solid Waste Law (Law No. 18/2008) calls for sound waste handling (collection, transport, landfilling) based on the 3R approach (reduce, reuse and recycle). It requires all levels of government to develop coherent MSW plans, contribute to the financing of MSW management, and build public awareness. The law mandates waste separation as an initial step in recycling. It further stipulates that non-controlled landfills (operating as open dumps) must be closed by 2013 and that new landfills must be sanitary, avoid methane emissions, and be equipped with integrated processing facilities (MoEF, 2008). However, there is a considerable gap between the legal provisions and management practices on the ground.

Local governments are required by law to have MSW management plans, but few have consistent plans and many lack capacity and funding for their implementation. Many cities lack waste processing facilities. Finance available to local governments is insufficient, as waste charges are too low, narrowly based and weakly enforced to cover waste collection and treatment costs (Chapter 2). The national government has provided capital funding for disposal infrastructure (e.g. sanitary landfills and, more recently, waste-to-energy plants), but limited local resources and capacity for operation and management have resulted in many landfills turning into uncontrolled open dumps over time. Making national funding conditional on local performance and co-funding could help sustain the operation of new infrastructure while ensuring that national funding is complementary to sustainable local financing rather than a substitute for it. This would need to be complemented with capacity-building measures, improvement to information management and more effective co-ordination between government levels. State subsidies may be needed to get basic waste management into place where it is currently lacking.

Presidential Regulation No. 97/2017 on the National Solid Waste Management Policy and Strategy set a target of reducing 30% of waste generated by 2025 (from BAU) and handling the remainder.[13] Among other matters, it calls for strengthened co-ordination between government levels, better law enforcement, increased central and regional government budgets, formation of an information system, community involvement and education, stronger involvement of the business sector, and incentives for better waste handling. It

requires local authorities to develop regulations on meeting waste reduction and management targets for 2025, and make regular reports. As of early 2019, 300 cities out of 514 cities/regencies had developed local strategies, and 13 out of 34 provinces had submitted their waste management policy and strategy. The regulation addresses many barriers to more sustainable waste handling and should be implemented with priority.

Waste "exchanges" have proved to be an innovative and effective tool to speed up improvement of municipal waste services. The development of waste banks (Box 1.1) has helped engage municipalities and local communities, build awareness among citizens and start developing waste sorting and recovery capacity, while also creating socio-economic value (e.g. creating job opportunities and engaging the large informal workforce involved in waste sorting and recycling). In the city of Surabaya, people can pay for bus tickets with plastic bottles. Such initiatives can help raise citizens' awareness of the value of waste sorting and recovery. They should be complemented with a comprehensive strategy for developing a recycling industry.

The MoEF is developing a draft roadmap for producer programmes for waste reduction, in line with the extended producer responsibility (EPR) approach. The roadmap is intended as a guideline for avoidance of plastic waste (e.g. packaging) and for product design that facilitates reuse and recycling. While it may help put in place incentives and infrastructure for waste reduction, the government should consider implementing binding EPR programmes in the medium term, at least for the most environmentally harmful products (e.g. batteries, vehicles, electronic products), so as to reduce environmental and health problems associated with landfilling them. Involvement of the informal sector in the design and implementation of such programmes will be critical to their success. Following the example of many countries (e.g. South Africa and Poland), the government is considering introducing an excise tax on plastic bags, encouraged by a successful plastic bag fee piloted in several cities in 2016,[14] or gradually banning single-use plastic bags. Eighteen local governments already have such a ban in retail stores.

Hazardous and toxic waste

Control of hazardous and toxic waste (HTW) has become a major government concern, since management practices and monitoring of companies and individuals are generally poor (MoEF, 2017d). Illegal HTW dumping, such as the common practice of disposing of medical waste in municipal landfills, contributes to air and water pollution and soil contamination. Knowledge about HTW handling has improved; the number of companies monitored rose from 39 in 2012 to 295 in 2016, MoEF data show.[15] Nevertheless, continued improvement is needed. In 2016, 73 million tonnes of HTW was inventoried, mostly from mining (89%), followed by infrastructure and the service sector (7%), manufacturing (2%) and agri-industry (2%). More than three-quarters (77%) of monitored HTW was handled through permitted dumping,[16] with the rest being reused, processed, landfilled or exported.[17]

Government Regulation No. 101/2014 on the Management of Hazardous and Toxic Waste Materials emphasises the obligation for polluters to both manage the HTW they generate (either themselves or through a third party) and rehabilitate any environmental damage it causes. Local governments must carry out the rehabilitation if the polluters are unidentified. Licences for operating hazardous waste handling facilities are issued by the MoEF (MoEF, 2015b). As there is only one engineered hazardous waste landfill in the country (in West Java, western Indonesia), most hazardous waste is stored by industries on site under a five-year permit issued by the district government. Indonesia also exports hazardous

waste under the Basel Convention. Support may be required by the government to build hazardous waste treatment infrastructure to cover eastern Indonesia. The government has increased resources to control medical waste from hospitals and built a first medical waste incinerator in South Sulawesi (eastern Indonesia).

Monitoring compliance with the regulation has been challenging due to a general lack of resources and capacity (MoEF, 2015c). A significant share of permit verification remains document-based and subject to fraud. Many local governments do not issue permits for (or verify) temporary storage and it is unclear what happens to the waste once the storage permit expires (MoEF, 2015b). In 2018, the MoEF increased its efforts to supervise and provide technical guidance on the matter. Still, there is a need to dedicate more resources to promote, control and enforce compliance of waste management activities with national regulations, as promoted by the OECD Council Recommendation on Environmentally Sound Management of Waste. This could include increased inspection of HTW handling facilities, capacity-building measures, clear reporting obligations and fines for non-compliance. Efforts are also needed to strengthen and implement an environmental liability regime for facilities handling dangerous substances (Box 1.2).

Box 1.2. Environmental liability is enshrined in law, but implementation is challenging

The 2009 Law on Environmental Protection and Management provides for strict liability for damage resulting from handling of hazardous substances and waste, whereas liability for damage from other pollution is fault-based. The national and provincial governments have a right to sue economic actors for compensation and/or to impose remediation actions for damage to the environment that is not related to private interests. Citizens can file individual and civil class action suits for compensation for environmental damage. Non-government organisations (NGOs) can file claims for environmental remediation without monetary compensation. Despite an ongoing environmental certification programme for judges (nearly 800 of whom are now certified), criminal enforcement is limited by judicial capacity and procedural constraints (Sembiring, 2017). In one verdict, the Supreme Court ordered palm oil and logging concession companies to restore damage caused by forest fires and illegal logging detected in areas where the companies operate, and to pay USD 1.3 billion in compensation. The MoEF has investigated about 600 criminal cases for environment and forestry violations since August 2015, and the national police investigated more than 150 environmental and forestry-related criminal cases.

The LEPM requires guarantee funds to be provided by individual operators for remediation of potential environmental damage. The responsible authority may contract with a third party to carry out remediation work using these funds if operators do not remedy the damage. A reclamation guarantee fund and a post-mining guarantee fund were created by a 2014 regulation of the Minister of Energy and Mineral Resources. Government Regulation No. 46/2017 on Economic Instruments in Environmental Matters stipulates that guarantee funds may be provided as a deposit, bank guarantee or insurance policy. Many of these instruments have not yet been implemented. Indonesian law does not require liability insurance cover for pollution, except for waste management companies. However, demand for voluntary environmental liability insurance could increase due to the stronger enforcement of liability in recent years: for example, the MoEF has brought substantial compensation claims, worth USD 1.3 billion, for forest fires and illegal logging.

The LEPM sets a 30-year limit on the operator's liability for contamination after closure of an industrial site. It does not oblige the government to clean up pollution if the

responsible party is unknown or insolvent, or the liability has expired, which is another barrier to remediation (Kartikasari, 2017). Remediation of contaminated sites is the responsibility of district governments, but they lack the necessary financial resources and are unwilling to identify, assess or report the sites. The central government has only just started to create an inventory of contaminated sites. There are no guidelines or standards for restoration of land, water bodies or ecosystems. Government Regulation No. 46/2017 envisages creation of a fund for remediation of environmental damage "caused by unknown sources" but does not specify whether the fund would exist at the national or provincial level, or both.

1.4.2. Chemical management

The chemical sector plays an increasingly important role in the economy. It was the fourth-largest manufacturing sector in 2015, accounting for 1.8% of GDP (BPS, 2018d). The share of chemical products in imports by Indonesia increased to 19% in 2015. Data on national production of chemicals are not available (EIBN, 2016).

Indonesia has ratified the major international chemical conventions.[18] Government Regulation No. 74/2001 on Hazardous and Toxic Chemicals Management provides the basis for the management of hazardous chemicals (called *bahan berbahaya dan beracun* in Indonesian, or B3). It bans the export, import and use of 10 chemicals, and limits the use of an additional 45 chemicals and 209 substances listed as "usable hazardous and toxic substances". It also requires notification of B3 chemicals prior to first import. The regulation addresses only a small subset of hazardous substances among what are likely thousands of chemicals on the Indonesian market. As the lists of B3 substances have not been updated since 2001, newer substances (including those identified for action under the Stockholm Convention) are not regulated in Indonesia.

A 2017 regulation sets out information requirements for registration and notification of B3 substances. These are rather limited (e.g. one-time registration, provision of a safety data sheet). An electronic registration system has been developed to facilitate compliance. Indonesia passed legislation to implement the Globally Harmonised System of Classification and Labelling (GHS) in 2009, which means chemicals and mixtures in the workplace, agriculture, transport and consumer sectors must be classified by industry according to the GHS, labelled and accompanied by a safety data sheet. Overall, there appears to be a need for a stronger regulatory framework addressing more hazardous chemicals. The registration and notification requirements could serve as first a step towards establishment of an inventory of chemical substances manufactured or imported in Indonesia, which would allow for systematic assessment and risk management. In the medium term, Indonesia may consider adhering to and participating in the OECD system of Mutual Acceptance of Data in chemical assessment.[19]

Information on the release of chemicals to the environment is scarce. There is no pollutant release and transfer registry, which would mandate public disclosure of volumes of releases of a subset of hazardous chemicals. Monitoring studies on persistent organic pollutants have shown the presence of banned pesticides and chemicals in air and/or water. This indicates a potential lack of enforcement of bans or controls of the most restricted chemicals and the need to manage chemicals that have been added to the Stockholm Convention (GoI, 2014b; Stockholm Convention, 2015; Ito et al., 2016).

Indonesia ratified the Minamata Convention on Mercury through Law No. 11 of 2017. A presidential regulation on a national action plan is under development, focusing on

manufacturing, the energy sector, small-scale gold mining and the health sector. The action plan aims to eliminate mercury by 2025. It covers regulatory, data and information, technical, capacity-building and law-enforcement aspects, including development of non-mercury gold processing in small-scale gold mining, capacity building at village level, mapping of small-scale gold mining and mercury pollution, and development of mercury-contaminated soil recovery and mercury storage systems.

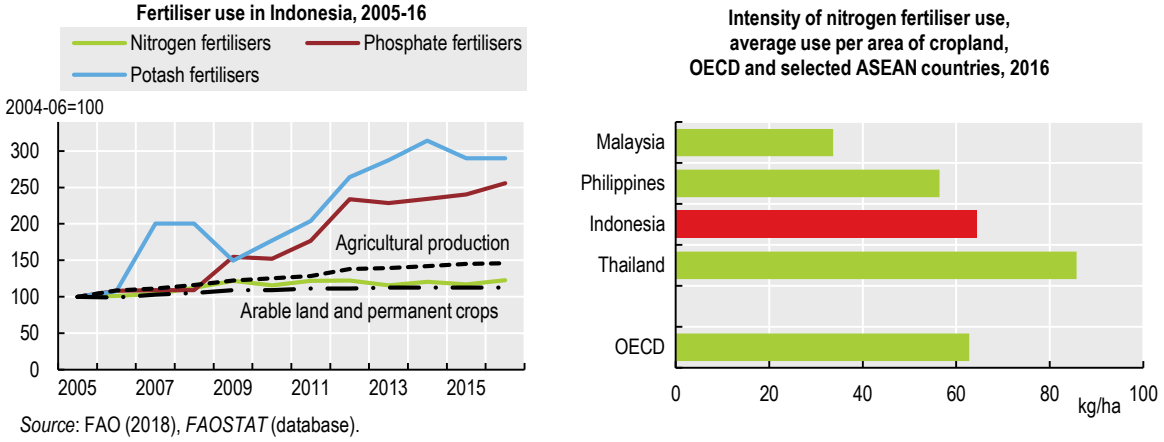
1.4.3. Agricultural inputs and fisheries

Agriculture and nutrient inputs

Agriculture continues to be an important driver of employment and growth, accounting for 10.5% of GDP in 2017 (excluding forestry and fisheries) and employing 30% of the workforce (Section 1.2). Rice and palm oil are the two largest commodities produced domestically, while palm oil and rubber account for more than half of agri-food exports. Indonesia has seen a strong increase in agricultural output, with average annual growth of 4% between 2005 and 2016, driven in part by productivity gains but relying mainly on conversion of forest and peatland. Total agricultural area expanded by 10% between 2005 and 2016 (FAO, 2018). There is evidence that two-thirds of new palm oil plantations came at the expense of biodiversity-rich tropical forest in 1990-2010 (OECD/FAO, 2017). The president has repeatedly issued moratoriums on new permits for concessions on primary forest land or peatland (Chapter 3).

Fertiliser consumption increased along with agricultural expansion. Application of potash fertilisers (mainly for palm oil) and phosphate fertilisers (for palm oil and rice) nearly tripled over 2005-16 (Figure 1.13). Nitrogen fertilisers, which remain the most widely used, increased by 23%. Even though the intensity of nitrogen use remains moderate by international comparison (Figure 1.13), there is evidence of over-application in some areas (e.g. Lombok island) (MoF and GIZ, 2017). Over-application of fertiliser can have a far-reaching impact on natural capital (e.g. seeping into water bodies, causing eutrophication and groundwater contamination). The government provides substantial subsidies to chemical fertiliser manufacturers (3% of public spending in 2015) to reduce the cost of fertilisers for Indonesian farmers. This risks encouraging wasteful consumption and should be replaced with other forms of agricultural support (Chapter 2).

Figure 1.13. Fertiliser consumption has increased



Source: FAO (2018), *FAOSTAT* (database).

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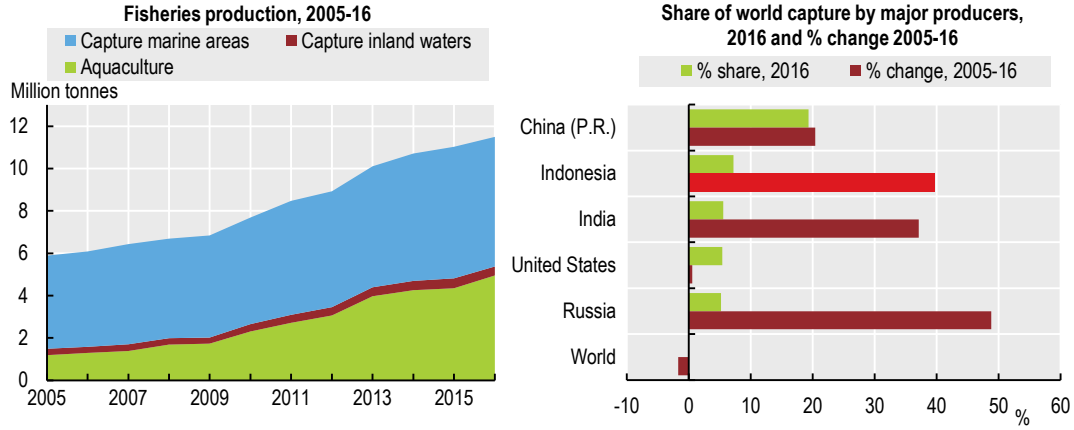
Fisheries

Fishery activities accounted for 0.3% of GDP in 2017. Fish production nearly doubled over the past decade (+95% over 2005-16), driven primarily by quadrupling of aquaculture output (Figure 1.14). Indonesia has the world's second largest capture fishery output and third largest aquaculture production. It is also the second largest producer and leading exporter of seaweed. Increasing domestic production has been (and remains) the main objective underpinning fishery policy. Over the coming decade, aquaculture production is expected to expand by about 37% (OECD/FAO, 2017).

Fishing and aquaculture have a strong social dimension as they support the livelihoods of about 20 million people, notably in poor and remote areas (Delpeuch, 2017). However, unsustainable intensification of aquaculture has created issues in disease management and negative environmental effects. Several fish stocks (e.g. grouper, snapper, some valuable tuna species) are overexploited, and aquaculture (notably shrimp cultivation) is a major driver of mangrove deforestation (Section 1.5). The government has a strong policy focus on fighting illegal fishing, notably by foreign vessels, and restricts the operation of large vessels (> 150 GT). However, smaller vessels (< 5 GT), which make up 95% of Indonesia's fishing fleet, do not require fishing permits and remain largely unregulated (OECD, 2014). Indonesia is developing a roadmap to improve fishery management through quotas, capacity rules, closed seasons and zoning laws. This could help reduce pressures on fish stocks. Technology could be used more to support monitoring, law enforcement and inter-agency co-operation (OECD, 2018a).

Figure 1.14. Fish production is increasing rapidly



Source: FAO (2018), *FAOSTAT* (database); FAO (2018), *FAO Yearbook of Fisheries and Aquaculture Statistics 2016* (and previous issues).

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1.5. Managing natural capital

The World Bank estimates that natural capital[20] – such as forests, agricultural land, fossil fuels and minerals – accounts for about 20% of Indonesia's total wealth, at a total value of USD 2.4 trillion (Lange, Wodon and Carey, 2018). In addition to being a direct input to the economy, Indonesia's natural capital provides essential and valuable ecosystem services, from provision of freshwater and habitat to prevention of natural hazard and carbon storage. More sustainable and effective management of its natural capital will help Indonesia ensure

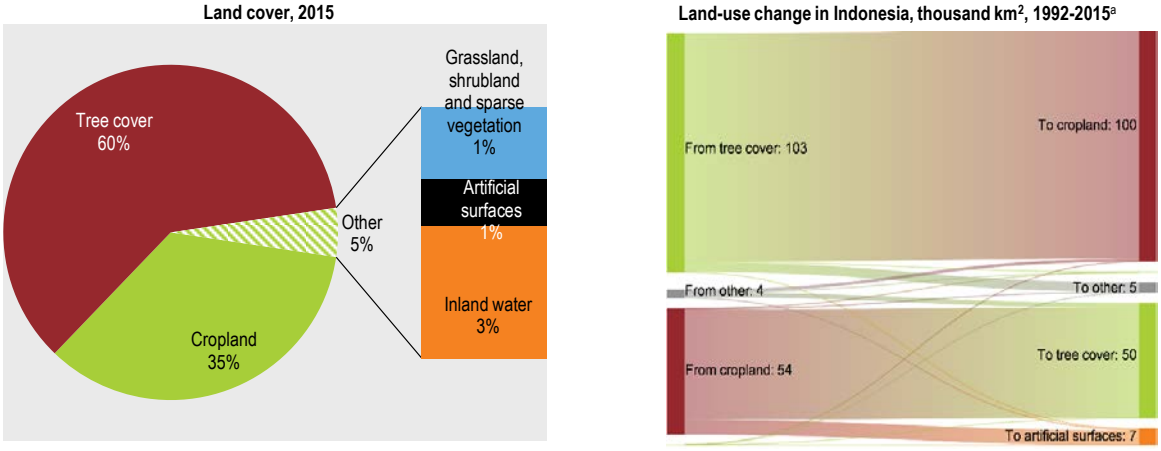
that these benefits can be enjoyed for generations to come. It will also contribute to global efforts to reaching the objectives of the Convention on Biological Diversity, the Paris Agreement and the SDGs.

1.5.1. Physical context and land cover

Indonesia is an archipelago state of five main islands (Java, Sumatra, Kalimantan, Sulawesi and Papua), two major archipelagos (Nusa Tenggara and the Moluccas Islands) and about 17 000 minor islands, of which 6 000 are inhabited. With total land area of about 191 million ha, it has the world's 14th largest country. Its sea area (including the exclusive economic zone or EEZ) is about four times the land area (790 million ha), making it the 7th largest country in terms of sea and land area combined.

About 60% of the land area is tree-covered, compared to the OECD average of 35% (OECD, 2018f). Cropland amounts to 35%, compared to 16% in the OECD. Artificial area (e.g. urban space) remains small at around 1%, but has more than doubled over the past decade in some provinces. Cropland has also expanded fast, particularly in Central and West Kalimantan and Riau, mostly at the expense of forest (Figure 1.15). Indonesia is among the ten countries that have lost the most natural and semi-natural vegetated land to other types of land cover since the early 1990s (OECD, 2018f). As Chapter 3 discusses in detail, the main pressures on natural land include land clearing for agriculture, timber plantations and mining.

Figure 1.15. Nearly two-thirds of land is tree-covered



a) Actual tree cover loss is likely to be significantly higher as transitions to plantation crops (e.g. oil palms) may have been classified as conversions to tree cover.
Source: OECD (2018), "Land cover in countries and regions", *OECD Environment Statistics* (database).

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1.5.2. Biodiversity

Indonesia is globally important as a centre for biodiversity. It is one of the world's 17 megadiverse countries and has two of its 25 biodiversity hotspots, areas which combine high degrees of endemism and biodiversity loss (CBD, 2018). Some 15% of global flora and 10% of global fauna species have been documented in Indonesia. They include an estimated 13% of the world's mammals, 8% of reptiles and 16% of bird species (LIPI, 2014). Indonesia has 13 land-based and 6 aquatic (freshwater and marine) ecosystems, which

include 74 vegetation systems, as well seven wetlands considered to be of international importance under the Ramsar Convention (MoEF, 2018b).

The importance of biodiversity for traditional medicine and agriculture is deeply rooted in Indonesian society. It is estimated that 40 million Indonesians living in rural areas rely on biodiversity for their subsistence needs. Indonesia has the second highest number of indigenous medicinal plants, after the Amazon rainforest, creating vast pharmaceutical and bio-technological research opportunities (MoEF, 2014a).[21] In Aceh province, the estimated economic value of forest ecosystems could be as much as USD 108 million per year by 2038, largely due to pharmaceutical potential (Beukering et al., 2008). Indonesia ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation in 2013, and issued a regulation to support its implementation in 2018 (MoEF, 2018b).

The main pressures on biodiversity are habitat loss from deforestation, pollution, overexploitation, invasive alien species and climate change (MoEF, 2014a). Effective protection of biodiversity is hampered by factors including limited knowledge about biodiversity, particularly at subnational levels, a generally low political priority on biodiversity conservation (reflecting limited economic valuation of biodiversity and ecosystem services), insufficient human capacity, lack of synergies among biodiversity programmes, the absence of local monitoring and evaluation institutions and lack of stakeholder participation (MoEF, 2014a). The Indonesian Biodiversity Strategy and Action Plan 2015-20 aims to address these barriers and commits to improving biodiversity research, data management and documentation; promoting sustainable use; supporting biodiversity conservation and rehabilitation; and strengthening capacity for sustainable management. The expansion of tourism across the archipelago represents an opportunity for economic incentives to protect biodiversity (OECD, 2018a).

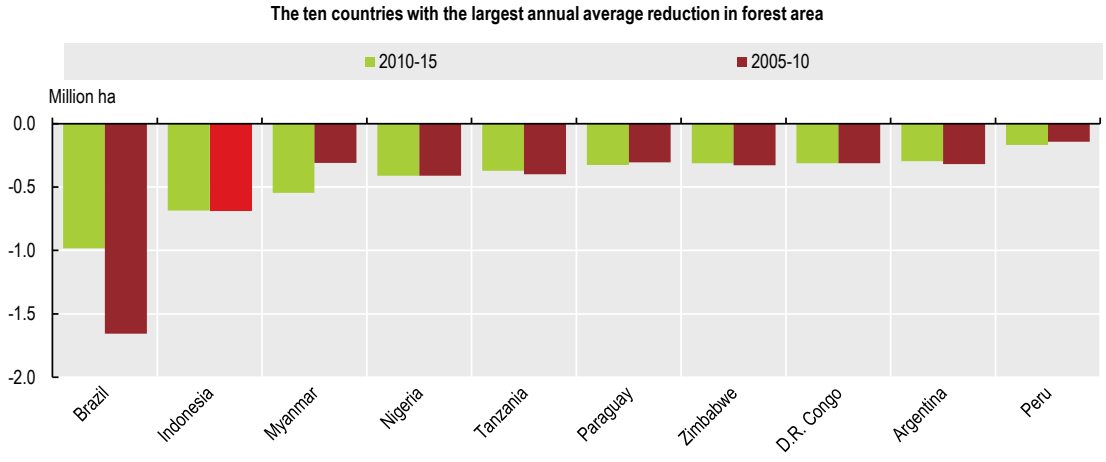
Forest and peatland ecosystems

Indonesia's rich terrestrial ecosystems include one of the world's largest areas of tropical forest and peatland, of critical importance for both biodiversity and climate change. Its vast forests span over 91.7 million ha, or about 50% of the total land area, and represent 2% of global forest resources. Nearly 95% is natural forest and 5% planted (FAO, 2018). Indonesia has over 15 million ha of peatland, which makes up 12% of the forested area (MoEF, 2018b). As Chapter 3 discusses, Indonesia faces serious pressure on its natural forests due to logging and land clearing for agriculture, timber plantation and mining. Between 2005 and 2015, total forest area declined by 7%, which represents the second highest absolute forest loss worldwide, after Brazil (Figure 1.16). Conversion of tropical lowland rainforest for agriculture is a particular concern, as these forests are very biodiverse. After peaking at 1.2 million ha in 2015, the deforestation rate decreased to 0.6 million ha in 2016 and 0.5 million ha in 2017 (Chapter 3).

Coastal and marine ecosystems

Indonesia has extremely rich coastal and marine biodiversity. It hosts some 18% of the world's coral reefs (5 million ha), which are home to more than 1 000 coral species and more than 2 000 fauna species, including 97 endemic ones. It also possesses about 21% of global mangrove habitat (3 million ha) and globally significant seagrass meadows (Dirhamsyah, 2016; LIPI, 2014).

Figure 1.16. Indonesia registered the second-largest forest loss, after Brazil



Source: FAO (2018), *FAOSTAT* (database).

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Many of its marine and coastal ecosystems are under threat from resource use, terrestrial development and pollution. Indonesia ranked 145th out of 221 EEZs in the 2017 Ocean Health Index (OHI, 2018). Mangrove area has decreased from about 4.25 million ha in the early 1980s to 3.4 million ha today (LIPI, 2014), driven by transformation of mangrove mud coasts into built-up areas or fishponds. Mangrove loss (which accounts for 6% of total annual forest loss) is a significant source of GHG emissions as well as a cause of coastal erosion and land loss. Nearly half of mangroves (1.8 million ha) are in damaged condition. The government aims to restore this area by 2045. More than two-thirds of Indonesia's coral reefs were considered to be in moderate (35%) or bad (35%) condition in 2017, with a smaller share being in good (23%) or very good (6.4%) condition (LIPI, 2017). The coral reefs were also found to be the most littered by plastics in Asia-Pacific (Lamb et al., 2018). The declining health of Indonesia's marine ecosystems could have profound socio-economic implications, as they provide valuable ecosystem services and support economic activity and the livelihoods of local communities (Box 1.3).

Box 1.3. The economic benefit of Indonesia's costal and marine ecosystems

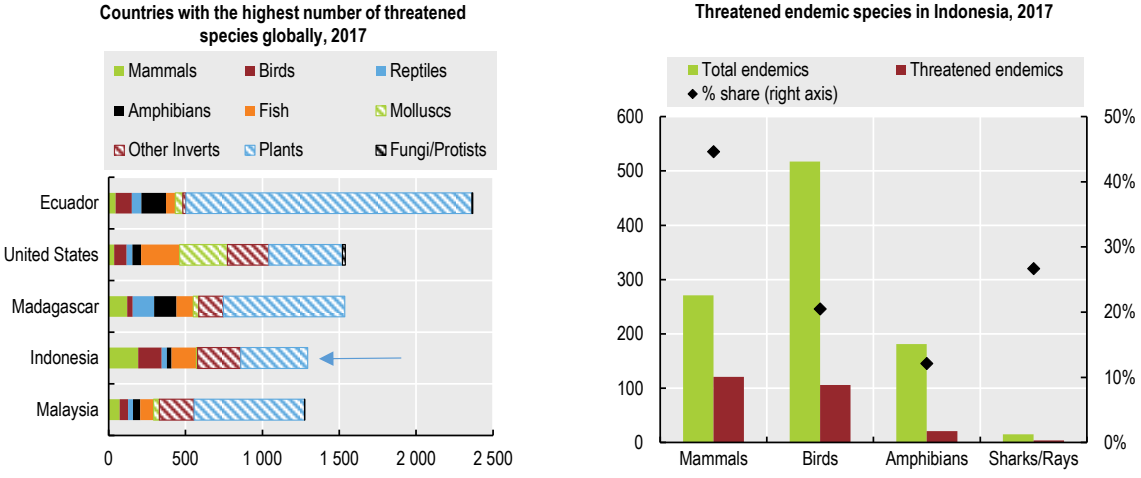
Indonesia's marine ecosystems provide valuable ecosystem services, from provision of fishery habitat to erosion control and carbon sequestration. Its coral reefs, for example, were estimated to provide economic benefits of USD 1.6 billion per year, largely through fisheries, tourism and coastal protection. Mangrove ecosystems that spread over nine districts in Central Sulawesi province were estimated to provide annual economic benefits worth USD 1.7 million (mainly due to their erosion buffer role), while seagrass beds in three villages in Riau Islands province provide annual benefits worth USD 3.6 million per hectare, mainly from marine tourism and fisheries.

Source: Burke, Selig and Spalding, 2002; Putranto et al., 2018; Budiharsono et al., 2011.

Threatened species

Indonesia has some of the world's highest numbers of threatened species, jeopardising its status as a mega-diverse country. The 2018 IUCN Red List recorded nearly 1 300 species as threatened (Figure 1.17). Due to a decline in species' conservation status, Indonesia was ranked among the countries facing the highest loss of biodiversity (Waldron et al., 2017).[22] According to national sources, 9% of bird species, 27% of mammals and 3% of reptiles are threatened with extinction (CBD, 2018). The shares of endemic threatened species are even higher (Figure 1.17). In 2018, the government revised the list of protected species to more than 900 species. The government aims to monitor 42 of these at nearly 300 monitoring sites. Indonesia has established targets to increase the populations of 25 endangered priority species listed on the IUCN Red List by at least 10% from the baseline figure for these populations that was recorded in 2013 (MoEF, 2018b). It has also developed a national strategy and action plan for conservation.

Figure 1.17. Indonesia has among the highest numbers of threatened species in the world



Source: IUCN (2018), "Table 8a", IUCN Red List version 2018-1.

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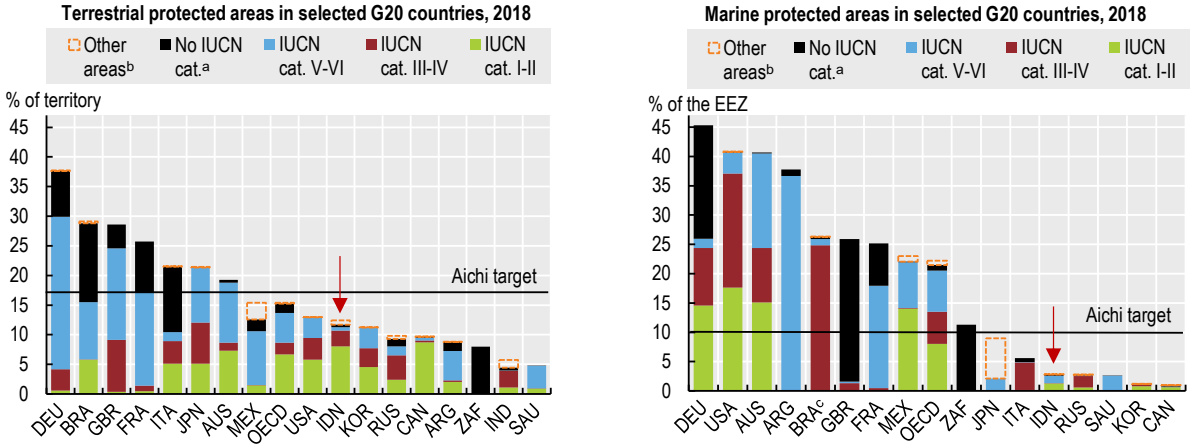
Protected areas

Indonesia's share of terrestrial protected areas, as defined by the IUCN, is low by international comparison. Terrestrial protected areas covered 22.2 million ha in 2018, or 12% of total land area. The share has slightly increased from 11% in 2005 (partly thanks to the creation of four new national parks), yet remains significantly below Aichi Target 11 of the Convention on Biological Diversity: to protect at least 17% of terrestrial and inland water areas by 2020. More than two-thirds of the protected areas (69%) fall within the most stringent IUCN protection categories, which is very high by international standards (Figure 1.18). Only 5% are areas with sustainable use of natural resources (OECD, 2018g). As in many countries, protected areas are fragmented (Figure 1.18). In addition to official protected areas, 29.7 million ha of land is classed as protection forest and afforded legal protection from conversion and logging; and 0.7 million ha is protected in essential ecosystem areas (Chapter 3) and *ex situ* conservation areas. Marine protected areas reached 16.7 million ha, or 2.8% of the EEZ in 2018, up from 1.1% in 2005 (OECD, 2018g). More recent data from the MoEF suggest that 20.9 Mha of marine protected areas had been established by the end of 2018, which raises the share to 3.4% of the EEZ (the Aichi target is to protect 10% by 2020), or 6.9% of Indonesia's territorial sea.

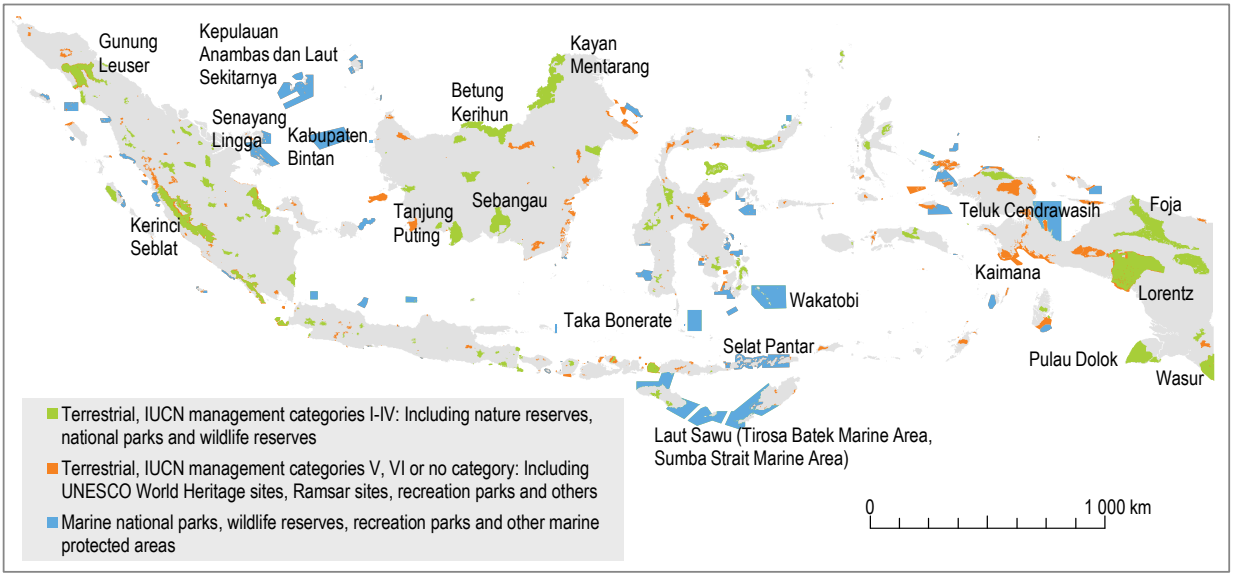
As in many developing countries, most protected areas have limited management resources, with a lack of funds, personnel and facilities restricting the ability to control illegal or non-compliant activities. Over 2000-12, 12% of primary forest loss was in protected areas (Chapter 3). While virtually no national parks were effectively managed in 2011 (BAPPENAS, 2016), about half of conservation areas now have legalised management plans in place. Though this constitutes an improvement, continued efforts are needed to strengthen institutional, human and financial capacity for effective management of conservation areas.

Figure 1.18. Protected areas need to expand to reach the Aichi target



Note: Protected areas according to the IUCN categories: Strict nature reserves and wilderness areas (I); National parks (II); Natural monuments and habitat/species management areas (III-VI); Protected landscape/seascape (V).
a) Includes all regionally/internationally designated areas.
b) Areas reported without explicit boundaries.
c) Data include marine protected areas of the Archipelago of São Pedro and São Paulo Trindade and of the Archipelago of Martim Vaz and Monte Columbia.
Source: OECD (2018), "Biodiversity: Protected areas", *OECD Environment Statistics* (database).

Map of protected areas in Indonesia



Source: IUCN and UNEP-WCMC (2018), *The World Database on Protected Areas*, www.protectedplanet.net.

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To better manage and restore ecosystem health in protected areas, the government is partnering with stakeholders, notably local communities and NGOs. While still small in number, 13 conservation areas have already shown success in ecosystem restoration using such an approach (MoEF, 2018b). Establishing protected areas that allow for sustainable use can help bridge biodiversity objectives and livelihood objectives for traditional communities. Entrance and user fees for protected areas that are open for tourism, for example, can help raise revenue for maintenance and conservation, while tourism-related activities can create employment for local communities (OECD, 2018a).

1.5.3. Management of water resources

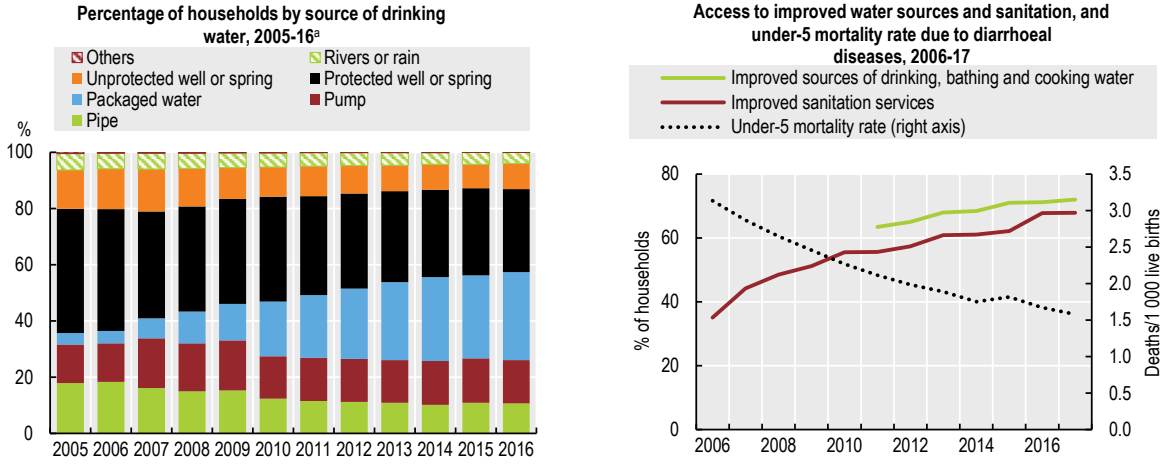
Access to water supply and sanitation

The share of the population with access to improved water sources increased to 72% in 2017 (Figure 1.19).[23] While this constitutes a significant improvement, the share without access is high compared to regional peers. Disparities between urban and rural areas have decreased but remain large, ranging from 92% access in Jakarta to 30% in West Kalimantan and Papua (Annex 1.A). The expansion of water supply infrastructure has not kept pace with population growth and urbanisation, as evidenced by the decreasing the share of households served by piped water (from 18% to 11% over 2005-16; Figure 1.19). Low regulated water tariffs make the much-indebted public water utilities reluctant to invest in network expansion (Chapter 2). In the absence of public water supply (and presence of polluted surface water), most people obtain drinking water from private small-scale or community-based providers that usually use groundwater or shallow wells and operate without a permit. An increasing share of the population relies on bottled water (Figure 1.19).

Access to sanitation services improved from 35% in 2006 to 68% in 2017 (Figure 1.19). However, it remains significantly lower than in neighbouring countries. The urban-rural divide is significant, with some 30% of rural households having toilet facilities and about 20% having septic tanks (ADB, 2016). The absence of an established sanitation network means households must install on-site septic tank systems or directly discharge untreated waste into channels or local rivers. Inadequate water supply and sanitation have long been among the most important causes of under-5 mortality in Indonesia (ADB, 2016), but recent improvement helped significantly reduce under-5 mortality due to diarrhoeal diseases (Figure 1.19).

The government set an indicative target of 90% access to improved sanitation (including 20% safely managed sanitation) by 2024. Promoting off-grid technology (septic tanks, decentralised sanitation), improving quality of septic tanks and supporting investment in small-scale projects may be the best way to improve access to sanitation, with investment in piped infrastructure being part of the solution in the medium to longer term. Continued efforts are needed to enhance the capacity of regulators and operator institutions at the local level. Developing comprehensive strategies and policies for urban water supply, sanitation and urban wastewater management, at both the national and subnational levels, would greatly aid in achieving targets in this sector. The Accelerated Sanitation Development Program aims to strengthen local governments' capacity in sanitation and support the formulation of local sanitation strategies.

Figure 1.19. Water supply has not kept up with population growth



a) 2012 data: average of 2011 and 2013 data.
Source: BPS (2018), *Environmental Pillar: Indicators of Sustainable Development 2018*; BPS (2018), "Social and Population", *Statistics Indonesia* (database); WHO (2018), *WHO Mortality Database.*

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Water resources

Indonesia is rich in water, being endowed with an estimated 5% of global water resources (MoEF, 2011). Water stress, defined as the ratio of water abstraction on renewable resources, is low. However, unequal distribution, seasonal variability, increasing water consumption and poor management are creating water stress in some areas, including Java, Bali, Maluku and North Maluku (WRI, 2018b). Water stress is expected to intensify with continued urbanisation, economic growth, climate change and land-use change (which affects groundwater recharge; see Chapter 3) (Luo, Young and Reig, 2015). At the same time, Indonesia is naturally prone to floods, and associated risks are increasing due to settlement and economic development in flood-prone areas as well as land-use change (deforestation, wetland drainage and conversion to agricultural use), which reduces the buffering capacity of river catchments.

Water abstraction was estimated at 175 billion m^3 in 2016. Agriculture accounted for 82%, municipalities for 12% and industries for 6% in 2000 (WEPA, 2018). More recent estimates about how much water is being extracted (and from where, when and by whom) are not available.[24] In general terms, water consumption in Indonesia is characterised by large-scale surface water use for irrigation and hydropower; use of shallow groundwater for domestic purposes; and use of deep groundwater, especially in urban areas, by industry and services. Indonesia ranks among the ten largest groundwater-consuming countries (based on abstracted volume), and among them is the only one abstracting groundwater primarily for domestic use (ADB, 2016).

Groundwater levels have dramatically declined in recent decades, including in aquifers serving Jakarta, Semarang and Bandung. This has caused environmental problems, such as brackish water contamination in coastal areas and land subsidence. In Jakarta, some costal districts have dropped 4 meters in the past 40 years; about 40% of the capital now lies below sea level (Kimmelman, 2017). Water abstraction permits are issued by district governments, unless they concern inter-jurisdictional water bodies, in which case the responsible authority is at the higher administrative level. Abstraction permits are generally

not well enforced, illegal wells are common and industrial water abstraction is not monitored (OECD, 2016a). Small water users are not regulated, which – given their overall number – could harm groundwater management sustainability in the long term.

In an important step, the Jakarta city government has announced increased enforcement action against high-rise buildings suspected of violating rules on groundwater use, wastewater management or provision of infiltration wells. In addition to regulatory action, a stronger focus on demand management and promotion of water use efficiency can help alleviate pressure on all water resources. As a general principle, water abstraction licensing regimes should reflect water scarcity. In areas where groundwater resources are critically low, this may imply groundwater use becoming more expensive than extension of piped water supply or construction of non-centralised solutions. Regulating smaller-scale water providers should be considered.

Water quality

The water quality of rivers and lakes is poor and has declined over the past decade. Indonesia's Water Quality Index (WQI), a composite index ranging from 0 (worst) to 100 (best),[25] stood at a rather moderate level (53.2) in 2017. The rivers on Java island are in a particularly critical state, with half of the 47 rivers being considered polluted to heavily polluted (MoEF, 2017e). The largest source of water pollution is wastewater from households (untreated domestic sewage); other major sources include solid waste disposal, industrial effluent, mining (including illegal mining, which uses large amounts of mercury), agriculture and aquaculture, and urban run-off. Wastewater infrastructure is underdeveloped. Only 13 cities have a centralised wastewater treatment system. It is estimated that nationally only 14% of wastewater is treated (ADB, 2016); an even lower share is considered "safely managed".

The MoEF aims to improve water quality to a minimum WQI level of 55 by 2019. Main actions are targeted at 15 priority watersheds (including the Citarum and Ciliwung in Java and the Kapuas in Kalimantan) and focus on improving the knowledge base (through continuous water quality monitoring systems and inventorying of pollutant loads and their source), the construction of small-scale bio-digesters and wastewater treatment facilities, and engaging surrounding industries. In 2016, two out of six targeted rivers showed signs of improvement while four registered stagnation or deterioration of water quality (MoEF, 2016).

Government Regulation No. 82/2001 on Water Pollution Control establishes a general framework for water quality standards and classification. There are four use-based water classes (for drinking water abstraction, recreation, fisheries and agriculture). According to the regulation, if a river crosses district boundaries, the provincial government must determine the river's water class and carrying capacity, inventory existing pollution sources and set water quality standards. For rivers declared to be of national strategic interest, the Water Law of 2004 (revoked by the Constitutional Court in 2015[26]) transferred responsibility to the central government. Confusion remains as to which authority should regulate larger inter-jurisdictional water bodies (Sembiring et al., 2017).

A ministerial regulation sets effluent standards for various types of pollution sources in terms of concentration and maximum load. It is up to the district government to set effluent limits in wastewater permits for individual industrial facilities based on the regulatory framework set by higher-level authorities. The law requires wastewater discharge permits to take into account the receiving river's water quality and carrying capacity. However, due to the lack of co-ordination between administrative levels, effluent limits are often set

arbitrarily (Fatimah et al., 2017). There is evidence that wastewater discharge permits of some textile industries along the Citarum River were granted with little consideration of carrying capacity and not preceded by an *ex ante* environmental impact study, contributing to pollution (Greenpeace, 2016). Monitoring of wastewater effluent from urban, industrial and agricultural sources is weak. Industrial facilities and farms do self-monitoring, which is spot-checked by local environmental staff; no figures are disclosed on the results of self-monitoring (OECD, 2016b).

Box 1.4. Recommendations on climate change, air, waste, water and environmental information

Climate change

- Continue to develop a national climate change strategy under the Low Carbon Development Indonesia initiative to address the 2030 target and beyond. Integrate the 2030 target into the national development plan for 2020-24 (as planned) and ensure that the long-term goals are broken down into short-term goals and clear responsibilities among actors. Strengthen capacity for assessing mitigation options, including their economic, environmental and social impact.
- Continue to improve the quality of GHG emission data (both sectoral and provincial), annual baselines and sectoral mitigation targets in order to establish a credible reference making it possible to track progress and assess the effectiveness of climate policies.
- Revise national energy policy to ensure consistency with climate change policy. Guide the energy transition through an emission reduction goal for the power sector, supported by market-based instruments, to reduce its carbon intensity (e.g. through carbon pricing). Ensure that any new coal power plants are high-efficiency plants, that existing plants are refurbished and that the most inefficient plants are phased out. Plan for halting investment in unabated coal by 2030.

Air management

- Continue to develop air quality monitoring systems. Expand information on air emissions from stationary sources and start to systematically collect data on emissions from mobile sources. Make the data publicly available and, in the medium term, work towards establishment of a national air emission inventory.
- Develop a comprehensive and integrated strategy to address air pollution that covers all major pollution sources, with priority actions including i) updating emission standards for heavily polluting sectors such as coal-fired electricity generation and pulp and paper; ii) strengthening and enforcing vehicle emission and fuel quality standards; iii) promoting vehicle electrification, notably for motorcycles; v) protecting and investing in natural capital that contributes to the ecosystem service of air filtration; and iv) ensuring effective implementation of local clean air programmes in areas regularly exceeding air quality standards.

Waste management

- Accelerate efforts to expand formal waste collection services to reach 100% of the population. Phase out open dumps and ensure that landfills meet environmental standards. Increase investment in waste disposal capacity, in line with projected future demand, and ensure that new infrastructure captures GHG emissions.
- Formalise waste sorting and recycling, for instance through continued involvement of the informal sector in waste banks and by providing training and social empowerment (e.g. through co-operatives).
- Implement extended producer responsibility programmes for the most harmful and abundant products to limit the need for new disposal capacity, and reduce the environmental and health problems associated with improper management of dangerous waste. Consider supporting the construction of hazardous waste treatment infrastructure to cover eastern Indonesia.

Chemical management

- Strengthen the legal framework for the management of industrial chemicals in order to create a national inventory of chemicals and provide authority for systematic assessment and management of chemicals as information evolves. Improve the monitoring of chemicals in the environment.

Water management

- Implement integrated urban water management to enhance water safety. Expand piped water services to increase access to safe drinking water and reduce groundwater use. Enhance capacity of regulators and water supply providers, including for monitoring of groundwater levels and enforcement of permits. Develop long-term strategies to ensure water security for areas where water stress is projected to intensify, taking into account nature-based solutions.
- Improve monitoring of water pollution and enhance pollution prevention and mitigation. Continue to expand and improve sanitation facilities by promoting off-grid technology, faecal sludge management systems, investment in small-scale projects and expansion of centralised sewerage networks in metropolitan areas, taking into account possible use of reclaimed water as an alternative to groundwater to limit depletion.

Information and education

- Continue to undertake public communication campaigns to raise public awareness about the state of the environment. Foster environmental education to enhance understanding of the environmental, economic and health risks associated with pollution and environmental degradation. Further develop environmental education in school curricula.
- Revive regular publication of the State of the Environment Report and consider establishing a green growth monitoring and reporting framework linking economic activity with environmental performance.

Notes

[1] If not otherwise noted, projections cited in this chapter are based on the baseline projections of the OECD ENV-Linkages Computable General Equilibrium Model. It describes how economic activities are interlinked across several macroeconomic sectors and regions. It links economic activity to environmental pressure, specifically to GHG emissions (Château, Dellink and Lanzi, 2014).

[2] Provincial governors are both elected members of the provincial councils and ex-officio representatives of the central government, answerable to the president.

[3] The methodology used to calculate the EQI has changed three times over the last ten years (in 2009, 2011 and 2015). A notable change in the latest version is expansion of the land cover index to not only forest cover but also forest growth, soil condition, water and soil conservation and habitat change. In the previous methodology, used over 2011-15, an EQI above 74 classified as "good" to "excellent" (>90), between 73 and 66 as "quite good" and below 66 as "bad" to "alarming" (>50) (MoEF, 2014b).

[4] KEN defines "new energy sources" as any energy generated by using "new technology", a term that includes renewable sources but also non-renewable sources such as nuclear power and new technology based on coal-to-liquid or coal-to-gas processes.

[5] Indonesia's energy data and balances exclude traditional biomass (e.g. firewood and charcoal), which is included in all IEA data cited elsewhere in this report.

[6] Official electrification statistics not only refer to grid connection but also include access to solar-powered lamps. These are distributed by the government to rural households.

[7] They include Ministerial Regulations No. 70/2017 on Guidelines on Measurement Reporting and Verification for REDD+, No. 71/2017 on the National Registry System on Climate Change Control and No. 73/2017 on Guidelines on the Implementation and Reporting of National Greenhouse Gas Inventories. In 2018, the MoEF published guidelines for quality control and quality assurance in the GHG inventory process as well as guidelines on the application of MRV methodologies in order to improve the quality of Indonesia's GHG inventory.

[8] Projections are subject to considerable uncertainty, particularly regarding the response of the El Niño Southern Oscillation to climate change.

[9] The data on $PM_{2.5}$ exposure in the OECD Environment Statistics database are based on concentration estimates from the Global Burden of Disease 2017 project. They are derived by integrating satellite observations, chemical transport models and measurements from ground monitoring station networks. Indonesia does not monitor $PM_{2.5}$ concentrations countrywide.

[10] The AQI is based on data obtained from sporadic monitoring (passive sampling) and two pollutants only (SO_2 and NO_2). As a consequence, there have been some inconsistencies. For example, West Kalimantan registered a significant improvement in the AQI over 2014-15 while being affected by one of the worst forest fires in years.

[11] Data are collected over a period of one week twice a year: one week in the dry season and one week in the rainy season. Data are also sporadically collected in industrial and agricultural areas.

[12] Data used in this section refer to "household waste" and "household-like waste", as defined in Law No. 18/2008. Household-like waste derives from commercial areas, industrial areas, special areas, social facilities, public facilities, and/or other facilities (not all of which are included in the OECD definition of MSW). The central government gathers most data from city surveys, as few municipalities collect data on the volume of MSW collected or treated. Data on waste and source composition are generally lacking or incomplete (Damanhuri, Handoko and Padmi, 2014). Due to

the differences in definitions and coverage, Indonesian and OECD statistics on waste are not directly comparable.

[13] The regulation aims to reduce 30% and handle 70% of projected generated waste by 2025. According to Law 28/2008, "waste reduction" includes waste prevention and the conversion, recycling and reuse of waste. "Waste handling" refers to sorting, collection, transport and processing.

[14] The MoEF charged a pilot plastic bag fee in 28 cities in early 2016 for three months. The pilot had very positive results, reducing plastic bag use by 55%, despite the fee's low rate of IDR 100 (0.8 USD cent) per bag.

[15] The data refer to statistics collected by the MoEF and exclude data collected by local governments. Since 2016, the MoEF has run an online reporting system (called SIRAJA), through which corporations can report directly on their management of hazardous waste.

[16] Dumping necessitates a specific permit under Government Regulation No. 101/2014. It can exclusively be done into soil or the sea and is uniquely allowed for mine tailings and drilling powder resulting from operations and/or exploitation at sea by using synthetic-based drilling mud.

[17] Indonesia ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal in 1993.

[18] Including the Stockholm Convention on Persistent Organic Pollutants, the Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade, and the Minamata Convention on Mercury.

[19] The OECD Mutual Acceptance of Data system is a multilateral agreement allowing participating countries to share results of non-clinical safety tests on chemicals and reducing duplication of testing by industry and assessments by governments. If Indonesia were to join this system, results from tests conducted in Indonesia labs would be accepted in all OECD and non-member adhering countries.

[20] Natural capital comprises resource inputs and environmental services for economic production (OECD, 2005). Environmental services have three main components: i) provisioning services (e.g. food, water, material or energy); ii) regulating and maintenance services (e.g. climate, air quality, flood control, biodiversity); and iii) cultural services (e.g. aesthetic and spiritual values) (BISE, 2018). Various methods exist for measuring these values.

[21] About 1 500 of Indonesia's 15 000 medicinal plants are defined as rare.

[22] Reduction in biodiversity was calculated based on IUCN Red List changes for bird and mammal species (e.g. from "least concern" to "threatened", or "vulnerable" to "endangered").

[23] Most recent unpublished estimates suggest that access to water and sanitation reached 74.6% and 62.2%, respectively, in 2018.

[24] The National Industry Information System, expected to be implemented in 2019, will incorporate water usage by industry.

[25] The WQI reflects averages of the concentration of water quality parameters (total suspended solids, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total phosphorous, faecal coli and total coliform) from each monitoring point.

[26] The revocation meant the legislative framework reverted to the Water Law of 1974. A new draft Water Law is being discussed in the parliament.

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Annex 1.A. Regional statistics

		Total area (thous. km²)	Share of national population (%)	Population density (inh./km²)	Share of urban population (%)	GDP per capita (USD PPPs)	Unemployment rate (%)	Poverty (% of population)	Gini coefficient	Happiness Index	Car ownership (% of households)	Electrification rate % of households)	Mean population exposure to $PM_{2.5}$	Air Quality Index	Water Quality Index	Land Cover Index	Forest cover (1 000 ha)	Access to drinking water (% of households)	Access to sanitation (% of households	Waste dumped (%)
SUMATRA	Aceh	58	2.0	90	30.5	6.6	7.0	15.9	0.3	72.0	0.2	98.6	20.0	89.4	68.3	73.3	33.5	64.9	63.4	50
	North Sumatra	73	5.5	195	52.6	11.2	6.0	9.3	0.3	68.4	0.4	95.9	24.2	88.2	50.0	45.8	30.6	70.1	73.0	43
	West Sumatra	42	2.0	127	44.2	9.5	5.7	6.8	0.3	72.4	0.5	95.6	12.5	88.5	54.3	64.9	23.4	68.8	52.8	25
	Riau	87	2.5	77	39.6	24.9	6.0	7.4	0.3	71.9	0.1	86.6	15.8	..	53.1	47.6	54.1	75.1	70.0	33
	Riau Island	8	0.8	254	83.0	25.7	6.8	6.1	..	..	5.7	94.9	22.4	86.6	55.3	53.1	3.8	84.0	86.3	20
	South Sumatra	92	3.2	90	36.5	10.9	4.1	13.1	0.4	72.0	0.9	93.6	23.0	79.6	63.8	38.2	34.1	64.0	66.4	33
	Jambi	50	1.3	70	32.0	12.8	3.8	7.9	0.3	70.5	0.5	92.3	16.7	82.9	51.3	48.1	21.0	65.7	64.2	33
	Bengkulu	20	0.7	97	31.7	7.3	3.3	15.6	0.4	70.6	0.6	95.0	14.9	92.5	54.1	54.1	9.2	43.8	42.7	50
	Bangka Belitung	16	0.6	84	52.5	11.4	4.1	5.3	..	..	0.5	98.0	18.8	95.6	66.3	36.4	6.4	68.1	83.6	43
	Lampung	35	3.2	239	28.3	8.7	4.4	13.0	0.3	69.5	0.3	94.0	19.9	82.3	48.8	31.2	10.0	53.8	52.9	57
JAVA	DKI Jakarta	1	4.0	15 624	100.0	54.5	6.3	3.8	0.4	71.3	5.0	99.8	25.2	78.8	35.0	32.0	0.01	88.9	91.1	100
	Banten	10	4.8	1 288	67.7	10.6	8.5	5.6	0.4	69.8	0.9	99.8	20.7	50.7	47.7	37.5	2.0	66.1	71.7	57
	West Java	35	18.3	1 358	72.9	8.7	8.4	7.8	0.4	69.6	0.9	99.8	19.1	74.6	41.4	38.4	8.2	70.5	64.4	15
	Central Java	33	13.1	1 044	48.4	8.1	4.4	12.2	0.4	70.9	0.3	99.9	14.2	81.3	60.0	48.7	6.5	76.1	71.8	31
	DI Yogyakarta	3	1.4	1 201	70.5	7.4	2.9	12.4	0.4	72.9	0.3	99.9	11.4	90.6	36.0	32.8	0.2	77.2	89.4	..
	East Java	48	15.0	822	51.1	12.1	4.1	11.2	0.4	70.8	0.3	99.4	15.6	89.2	49.2	49.6	13.6	75.5	68.8	13
BALI NUSA T.	Bali	6	1.6	735	65.5	11.9	1.4	4.1	0.4	72.5	0.3	99.8	14.4	92.4	60.0	39.1	1.3	90.9	90.5	44
	West Nusa Tenggara	19	1.9	267	45.4	5.9	3.6	15.1	0.4	70.7	0.2	99.0	13.8	92.3	50.0	60.5	10.4	70.5	69.3	75
	East Nusa Tenggara	49	2.0	109	21.6	4.0	3.2	21.4	0.4	69.0	0.4	66.0	12.1	..	41.5	61.1	14.9	65.2	45.3	100
KALIMANTAN	West Kalimantan	147	1.9	33	33.1	8.5	4.3	7.9	0.3	70.1	0.3	82.5	12.5	91.6	57.5	58.6	82.0	68.8	49.7	100
	Central Kalimantan	154	1.0	17	36.6	11.4	3.7	5.3	0.3	70.9	0.2	81.8	12.4	89.9	55.3	69.2	127.0	63.9	45.5	71
	South Kalimantan	39	1.6	106	45.1	9.1	4.1	4.7	0.3	72.0	0.5	96.8	13.2	87.6	52.3	45.2	17.8	60.6	58.1	15
	East Kalimantan	129	1.4	28	66.0	38.7	7.7	6.1	0.3	73.6	1.0	92.4	10.8	96.2	57.7	82.7	138.3	82.8	72.8	67
	North Kalimantan	75	0.3	9	..	26.7	5.4	7.0	0.3	73.3	..	91.5	..	..	51.0	..	..	83.8	66.6	100
SULAWESI	North Sulawesi	14	0.9	178	49.8	10.5	6.6	7.9	0.4	73.7	3.0	98.8	10.8	92.7	54.6	58.2	6.9	73.3	71.9	40
	Central Sulawesi	62	1.1	48	27.2	10.6	3.4	14.2	0.4	71.9	0.3	87.3	10.7	89.1	50.0	81.8	39.3	67.1	61.1	78
	South Sulawesi	47	3.3	186	40.6	11.3	5.2	9.5	0.4	71.9	0.9	95.8	11.4	76.8	54.3	50.9	21.2	76.3	76.7	37
	South East Sulawesi	38	1.0	68	31.2	9.7	3.2	12.0	0.4	71.2	0.4	88.9	10.8	83.6	70.0	71.4	23.3	79.8	69.5	37
	West Sulawesi	17	0.5	79	22.9	7.0	3.1	11.2	0.3	70.0	0.7	77.8	10.0	89.2	56.9	67.3	10.9	60.7	59.5	75
	Gorontalo	11	0.5	104	39.0	6.9	4.0	17.1	0.4	73.2	0.5	95.4	12.3	..	48.6	76.6	8.2	75.0	58.8	20
MALUKU	Maluku	47	0.7	37	38.0	5.3	8.5	18.3	0.3	73.8	0.8	86.4	9.4	82.3	49.8	82.2	39.1	68.3	63.3	50
	North Maluku	32	0.5	38	27.8	6.3	5.1	6.4	0.3	75.7	0.6	84.3	8.9	..	50.6	83.2	25.2	65.7	66.2	71
PAPUA	West Papua	103	0.4	9	32.3	18.4	7.0	23.1	0.4	71.7	0.2	78.2	8.8	..	50.0	99.5	87.8	73.1	65.3	67
	Papua	319	1.3	10	28.4	13.7	3.8	27.8	0.4	67.5	0.4	41.6	10.4	..	62.5	97.4	293.7	59.1	33.1	78
Indonesia		**1 917**	**100**	**137**	**53.3**	**12.4**	**6.1**	**10.1**	**0.4**	**70.7**	**0.8**	**96.0**	**16.7**	**..**	**53.2**	**..**	**1 204**	**72.0**	**67.9**	**..**

Note: 2017 or latest available year. Poverty: percentage of population with per capita expenditure below the national poverty line (IDR 387 000/capita/month) September 2017. Unemployment: average of February and August data.

Source: Databases and publications of BPS (Statistics Indonesia) and MoEF.

Chapter 2. Towards green growth

This chapter discusses Indonesia's progress in greening its economy on the path to sustainable development. It examines the policy and institutional framework for sustainable growth, then reviews the use of tax policy to pursue environmental objectives and progress in removing subsidies that can encourage environmentally harmful activities. The chapter also analyses public and private investment in environment-related infrastructure, such as that for water and sanitation, waste, energy and transport, and reviews promotion of environmental technology and green innovation as a source of economic growth and jobs. The role of development co-operation is also discussed.

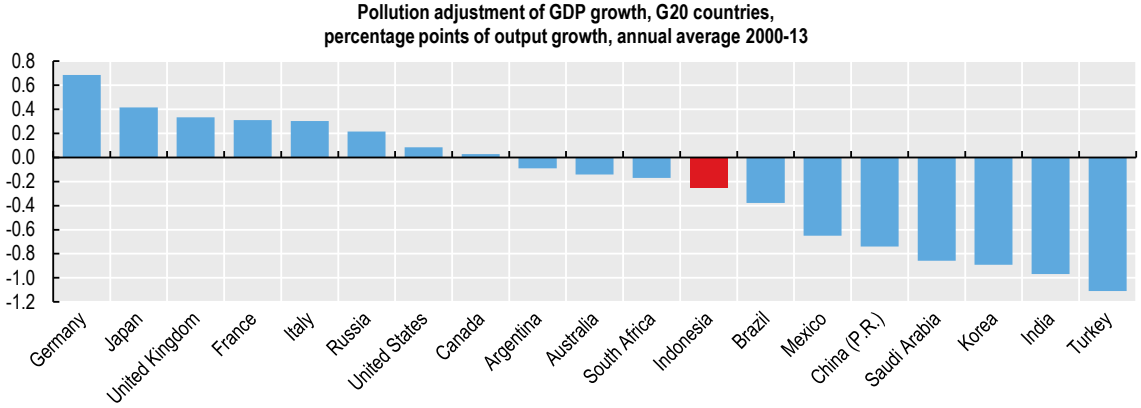
2.1. Introduction

Following the economic downturn of the 1997-98 Asian financial crisis, Indonesia enjoyed impressive economic growth, supported by a commodities boom and strong domestic demand. Gross domestic product (GDP) grew 5.3% per year, on average, from the turn of the century, helping the country significantly reduce poverty and raise living standards. Natural resources serve the country well, accounting for more than 20% of GDP and 50% of exports in recent years (Chapter 1). Indonesia's exceptional natural assets also attract a growing number of tourists.

Indonesia expresses a strong commitment to green growth. However, conflicting sectoral development goals and difficulties implementing and enforcing environmental legislation mean pressures on the natural asset base have continued to increase (Chapter 1). OECD analysis shows that, if pollution had been accounted for, GDP growth would have been 0.3 percentage points lower per year (Figure 2.1). If the country does not transition to a greener growth model, GDP could be reduced by up to 7% per year by 2050, according to government estimates (MoF, 2015a). About a third of expected losses and damage are related to degradation of natural resources and ecosystem services, while the remainder relates to the impact of climate change. The poorest will be hit hardest by climate change, as they disproportionately rely on healthy ecosystems for their livelihoods and well-being. For example, forests and other ecosystems are estimated to account for 75% of GDP among rural communities (TEEB, 2010).

This chapter discusses Indonesia's progress and remaining challenges in greening its economy. There are many opportunities to enhance both economic development and environmental sustainability. Seizing these will require better policy alignment, valuation of ecosystem services in economic planning and stronger use of market-based instruments. Reforming taxes on energy use, transport and natural resource extraction would help address environmental degradation cost-effectively while raising revenue for infrastructure and social spending. Better law enforcement and more cost-reflective pricing would boost investment in environment-related infrastructure, goods and services. Targeted support can alleviate the adverse impact of such reforms on poor and vulnerable populations.

Figure 2.1. Economic growth would be lower if pollution were accounted for



Source: "Environmentally adjusted multifactor productivity: Methodology and empirical results for OECD and G20 countries", *OECD Green Growth Papers*, No. 2016/04.

StatLink http://dx.doi.org/10.1787/888933931373

2.2. The policy and institutional framework for green growth

The principles of sustainable development and "a good and healthy environment as a basic human right" were added to Indonesia's 1945 Constitution in 2002. This provides the basis for integrating green growth into the country's development agenda. Indonesia has been active in international environmental co-operation and committed to implementing the Sustainable Development Goals (SDGs) adopted in 2015 as part of the UN 2030 Agenda, as well as its Nationally Determined Contribution adopted in the framework of the 2015 Paris Agreement.[1]

Sustainable development and green growth objectives are integrated in its well-established national development planning framework. This framework is based on long- and medium-term national development plans that provide the basis for sector and subnational strategic plans as well as annual work plans and budgets.[2] The 2005-25 National Long-Term Development Plan provides a "pro-poor, pro-jobs, pro-growth and pro-environment" vision for the country's development. The 2015-19 National Medium-Term Development Plan (RPJMN), now in its third period, contains objectives and targets to improve environmental quality and acknowledges the need to manage natural resources sustainably. It integrates most of the SDG targets as well as the country's climate change mitigation and adaptation targets (Chapter 1). Green growth principles and objectives have been mainstreamed into several provincial plans and strategies.

Despite these efforts, the national development planning architecture has not added up to a coherent policy framework for green growth. Sector plans and policies are not always well aligned with low-carbon or broader environmental and sustainable development goals, reflecting the precedence that economic and social development objectives tend to take over sustainability aspirations. The 2014 National Energy Policy, for example, sets a target of minimising oil consumption while increasing the share of renewable energy sources to 23% of total energy supply by 2025. Yet, at the same time, the policy aims to increase coal's share to 30% – doubling its use in absolute terms (compared to 2015). This risks locking in high-carbon infrastructure on a wide scale, increasing the level of stranded assets and the overall cost of transitioning to a low-carbon economy (OECD, 2017a). It could also jeopardise the country's efforts to reach its climate change mitigation objectives and will increase local air pollution. Similarly, rising production and export targets for oil palm – expansion of which has been a major driver of deforestation and peatland drainage (Chapter 3) – risk offsetting efforts to reduce deforestation and associated ecosystem degradation and greenhouse gas (GHG) emissions.

The use of environmental impact assessment (EIA) and strategic environmental assessment (SEA), two key instruments to mainstream environmental considerations into sector policies, plans and projects, has improved in recent years. SEA is increasingly conducted for spatial plans at the provincial and local levels, and more recently for some national and sector policies. An EIA is required to obtain any sector-specific business licence for activities with a potential environmental impact. However, lack of data, limited capacity, weaknesses in transparency and public engagement, and insufficient monitoring and follow-up hamper the instruments' effectiveness (Box 2.1).

Box 2.1. Mainstreaming the environment into policies, plans and projects: A capacity challenge

Strategic environmental assessment

SEA began to be applied in the early 2000s and became a legal requirement in 2009. Law No. 32/2009 on Environmental Protection and Management requires SEA to be conducted for all development and spatial plans as well as any policies, plans or programmes with a potentially significant environmental impact or risk. SEA should include consideration of alternatives and assessment of the environment's carrying capacity and cumulative effects, with particular emphasis on vulnerability to climate change and biodiversity. Government Regulation No. 46/2016 expanded the use of SEA to marine, coastal and small island zoning plans and provided a basis for a common approach to SEA.

Since 2009, over 100 SEA studies have been conducted, mostly for provincial spatial plans. There are also some examples of SEA for national sector policies (e.g. for the oil palm, coal and aquaculture sectors) as well as the Masterplan for the Acceleration and Expansion of Indonesia's Economic Development 2011-25 (DANIDA, 2018). At the local (district) level, spatial plans rarely undergo SEA.

Since SEA often starts quite late in the planning process, limited attention has been given to consideration of alternatives. Many SEA reports present long lists of detailed recommendations, making it difficult for decision makers to set priorities. Follow-up monitoring of these recommendations is almost never carried out (DANIDA, 2018). There is a serious need to strengthen technical capacity to perform SEA at the local level and increase stakeholder and public involvement. The government has developed guidance on SEA procedures and requirements, including for regional and national development plans, which may help improve its application.

Environmental impact assessment

EIA is required prior to securing sector-specific business licences (e.g. for mining exploitation, construction or plantation). Since the 2001 decentralisation reform, EIA has been primarily implemented at the local and provincial levels. If projects do not require an EIA, the operator must submit an Environmental Management and Monitoring Program (EMMP) document or a Statement of Ability to Manage and Monitor the Environment. EIA or EMMP approval results in the issuance of an environmental permit. However, the permits rarely contain limits on polluting activities, are valid indefinitely and are not subject to periodic review (Sano, 2016).

EIA documents are often of poor quality and overlook important potential environmental effects due to the low competence of accredited consultants who prepare them and the lack of data that should form the basis of the analysis (Sano, 2016). Indonesia's National Human Rights Commission expressed concern in 2015 that EIA documents were frequently manipulated by project proponents (Nugraha, 2015). Capacity of local commissions that review EIA documents is generally low and technical guidelines for the documents' development and review are often of poor quality. Many projects are approved without appropriate EIA, or even without an environmental permit. A positive development was a 2016 regulation introducing criminal sanctions for officials who approve a project without EIA and operators who lack an environmental permit. This helped decrease the number of activities without appropriate environmental authorisation. In 2018, a practice of issuing provisional business licences through an online platform before the EIA is completed was introduced, which compromises consideration of alternatives in the EIA process.

Effective implementation of the low-carbon development plan will require strong institutional co-ordination, with a clear division of responsibilities at all government levels. As in many countries, the institutional framework for environmental management and green growth is complex, with many line ministries involved in policy implementation and sometimes unclear division of responsibilities. The Ministry of Environment and Forestry (MoEF) has the main responsibility for ensuring environmental protection and natural resource conservation and is the main focal point for climate change. But with environmental legislation being primarily sector-based, several other ministries have important responsibilities for green growth, including those for agriculture, energy and mineral resources, public works, industry, transport and finance. In addition, Indonesia's devolved administrative system (Chapter 1) makes subnational governments important partners for the green growth transition.

The government has striven to ensure co-ordination among ministries and agencies and between government levels on green growth policy formulation and implementation (e.g. by merging the environment and forestry ministries). However, it lacks sufficiently effective arrangements. Apart from issue-specific presidential instructions that prescribe roles for individual ministries and sometimes create interagency working groups, there is no formal operational mechanism to address the fragmentation of responsibilities. Environmental management, especially with respect to permitting and compliance assurance, thus often entails overlapping interests and institutional conflicts. National co-ordinating councils on climate change and land use have been dissolved. The four co-ordinating ministries[3] working to harmonise policy planning across line ministries could play a more effective role in ensuring policy coherence between sectors and assigning clear responsibilities with regard to efforts to reach low-carbon-economy targets. The establishment of formal vertical co-ordination mechanisms could help ensure more effective co-ordination between the central, provincial and district/city authorities.

Indonesia would benefit from building a dedicated monitoring framework to follow progress towards green growth. The MoEF publishes annual reports on selected environmental issues (e.g. air quality, water quality), although a comprehensive State of the Environment report has not been published since 2014 (Chapter 1). Efforts are made to enhance knowledge on the state and flows of natural capital (Box 2.2). Over the medium term, a monitoring framework could go further by linking economic activity with environmental performance; it could also include indicators on policy effectiveness regarding environmental challenges and on value added and jobs created in green sectors. Systematic reporting on such parameters can help raise awareness of the low-carbon, green transition, build consensus on it and increase ownership of it.

Box 2.2. Indonesia is strengthening natural capital accounting

Indonesia has done natural capital accounting for more than 30 years. Furthermore, Government Regulation No. 46/2017 on Environmental Economic Instruments mandated central and local governments to provide data and information to develop natural capital accounts. Statistics Indonesia (BPS) began compilation of an integrated environmental and economic accounting system called Sisnerling in the early 1990s and now develops annual asset accounts for forest resources, minerals and energy in line with international System for Environmental-Economic Accounting (SEEA) standards. As in many countries, low data quality, data fragmentation across institutions, limited data harmonisation and insufficient inter-institutional co-operation more generally hamper

practical use of this information in decision making. BPS has suffered considerable human resource and technical capacity constraints in developing Sisnerling.

Since 2013, Indonesia has collaborated with the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) global partnership to strengthen, expand and facilitate the use of natural capital accounting in policy making. As part of the partnership, a pilot land-use account was done for West Sumatra and a land cover account for West and East Kalimantan.

Source: WAVES, 2016; WAVES, 2018.

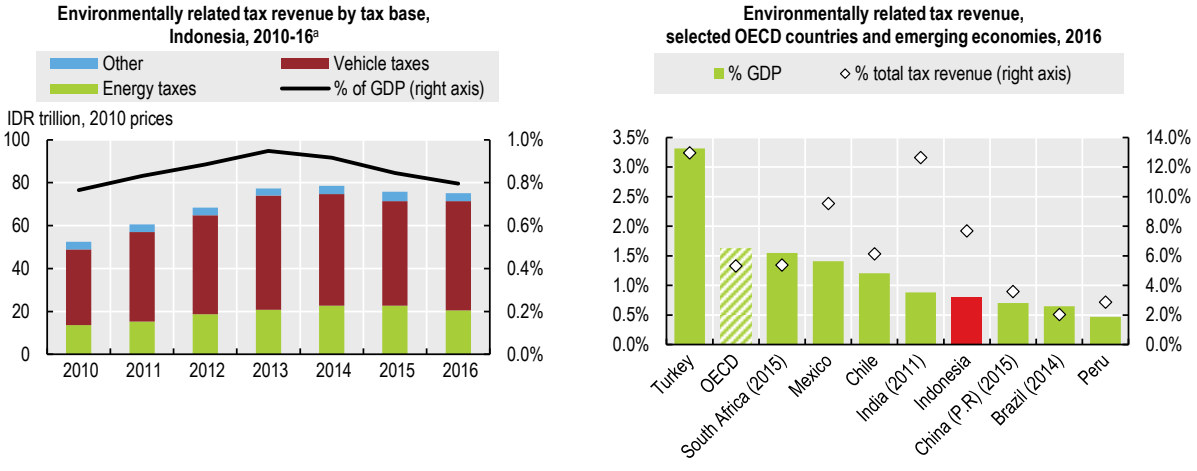
2.3. Greening the system of taxes, charges and prices

2.3.1. Environmentally related taxes: an overview

Indonesia has considerably improved its tax system over the past decade in respect to both revenue raised and administrative efficiency. However, its revenue/GDP and tax/GDP ratios, at 14% and 12%, respectively, remain low by comparison with countries at a similar income level. This has been attributed to factors including high informality levels, low tax compliance levels, widespread tax exemptions and narrow tax bases. Subnational governments raise only about 10% of total tax revenue directly, relying substantially on central government transfers to fund public services (OECD, 2018a).

Revenue from environmentally related taxes is low by international comparison.[4] The OECD estimates that the revenue reached IDR 98 trillion in 2016 (USD 7 billion) (Table 2.1), or 0.8% of GDP. The bulk of it stems from vehicle taxation, whereas transport fuel taxes account for the greatest share in most countries. In 2010-13, revenue increased by 43% (in real terms), faster than GDP (Figure 2.2), driven by sharp growth in the vehicle fleet and rising energy consumption in road transport. Revenue declined slightly thereafter with a slowdown in vehicle sales, though these picked up again in 2017.

Figure 2.2. There is room to increase energy tax revenue



a) Data include estimates and preliminary data. As from 2013, data include revenue from the luxury good excise tax on motor vehicles.
Source: OECD (2018), "Environmental policy instruments", *OECD Environment Statistics* (database); calculations based on submission from the Ministry of Finance.

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The tax structure in energy use, transport and natural resource-based activities aligns poorly with environmental objectives and the polluter-pays principle. Tax rates generally do not reflect the cost of environmental damage; industry and other sectors, such as agriculture, are exempt from various taxes and charges; and pollution (e.g. air emissions, wastewater discharge) and products causing pollution (e.g. fertilisers and pesticides) are not taxed at all. Indonesia applies taxes on natural resource use, but low rates and weak enforcement limit their impact on consumption and production. Charges and fees for public services, such as water and waste collection, are inconsistently applied and too low to stimulate efficient use or finance service provision.

As the OECD's 2018 Economic Survey indicates, well-designed green fiscal reform could help Indonesia boost much-needed tax revenue while reducing pollution and other environmental externalities in a cost-effective way (OECD, 2018a). Although Indonesia's fiscal position is in good shape, due in part to energy subsidy reform (Section 2.4), social and infrastructure spending needs are large. Taxing "bads", such as pollution, can raise revenue at a lower economic cost than taxing "goods", such as labour and corporate income, if good use is made of the revenue raised (OECD, 2017b). Government Regulation No. 46/2017 on Environmental Economic Instruments may provide momentum to reconsider and expand the use of taxes for environmental purposes, as well as instruments such labelling, sustainable procurement, tradable permits, subsidies, environmental insurance and the Environmental Management Fund.

Table 2.1. Transport taxes account for the bulk of environmentally related tax revenue

Revenue from key environmentally related taxes, 2016

	Details	Levied by	Revenue sharing	Revenue (IDR billion)	Share of environmentally related tax revenue
Energy taxes					
Motor vehicle fuel tax	5% of retail price, excl. VAT; 7% in some regions	Province	70% to local gov.	16 537	17%
Street lighting tax	Up to 10% of electricity consumption (retail price, excl. VAT)	District	-	10 404	11%
Vehicle taxes					
Luxury goods sales tax on vehicles	Up to 125% of vehicle factory price	State	n/a	1 834	2%
Vehicle registration tax	10% of vehicle resale price	Province	30% to local gov.	28 288	29%
Vehicle ownership tax (annual)	Based on weight, engine size and vehicle's assessed value	Province	30% to local gov.	35 816	36%
Other environmentally related taxes					
Surface water tax	10% of water consumption	Province	70% to local gov.	563	1%
Groundwater tax	20% of water consumption	District	-	605	1%
Parking tax	30% of parking fees	District	-	976	1%
Swallow's nest tax	n/a	District	-	9	0%
Forestry taxes, fees and charges	n/a	n/a	n/a	3757	4%
Total				**98 791**	**100%**

Source: OECD compilation, based on state and local revenue statistics and country submission.

There is room both to use existing taxes more effectively and to introduce new taxes. Opportunities include expanding energy taxation (and introducing carbon pricing), redesigning vehicle taxation to encourage people to buy low-emission cars and use public transport, and increasing and better enforcing taxes related to natural resource use in the forestry and fishery sectors. Water extraction fees need better enforcing and could be expanded. Indonesia should also consider introducing taxes on pollution (e.g. waste and wastewater release) and/or on products causing pollution (e.g. fertilisers, pesticides).

Many countries have used green fiscal reform to make their tax system less distortive and more growth- and employment-friendly, including Norway, the United Kingdom, Germany and Portugal. To advance on such reform, Indonesia could consider establishing a committee that would bring together stakeholders such as the ministries of finance, environment and forest, energy and mineral resources, agriculture, and industry. Past attempts to reform existing taxes or introduce new ones have met strong resistance from industry, but difficulty co-ordinating relevant ministries has also played a role. The establishment of a green fiscal reform committee could help in analysing options and economic, social and environmental consequences of introducing green taxes. In France, a green tax commission was instrumental in adopting a carbon tax.

2.3.2. Taxes on energy use and carbon pricing

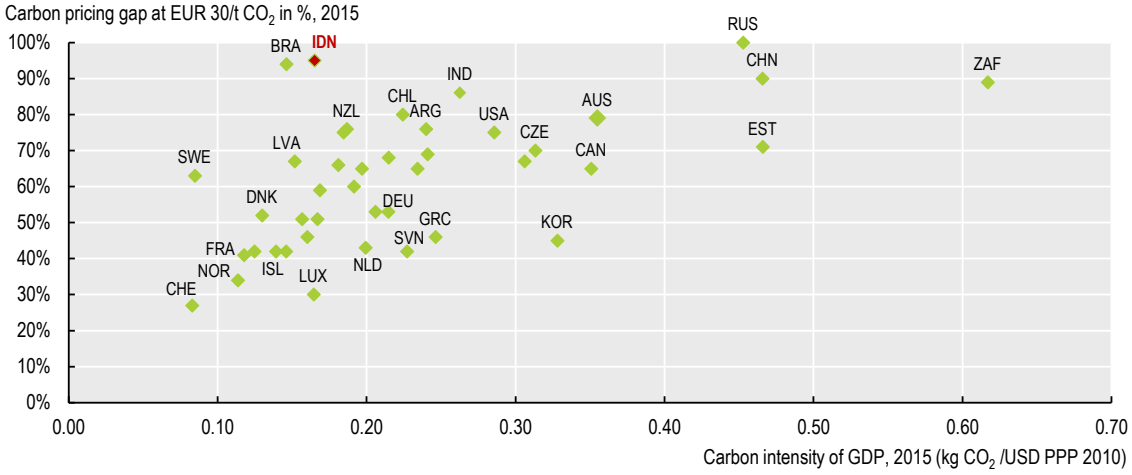
Indonesia does not tax energy use at the national level, nor does it have an explicit carbon tax or a carbon emission trading system. Only two low-level energy taxes are applied: a regional motor vehicle fuel excise tax and a local street lighting tax, which effectively acts as an electricity consumption tax. Thus nearly all energy not used for road transport – i.e. the bulk of energy use – is untaxed. Revenue from energy taxes amounted to 0.2% of GDP in 2016, compared to 1.2% of GDP in OECD countries (OECD, 2018b).

The main tax on energy use is the automotive vehicle fuel tax, imposed on petrol and diesel used in road transport. It is applied throughout the country, but levied at the regional level, with regionally differentiated rates. Law No. 28/2009 capped the rate at 10% of the sales price, but a 2014 presidential decree lowered the top rate to 5% (with a premium of 2% allowed outside Java-Madura-Bali due to the higher distribution costs). Fuels other than petrol and diesel (including biofuels, natural gas and liquefied petroleum gas, or LPG), as well as fuels for off-road transport (e.g. in the agriculture and fishery sectors), are not subject to the tax. The tax is lower for diesel than for petrol, but the effective rate on CO_2 emitted in combustion of both fuels is low by international comparison. For example, the tax translates to an average effective tax of EUR 7.6 per tonne of CO_2 emitted from fuel consumption in transport, far below the external cost of transport-related energy use and much lower than effective tax rates in India (EUR 49/t CO_2), China (EUR 70/t CO_2) or South Africa (EUR 95/t CO_2). Only Brazil and Russia apply lower excise taxes on energy use in road transport (OECD, 2018c). However, the government is revising the national regulation to enable subnational governments to increase the fuel tax rate. Efforts are also under way to reduce subsidies to transport fuels (Section 2.4.1) by using a more targeted mechanism.

The street lighting tax is a small levy imposed by district governments on households. It is collected by the state-owned electricity company, PLN, and transmitted to local governments. It effectively is a residential electricity tax. Part of the revenue is allocated to provision of street lighting. The maximum rate is set at 10% for general consumers and 3% for industry and for petroleum and natural gas production; for self-generated power the rate is 1.5% (Hakim, 2016). Public institutions are exempt from the tax. Attempts to increase the rate for industry have met strong opposition from businesses.

The limited use of taxes on energy use means CO_2 emissions from energy use are virtually untaxed. In 2015, only 16% of CO_2 emissions from energy use were priced (the second lowest value among 42 OECD and G20 countries), and none were priced above EUR 30 per tonne of CO_2, which is a conservative estimate of the climate damage from 1 tonne of CO_2 emissions (OECD, 2018d). Among emerging economies, Indonesia has the second highest carbon pricing gap, at EUR 30 per tonne of CO_2, highlighting its lag in use of cost-effective policies to decarbonise the economy (Figure 2.3). In addition to low taxes, Indonesia applies policies that reduce energy production costs and end-user prices relative to other forms of investment or consumption, thereby effectively running counter to energy taxation. Examples include subsidies for energy production and consumption, and domestic sales mandates (Section 2.4). As a consequence, energy prices are well below their associated social and environmental cost.

Figure 2.3. Energy taxes do not reflect the climate cost of fuel use



Note: The carbon pricing gap shows the extent to which countries price carbon emissions below the benchmark value. It measures the difference between the benchmark and the actual rate for every percentile and sums all positive differences. The gap is measured as a percentage. If the effective carbon rate on all emissions were at least as high as the benchmark value, the gap would be zero; if the effective carbon rate were zero throughout, the gap would be 100%. EUR 30 is a low-end estimate of the climate damage from 1 tonne of CO_2 emissions. Data refer to CO_2 emissions from energy use only.
Source: OECD (2018), *Effective Carbon Rates*; IEA (2018), IEA *CO_2 Emissions from Fuel Combustion Statistics* (database).

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The government considered introducing a carbon price in 2009, when the Ministry of Finance published a green paper on climate change identifying policy options that would help the country reach its international climate change commitments. The paper recognised that energy prices were below social costs and recommended gradually removing energy subsidies and introducing carbon pricing, as well as complementary measures to promote energy efficiency and low-emission technology. It proposed using international public financing and incentivising regional governments to undertake carbon abatement measures in the land-use sector through the intergovernmental fiscal transfer system. The paper argued that cost-effective climate policy would give Indonesia an early-mover and competitive advantage relative to other countries in the region (MoF, 2009).

The green paper proposed applying a carbon tax on fossil-fuel combustion for electricity generation and large industrial installations as of 2014, at USD 10 per tonne of CO_2. It was estimated this would raise IDR 95 trillion (USD 7 billion) by 2020. In line with international practice, the paper suggested gradually increasing the tax rate and using part of the revenue to alleviate the impact of higher prices on vulnerable communities through

cash transfers, or supporting low-emission technology and efficiency improvements in business. Modelling conducted for the paper indicated that a relatively low carbon tax of USD 10/ t CO_2 could reduce emissions from fossil-fuel combustion by around 10% compared to business as usual by 2020 without negatively affecting growth or poverty reduction aspirations, especially if the revenue was recycled (MoF, 2009). No legislation has been introduced to impose the tax. However, Presidential Regulation No. 77/2018 provides a legal framework for carbon trading and reception of international grants or funds for emission reduction. Establishment of emission limits, e.g. for selected industries, would support effective implementation of a carbon trading mechanism in Indonesia.

In the absence of an explicit carbon tax, bringing energy taxes closer to the marginal social costs associated with its use is all the more important for greening the economy cost-effectively. It would also help Indonesia raise tax revenue while making the adoption of renewables or low-emission technology more attractive. A first step would be to lift the 5% cap and raise the regional automotive fuel tax to a level that more realistically reflects externalities of fuel use. Further, a price signal needs to be established in non-road sectors (which account for the majority of energy use). This can be done either through an explicit carbon price (as suggested in the 2009 green paper) or fuel excise taxes, which put a price on the carbon content on fuel and therefore have a similar potential to change polluting behaviour. Acting sooner, while energy demand is still relatively low and the adverse impact on industry and residential and commercial energy use would be limited, would help put the economy on a sustainable low-carbon growth path at lower cost (OECD, 2018a). Indonesia can build on the experience of other middle-income countries that are implementing carbon pricing mechanisms (Box 2.3). The government has begun to study potential carbon pricing mechanisms, including a cap and trade system for the power sector, the pulp and paper industry and the cement sector.

2.3.3. Transport taxes and charges

Economic growth, rising incomes, population growth and urbanisation have increased the number of cars and motorcycles in use. This has led to rising energy consumption, emissions of GHGs and local air pollutants, and crippling congestion (Chapter 1). As the motorisation rate is expected to continue to rise, fiscal policies have a role to play in managing the associated environmental impact and, ultimately, encouraging a shift towards more sustainable mobility modes, which current vehicle taxation does not sufficiently do. Indonesia's vehicle taxes are not linked to environmental and economic externalities of transport use, such as GHG emissions, air pollution and congestion, and thus are behind international best practice. Road pricing is limited to toll roads on Java and Sumatra.

Vehicle taxes

Revenue from vehicle taxes is significant, amounting to 0.5% of GDP in 2016 (compared to 0.4% of GDP, on average, in the OECD) (OECD, 2018b). Vehicle taxes are an important source of revenue for subnational governments, accounting for about 20% of their total tax income. The revenue has increased markedly since 2010, reflecting sharp growth in the vehicle fleet (Figure 2.2). A slight decline in revenue over 2013-16 reflected a slowdown in vehicle sales, which recovered in 2017-18.

Box 2.3. Carbon pricing instruments in middle-income economies

Worldwide, 67 jurisdictions used some kind of explicit carbon pricing in late 2017 and many more effectively price carbon through excise taxes. Among carbon pricing instruments, carbon taxes have been particularly attractive to developing and emerging economies due to their simple administration compared to emission trading systems (ETS). Carbon taxes can be added to existing fuel tax systems and there is no need to measure actual emissions at a large number of plants. A tax can also generate revenue from the informal sector. Flanking measures (e.g. lump-sum or targeted transfers) can help mitigate the adverse affordability impact for the most vulnerable households as well as competitiveness concerns. The examples below showcase some middle-income countries that recently launched, or are about to launch, carbon pricing mechanisms to meet their Paris Agreement commitments.

- Colombia began imposing a carbon tax on 1 January 2017 on fossil fuels used for combustion, with exemptions for natural gas consumers outside the petrochemical and refinery sector. Companies may pay the tax using offset credits from projects in Colombia that are verified by accredited auditors. The expected revenue of USD 229 million a year is earmarked for the Colombia Peace Fund, which supports activities such as watershed conservation, ecosystem protection and coastal erosion management.
- Mexico, like Indonesia, has long regulated energy prices, with fossil fuels sold at subsidised rates. Since 2014, reforms have reduced energy subsidies and later increased taxes on the main transport fuels. Mexico introduced a carbon tax that applies to most fossil fuels. The price and tax reform went into effect gradually, with initially low prices, to increase policies' political acceptability. Mexico is now considering introducing an ETS. In 2017, it launched a year-long ETS simulation exercise to strengthen national capacity regarding the design, organisation and operation of an ETS. Over 90 companies in the power, steel, cement, refining and chemical sectors are participating voluntarily to get experience using registries and logging transactions.
- A similar ETS simulation is being launched in Thailand over 2018-20, building on a voluntary ETS in 2015-17, when the system was first tested.
- After multiple delays, South Africa's parliament approved a carbon tax in February January 2019 at ZAR 120 (about USD 7.5/t CO_2). Only certain entities above set thresholds (e.g. total installed thermal capacity of 10 MW) will report emissions and pay the tax in the first phase, to 2022. Complementary tax incentives and revenue recycling measures aim to minimise the impact on electricity prices and energy-intensive sectors such as mining, iron and steel. The reform will be revenue neutral.

Source: World Bank, 2017a; KPMG, 2018; OECD, 2018d; Arlinghaus and van Dender, 2017; Reuters, 2019.

Indonesia applies two types of one-off purchase taxes, in addition to VAT: a vehicle registration (or transfer of title) tax and a luxury-goods sales tax. The vehicle registration tax, levied at the provincial level, is up to 20% of the sale price for the first car.[5] This means older and likely more polluting cars pay less tax. The luxury sales tax is an ad-valorem tax on the factory price. The rate can be up to 125%, depending on engine size, vehicle type and whether the car was imported or produced domestically. The tax increases with engine size, incentivising purchases of smaller cars that tend to be more fuel efficient. However, the tax design provides some perverse incentives, for example by exempting pickup trucks, which emit high levels of local air pollutants and GHGs. Certain types of low-emission cars, such as hybrids and electric vehicles, which are both imported, face high import duties.

The vehicle ownership tax is levied annually at the provincial level. Law No. 28/2009 provides that its rate is based on two elements: the vehicle's assessed value and its weight (to reflect the degree of road damage or pollution it causes). The link with vehicle weight is not well promoted and people typically believe the tax is based only on value (MoF, 2015b). Thus, in the absence of stronger awareness-raising efforts, it is unlikely to have an impact on consumer choice. As the value of a car, and thus the tax liability, decreases over time, the tax potentially creates an incentive against renewal of the vehicle fleet towards more fuel-efficient cars. Indeed, the overall tax burden on used cars is lower in Indonesia than in other Asia-Pacific countries (APEC, 2016). Coupled with the relatively high purchase taxes, this means people have few incentives to replace old vehicles with new, potentially more fuel-efficient and less polluting cars.

Some subnational governments have started to more explicitly incorporate environmental objectives directly into vehicle taxation. Jakarta and East Java provinces, for example, impose additional annual ownership taxes on each car after an individual's first car in a bid to deter car ownership. However, this is commonly avoided by registering cars to different names (MoF, 2015b). Jakarta also imposes additional surcharges on passenger vehicles with engines of more than four cylinders or weight above 1.5 tonnes, such as SUVs (SmartExpat, 2017). Generally, heavy vehicles, such as trucks, continue to enjoy big tax breaks and face less than 50% of the tax burden on cars (APEC, 2016).

The national government reduced the luxury sales tax for so-called low-cost green cars to zero, provided they are assembled locally with at least 40% local content. This is aimed at boosting local demand and increasing motorisation while promoting greener technology. To be defined as a low-cost green car, a vehicle must have an engine smaller than 1 200 cc (15 00 cc for diesel cars) and get at least 20 km per litre. There is some evidence that this has increased sales of such cars (MoF, 2015b). The government is reviewing the tax incentive to encourage a broader set of low-emission vehicles (i.e. beyond small low-cost cars), including electric cars and hybrids. A local content requirement is likely to be in place. This may impede diffusion of zero-emission cars, given the lack of domestic supply.

There remains substantial scope to make motor vehicle taxes better influence purchasing decisions. The World Bank (2018a) estimates that better aligning motor vehicle taxes with environmental externalities from vehicle use and transforming the luxury goods tax into a specific excise tax (to avoid transfer pricing) could increase revenue by 0.6% of GDP. One option would be to link the main taxes (e.g. registration and ownership taxes) to parameters such as fuel efficiency or emissions of GHG and local air pollutants, as several OECD countries do. The government has begun discussions on switching vehicle taxation from engine size to emission levels. Linking vehicle taxes to fuel efficiency would be particularly justified in Indonesia, where no fuel efficiency standards exist and where fuel taxation is

very low. Reducing import tariffs and local content requirements would help accelerate diffusion of fuel-efficient and low-emission cars.

Road pricing

Road pricing has increased with the construction of some 1 000 km of toll roads, albeit mainly in Jakarta. As the government moves to electronic road pricing, variable pricing (e.g. linked to congestion and pollution levels) could be considered. This would allow charging of higher prices and encourage drivers to switch to other transport modes (e.g. public transport) when roads are busy or ambient air quality is above the national or local standard. The government may also consider broader congestion pricing (outside toll roads) in heavily congested areas, such as central Jakarta (Chapter 1). An electronic congestion charging system has been under consideration by the Jakarta government, and infrastructure construction was initiated, but implementation has been delayed. In the meantime, an odd-even system[6] was introduced, which potentially incentivises wealthy households to purchase a second vehicle.

2.3.4. Taxes and fees on natural resource extraction

Water abstraction and use

Two charges are levied on water resource abstraction: a surface water tax (at the provincial level) and a groundwater tax (at the local level). Both are based on "obtained water value", which is set in local regulations and depends on the water source, location, abstraction method, utilisation purpose, volume, quality and environmental conditions. Nationwide, the two taxes yielded revenue of about IDR 600 billion (USD 45 million) each in 2016 (about 0.4% of total subnational tax revenue). The tax rate and revenue can vary widely across the country, however. In the Sukabumi district of West Java, for example, the local groundwater tax provides nearly 20% of local revenue (Sunarti and Hayati, 2017).

A significant share of water use is exempted from the groundwater tax, including domestic use, irrigation for agriculture and small water suppliers (depending on regional regulation). Many larger users operate without a water abstraction permit and hence do not report and pay for the water they abstract. In Jakarta, it has been estimated that only 8% of annual groundwater abstraction is reported (Sunarti and Hayati, 2017). The tax is thus unlikely to encourage sustainable groundwater management.

The critical situation of many aquifers (Chapter 1) requires enhanced effort to control and enforce groundwater regulations, including taxation. The government is hesitant to remove tax exemptions for households, which is understandable given that the majority of Indonesians lack access to piped water networks and thus rely on alternative sources such as wells. An expansion to other users (e.g. small commercial groundwater providers using wells) could be considered: it would help reduce pressures on aquifers while increasing local government revenue and capacity to invest in water supply. For example, Rio de Janeiro state in Brazil uses part of the revenue from water abstraction charges to fund investment in wastewater collection and treatment (OECD, 2015a). Mexico uses a portion of its revenue to support payment for ecosystem service programmes that encourage conservation in watersheds, forests and other priority areas for biodiversity.

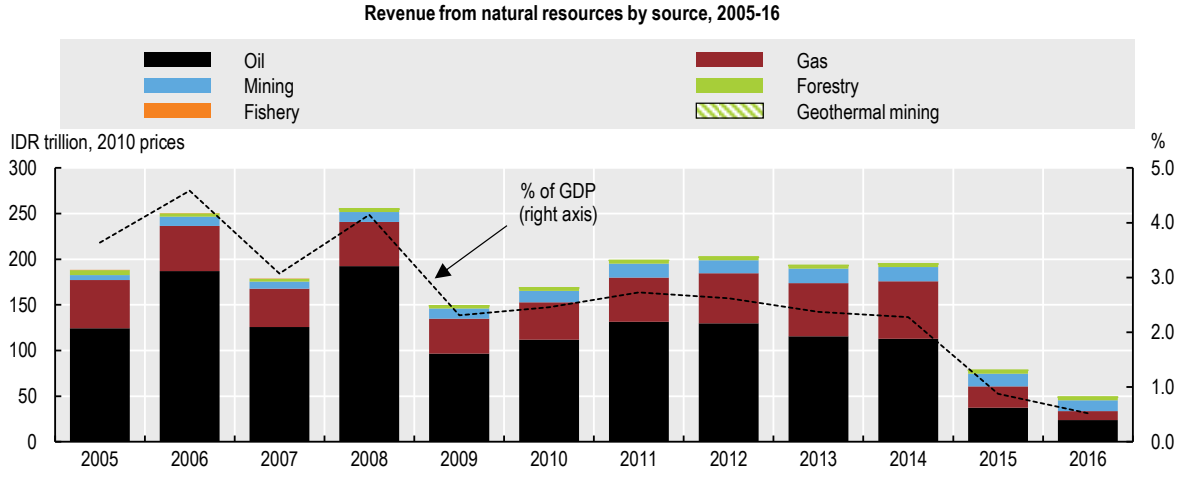
Fiscal treatment of other natural resources

Indonesia's wealth in natural resources is an important source of tax and non-tax revenue. In addition to general taxes (on value added, corporate income, property, etc.), natural-

based sectors are subject to taxes, fees and charges on resource use, revenue, permits and concessions, and public services. This revenue is reported in the annual budget as "non-tax state revenue" (*penerimaan bukan pajak*, or PNBP) for the oil, gas, mining, forestry, fishery and geothermal sectors. As not all of these fall under the OECD definition of environmentally related taxes and as no detailed breakdown is available, PNBP revenue is not included in the earlier discussion of environmentally related taxes.[7]

In 2005-14, PNBP revenue from natural resources averaged 3% of GDP annually, mostly from crude oil and natural gas (Figure 2.4). The sharp fall in international oil and gas prices in 2014 led to a dramatic decline in revenue in 2015 and 2016, which was compounded by an unattractive fiscal regime that weighed on activity and revenue (OECD, 2018a). Revenue from renewable resources (forestry and fisheries as well as geothermal energy) increased in absolute terms, but remains small at about 0.05% of GDP.

Figure 2.4. PNBP revenue from natural resource use has declined markedly



Note: Data show "non-tax resource revenue from natural resources" as reported in the annual state budget. This accounts for most revenue from natural resource-related activities in Indonesia and is mainly derived from taxes on resource use (e.g. production volume or value), royalties, and permits and concessions, but also includes fees and charges for administrative and other public services. State revenue from taxes on income, profits or capital gains from natural resource-related activities is not reflected in this figure.
Source: Based on submission from Ministry of Finance.

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Since the 2001 decentralisation reform, revenue is shared between the central and subnational government levels according to specific formulas (Table 2.2).[8] The reform delegated more authority to subnational governments to manage natural resources, increased their share in natural resource-related revenue and provided them with revenue-raising power (Ardiansyah, Akbar and Amalia, 2015). Decentralisation brought challenges as well, however, including governance problems and weak capacity for monitoring and law enforcement at the local level, leading to illegal and unsustainable extraction, especially in mining and forestry. This weighs on revenue while creating environmental costs. Strengthening law enforcement and land-use governance is a condition for a more efficient fiscal regime as well as effective and sustainable land use more generally.

Table 2.2. Municipalities enjoy the lion's share of revenue from natural resources

Sector	Revenue source	Percentage share (%)			
		Central government	Provincial government	Producer district/ municipality	Other districts/ municipalities in the province
Oil		84.5	3	6	6
Natural gas		69.5	6	12	12
Mining	Land rent	20	16	64	-
	Royalty (exploration and exploitation)	20	16	32	32
Forestry	Reforestation levy	60	-	40	-
	Resource rent	20	16	32	32
	Land rent	20	16	64	-
Fisheries		20	-	80	-
Geothermal		20	16	32	32

Note: 0.5% of the revenue sharing from oil and gas is allocated to provinces and local governments as an additional fund for education (earmarked grant).
Source: Budi et al., 2012.

Oil, gas and mining

Most non-tax revenue is raised from oil and gas extraction via production-sharing contracts, which split the extracted resource between the government and the contractor. Non-tax revenue from mining mainly stems from royalties and land rent. The overall government take from resource extraction is relatively high in the oil sector but lower in mining (NRGI, 2015; Arnold, 2012). Royalty rates have long been governed by provisions in individual mining contracts and licences, which are not disclosed. The 2009 Mining Law replaced the system of individual contracts with one based on concessions, or mining business permits, in which taxes and royalties are paid according to the general law, rather than negotiated contracts.[9] This shift should help increase transparency about tax and royalty payments of individual companies. Indonesia's participation in the Extractive Industries Transparency Initiative is also helping improve transparency in the sector. In March 2018, the government announced that beneficial ownership of mines must be revealed (OECD, 2018; PwC, 2018).

Improvement to management of the mining sector will be as important as higher royalty rates to increase state revenue. The 2009 Mining Law, which gave subnational governments the authority to grant mining licences, has led to a marked increase in the number of licences issued. Yet limited management, oversight and enforcement capacity at the local level, along with the lack of a single cadastre, left room for overlapping licences and mining in prohibited locations such as protected forests, along with unsustainable mining practices and illegal or misreported mining, resulting in a loss of government revenue (EITI, 2015). In 2017, mineral and coal mining companies owed the government some IDR 5.1 trillion (USD 380 million) (Esterman, 2017). To address this, the government has tightened regulations and introduced a "clean and clear" certification system under which mining companies must prove they meet financial and other technical requirements. A continued push for transparency in the issuance of mining permits will help ensure better oversight and enforcement of permit law and pave the way for a more efficient fiscal regime.

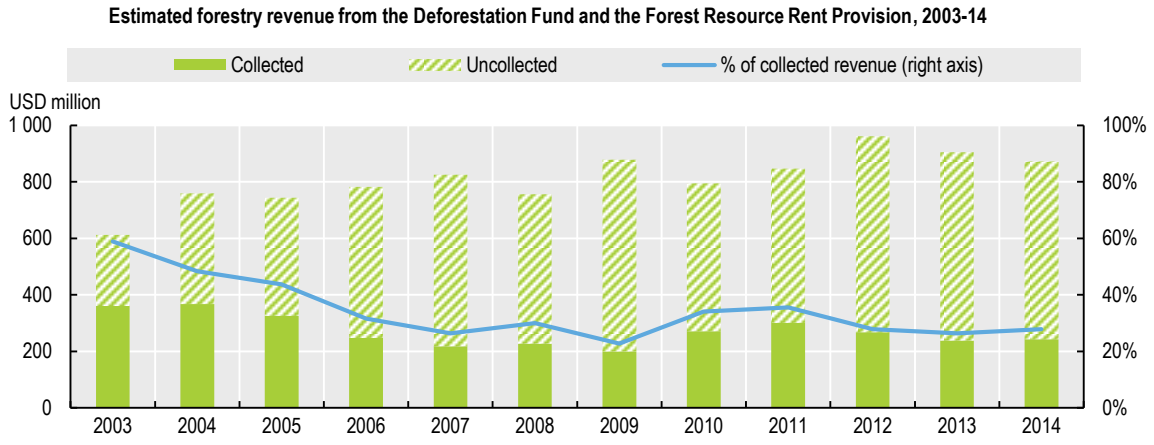
Forestry

Revenue from the use of forest resources is small and declined from around 0.11% in 2005 to 0.03% of GDP in 2016. The main levies in terms of revenue generation are payments to the Reforestation Fund (Dana Reboisasi, or DR) and the Forest Resource Rent Provision (Provisi Sumber Daya Hutan, or PSDH), although other revenue streams have increased in size since the mid-2000s.[10] Both levies are based on the volume of timber extracted, with rates depending on species, timber grade and where it was harvested.[11]

The DR rate and the benchmark price of the PSDH (on which the rate is based) are too low to capture a significant share of economic rent. The rates have remained largely unchanged since the turn of the century, despite rises in market prices for timber. Inflation alone eroded about 75% of the real value of the PSDH benchmark price between 1999 and 2014 (KPK, 2015). In March 2012, the Ministry of Trade nearly doubled the benchmark price, but after vigorous opposition from the forest industry it reverted to the previous level a month later. For such fees to work effectively towards efficient and sustainable resource use, it is important for the government to use objective standards that reflect environmental externalities of resource extraction in determining rates, rather than responding to political pressure.

Between 2003 and 2014, only one-third of potential revenue from the DR and the natural forest component of the PSDH were collected, leading to forgone revenue of USD 539 million to USD 749 million a year (Figure 2.5). This has been attributed to insufficient management of data on reported timber production and revenue collection, inadequate controls, ineffective law enforcement and the prevalence of a shadow economy for illegally harvested timber (KPK, 2015). The launch of the online Forest Product Administration Information System in 2016, which aims to improve data collection, analysis and dissemination of timber forest products, will help redress this situation.

Figure 2.5. Two-thirds of potential revenue from concessions in natural forests is not collected



Source: Based on KPK (2015), *Preventing State Losses in Indonesia's Forestry Sector*.

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The failure to better capture economic rents from timber production has implications not only for tax collection, but also for forest management sustainability (KPK, 2015). Since the early 2000s, there has been a shift from selective logging in natural forests (a model for sustainable forest management) to timber harvesting from plantations and land clearing

(where harvesting costs are significantly less) (Chapter 3). As a step in the right direction, the government issued new rates for the Forest Estate User Fee, a concession levy collected from mining and plantation companies, to better capture economic rents from forestry use. Raising the DR, PSDH and other fees should also be considered.

Fisheries

Revenue collection from the fishery sector has long been sluggish due to significant illegal, unreported and unregulated fishing. For example, the Ministry for Maritime Affairs and Fisheries estimates that only 40% of the nearly 9 900 operational ships with capacity of more than 30 gross tonnes (GT) are legally licensed. Aggressive undersizing of vessels further reduces revenue from the sector. The World Bank (2015) estimates that USD 20 billion worth of maritime resources are stolen per year by foreign and local fishing companies. Commercial fishing companies are subject to a licence fee, a fish levy and service fees. These apply to all vessels with capacity above 30 GT, or more than a 90 horsepower engine, and operating outside 12 nautical miles. The amount is based on the size of fishing fleets; higher rates apply to foreign fleets (Winter, 2009).

The government has accelerated efforts to collect more revenue: it has banned transhipment at sea, required all boats over 30 GT to use vessel monitoring systems, initiated a controversial campaign of sinking illegal (foreign) boats, and increased the budget of the Ministry of Marine Affairs and Fisheries (OECD, 2018a). This helped revenue more than quadruple between 2015 and 2016 (to reach IDR 300 billion), even though the volume of total marine fish capture slightly decreased. Efforts to improve monitoring and law enforcement on fishery activities should continue. In the medium-term, expansion of the fishery levies to smaller vessels should be considered, given that small-scale fishing makes up 95% of Indonesian fishery management (Chapter 1).

2.4. Reforming environmentally harmful subsidies

2.4.1. Support to fossil-fuel consumption and production

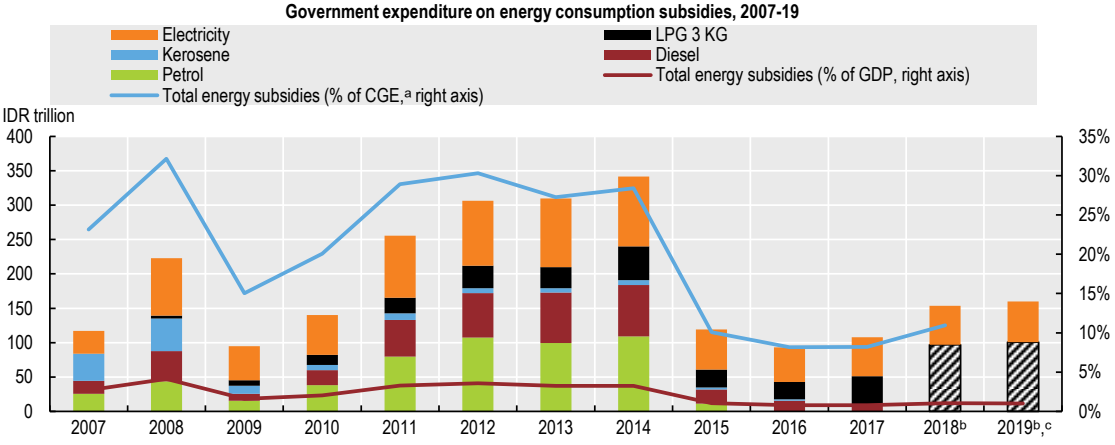
Indonesia has made great strides in reducing fossil-fuel subsidies in recent years. The country has a long history of subsidising energy use to keep energy affordable for the poor, increase energy access and raise household purchasing power. The bulk of support has stemmed from the government subsidising end-user prices for petrol, diesel, electricity and other energy products. Until 2014, these subsidies accounted for roughly 30% of central government expenditure, equal to nearly 4% of GDP (Figure 2.6). At the same time, subsidies were poorly targeted and highly regressive. Pressured by an increasingly large fiscal burden, the government has embarked on major reforms aimed at ensuring fiscal sustainability and better targeting. This helped cut subsidy expenditure by roughly half between 2014 and 2015 (Figure 2.6), freeing revenue for infrastructure and social programmes.

However, not all price reforms have been implemented as announced, putting into question the stability and durability of reform. Expenditure for fossil-fuel consumption support still amounted to IDR 95 trillion in 2017 (nearly four times the amount of energy-related tax revenue) and soared to IDR 153 trillion (USD 10.7 billion) in 2018. The government does not systematically track subsidies to fossil-fuel production, although it began to compile and quantify such measures in the framework of the G20 peer-review process on phasing out inefficient fossil-fuel subsidies (see OECD, 2018e for details). Such information will help the government understand whether the subsidies are achieving their objectives

cost-effectively. It will also help identify inefficient measures and prioritise ones to be phased out. To date, no plans exist to reduce production-based subsidies.

The government should implement a step-by-step phase-out of fossil-fuel subsidies and rigorously stick to its timetable, rather than responding to short-term budgetary or political pressures. The subsidies are holding back Indonesia's transition to a sustainable energy system, taking much-needed resources from the budget while also discouraging energy conservation and the switch to cleaner alternatives. Transparency about subsidy costs, benefits of their removal and strategies for compensation can help build public acceptance and support. Equity and poverty reduction concerns are best addressed through direct support to vulnerable households, rather than subsidies for energy use. Recent OECD analysis shows that increasing taxes on electricity can reduce energy affordability risk if parts of the additional revenue is transferred back to households (Flues and van Dender, 2017). Indonesia could build on its experience in using social safety net programmes to reduce the impact of price increases on the poor.

Figure 2.6. Indonesia has significantly cut subsidies to fossil-fuel consumption



a) CGE = Central government expenditure.
b) Detailed breakdown for fuel subsides not available.
c) Data refer to planned budget.
Source: Country submission; MoF (2019), *Indonesia's Effort to Phase out and Rationalise its Fossil-fuel Subsidies: A Report on the G20 Peer-review of Inefficient Fossil-fuel Subsidies that Encourage Wasteful Consumption in Indonesia.*

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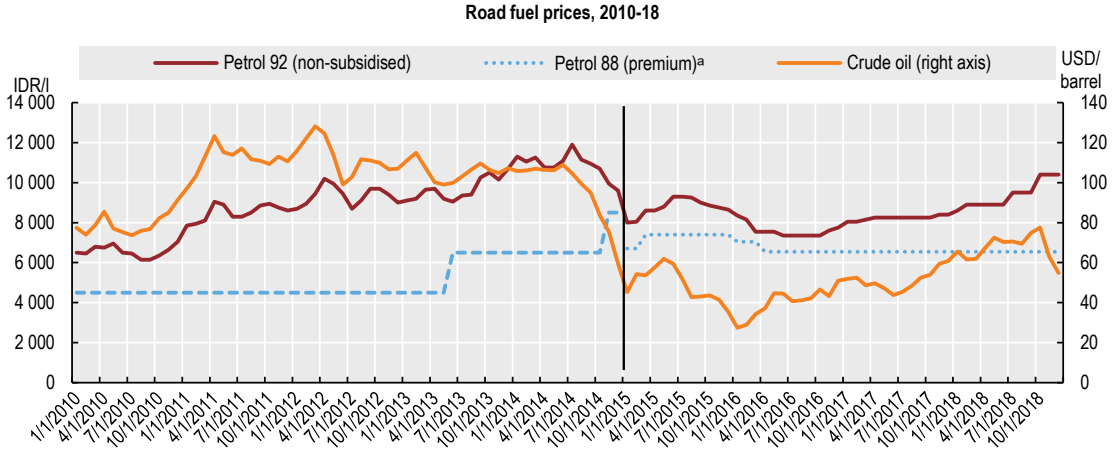
Petrol and diesel

End-user prices of transport fuels have been subsidised for decades. Subsidies have mainly involved the government compensating the state-owned energy company Pertamina for the low end-user prices the company is allowed to charge on its RON 88 petrol (called "premium" in Indonesia) and diesel sales. In 2013, the government raised premium petrol prices by 44% and diesel prices by 22%, bringing them closer to market prices (Figure 2.7). This upward adjustment, the first since 2008, was accompanied by cash transfers to 15.5 million households over four months, as well as increased spending on education and health. A second increase followed in November 2014. Aided by the unexpected decline of global crude oil prices, the government effectively eliminated the subsidy for premium petrol in January 2015[12] and fixed the diesel subsidy at IDR 1 000/litre (USD 0.07/l) below market prices, followed by a reduction to IDR 500/litre (USD 0.035/l) in 2016. The combination of subsidy reform and lower oil prices reduced the subsidy budget for premium petrol and diesel by more than 90% over 2014-16 (Figure 2.6).

The government announced it would adjust RON 88 prices to international prices every month, but has been reluctant to do so in practice. Fuel prices have remained constant since April 2016 even though global crude oil prices have risen (Figure 2.7). In March 2018, the president announced that fuel and electricity prices would be kept stable until at least the end of 2019; in June 2018, diesel subsidies were increased from IDR 500/l to IDR 2000/l (*The Jakarta Post*, 2018a).

Figure 2.7. Subsidies for fuel have not been adjusted to oil market prices since 2016



a) In January 2015, the government eliminated the subsidy for RON 88 fuel and announced it would adjust fuel prices monthly to reflect international prices.
Source: CEIC (2018), *Global Database*.

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In January 2017, the president launched a single fuel price policy (introduced through Energy Ministry Regulation No. 7174/2016) to improve equity and social justice by levelling fuel price disparity across the archipelago. Fuel retail prices in remote areas are up to three times higher than prices in Java because logistical, operational and development costs are higher. Implementation of the new policy will require significant infrastructure investment by Pertamina. It will also dramatically raise the company's operating costs, by up to an estimated IDR 900 billion per year (Indonesia Investments, 2016), as fuel distributors operating in remote and underdeveloped areas will be entitled to higher profit margins to encourage distribution in these areas. Pertamina was initially expected to cover the costs incurred under the single fuel price policy without additional subsidies, effectively shifting the subsidy burden from the state budget to Pertamina. The company initially planned to finance this through a cross-subsidy from its other business activities, notably the sale of non-subsidised fuels. Yet in the first year the policy was in effect, the company already reported losses of IDR 5 trillion (GSI, 2018). In November 2017, it was announced that the government would compensate Pertamina up to USD 1.3 billion (in addition to subsidies) for the fuel sale costs associated with the single fuel price policy as well as the freezing of fuel prices (*Jakarta Globe*, 2018). In the long term, investment in the necessary infrastructure should ensure access to energy more efficiently than artificially levelling fuel prices.

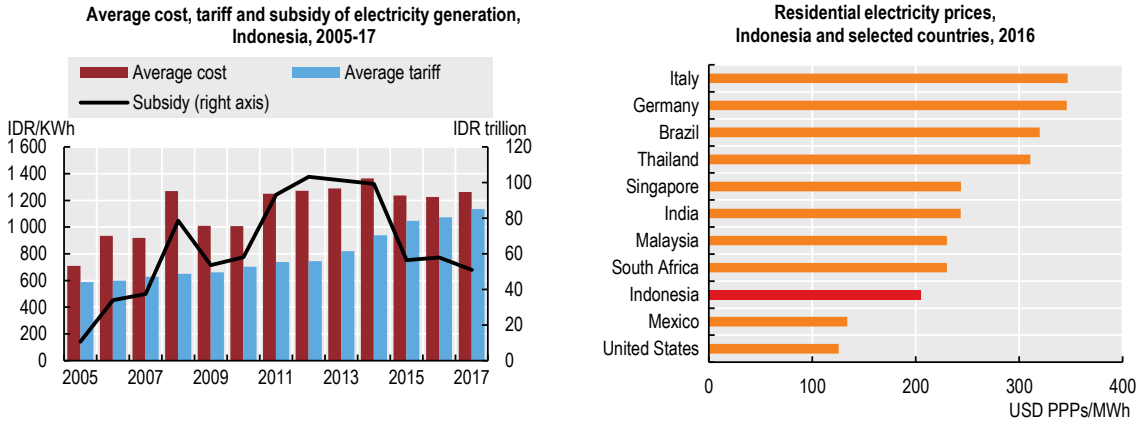
Electricity

As with the petrol and diesel subsidy, the government subsidises electricity in terms of end-user prices. It sets electricity tariffs (which the parliament must approve) and compensates PLN for the difference between the retail tariff and the average cost of generating electricity. In the early 2010s, average retail tariffs were about two-thirds of PLN's production costs. The gap has narrowed as the government began to better target the subsidy, but tariffs remain below cost, on average, and low by international comparison (Figure 2.8).

Between 2013 and 2017, subsidies to 30 million electricity consumers were phased out (OECD, 2018e). Electricity tariffs for these consumers were gradually increased until they reached market value, and now a monthly price adjustment mechanism keeps them at a level that would match PLN's production costs. At the end of 2016, only lower-income households (defined as subscribers of 450-VA and 900-VA electricity) remained subsidised – which still represented about 70% of PLN's customers. The government later split tariffs within the 450-VA and 900-VA classes into subsidised (for poor households) and non-subsidised (for wealthier households). The split was made possible by the availability of new household income data, based on Indonesia's unified poverty database. The non-subsidised rate was charged to wealthier 900-VA customers in 2017, reducing the number of subsidised consumers from 23 million to 4 million. Tariff adjustment for wealthier 450-VA consumers was also planned, but later suspended (OECD, 2018e).

Between 2013 and 2017, the average electricity tariff increased by 40% and the subsidy was reduced by half (Figure 2.8). As the government announced it would keep electricity prices constant through at least 2019, the electricity subsidy allocation in the 2018 state budget was set to increase. The subsidised tariffs continue to be significantly below production cost (e.g. the tariff for households with a 450-VA power connection is IDR 417, or USD 3.1 cents, per kilowatt hour, compared to production costs of IDR 1 260 in 2017).

Figure 2.8. Electricity tariffs are below the cost of supply



Source: IEA (2018), *World Energy Prices* (database); MoF (2019), *Indonesia's Effort to Phase out and Rationalise its Fossil-fuel Subsidies: A Report on the G20 Peer-review of Inefficient Fossil-fuel Subsidies that Encourage Wasteful Consumption in Indonesia*.

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Kerosene and LPG

The government has long subsidised the end-user price of kerosene, which is widely used for cooking. In 2007, it introduced the Kerosene-to-LPG Conversion Program in a bid to tackle rising government expenditure on kerosene subsidies while improving access to clean cooking fuel (LPG has higher energy intensity and emits less pollution than kerosene). The programme encouraged the shift by distributing a free stove, one fill and an additional 3-kg LPG cylinder to households, while in the meantime gradually withdrawing kerosene from distribution agents in the areas where the conversion packages had been distributed.

The programme led to a drop in kerosene use from 7.8 billion kg in 2008 to 0.5 billion kg in 2016, while LPG consumption jumped from 0.5 billion kg to 6 billion kg (OECD, 2018e). The subsidy budget for kerosene fell by IDR 45 trillion, and spending for LPG rose by IDR 21 trillion (Figure 2.6). There is a balance to be struck between the priority of ensuring access to clean cooking, on the one hand, and keeping LPG subsidies manageable while not encouraging wasteful energy consumption, on the other.

The budget burden associated with the LPG subsidy has been rising. The government has not adjusted the price of subsidised LPG (IDR 12 750 per 3-kg cylinder) since 2008, nor has it narrowed the target groups. Anyone can buy 3-kg LPG cylinders at subsidised prices, including wealthy and large consumers, and there is evidence that larger LPG cylinders are illegally being refilled from subsidised 3-kg cylinders and sold to large consumers. Acknowledging the need for reform, the parliament proposed providing the LPG subsidy only to the poorest 40% of households (and microbusinesses managed by those households), replicating the experience of the electricity subsidy reform. The LPG reform was to be implemented in 2017 but has been postponed twice due to revisions in the subsidy system and difficulties designing the reform, including the administrative and physical infrastructure of a smart-card system.

Oil, gas and coal production

Fossil fuel-producing industries benefit from fiscal incentives that aim to encourage reserve discovery and boost output (see OECD, 2018e for a detailed discussion). Estimates suggest that subsidies to coal producers alone amounted to at least USD 645 million in 2015 (Attwood et al., 2017). Several of the measures are still in place. The majority of the subsidies are tax incentives to the mining and processing industries (e.g. reduced VAT and corporate income taxes) and support to coal-fired power plants. In partnership with PLN, coal-fired electricity generators can apply for preferential loans, loan guarantees and subsidised credit. This policy, intended to secure power plant investment, is part of a 35 GW power capacity extension programme. Since 88% of Indonesia's electricity generation is based on fossil fuels, the measures can be considered a government subsidy encouraging fossil-fuel use.

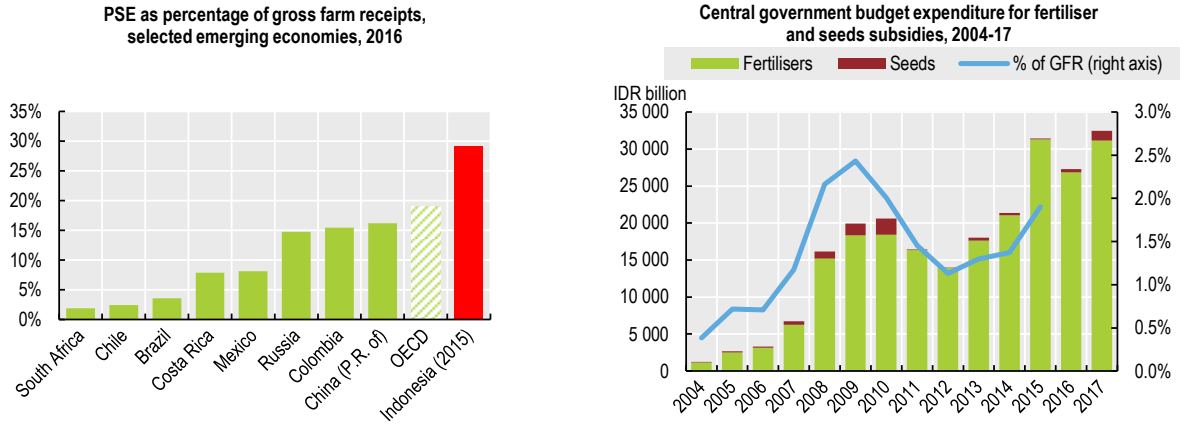
Fossil-fuel production is further supported through the domestic market obligation (DMO) policy. DMOs require oil, natural gas and coal producers to sell part of their output (usually between 15% and 25%) on the domestic market at heavily discounted prices. As DMOs provide Pertamina refineries and PLN power stations with cheaper feedstock, they can be characterised as producer support, even if they reduce the revenue of upstream companies (OECD, 2018e). In 2018, the government capped the price of coal sold to local power plants at USD 70/Mt for 2018-19 (30% below the Indonesian reference price for equivalent coal sold for export) to allow for the announced electricity price freeze to the end of 2019 without overburdening PLN's budget (Pardede, 2018). A price ceiling for natural gas is under discussion (*The Jakarta Post*, 2018b).

2.4.2. Support for agricultural production

Indonesia provides significant support to agriculture to foster its goal of food self-sufficiency.[13] Support to farmers, as measured by the producer support estimate, reached 29% of gross farm receipts in 2015 (or 4.6% of GDP) (Figure 2.9). The vast majority of support is provided through market price support and support to fertiliser manufacturers, which are among the most market-distorting forms of support and potentially environmentally damaging (OECD, 2015b). Market price support is mainly provided though minimum prices for certain commodities (e.g. sugar, soybeans, paddy rice) and via trade policies (e.g. import restrictions and export taxes for certain products). These interventions have created significant gaps between domestic and world market prices (reaching nearly 100% for rice in 2015-16), increasing food costs for consumers, hampering the competitiveness of the agricultural sector and triggering international disputes. The World Trade Organization ruled against Indonesia on 18 trade restrictions in 2016-17, including import bans on some products, selling restrictions and storage requirements for importers.

Budget expenditure for fertiliser subsidies increased more than tenfold (in real terms) between 2005 and 2017, when IDR 31 trillion (USD 2.3 billion) was budgeted (Figure 2.9). The steep increase was partly due to subsidised prices having been held constant despite growing fertiliser production costs. While subsidies are intended for small farmers (those producing on less than 2 ha), around one-third of fertiliser subsidies were misallocated in 2015 and largely benefited the largest farms (OECD, 2016a). In addition to economic inefficiency, such subsidies encourage wasteful use and pollution. Field studies in Lombok indicate fertiliser consumption above optimal levels (MoF and GIZ, 2017). The government plans to reform the subsidy, potentially using a smart card to better target the subsidy to small farmers.

Figure 2.9. Support to farmers has grown significantly



Notes: PSE = producer support estimates; GFR = gross farm receipts.
Source: Country submission; OECD (2018), "Producer and Consumer Support Estimates", *OECD Agricultural Statistics* (database, 2018 and 2017 editions).

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An alternative, more efficient way to support farmers' income could be to provide vouchers that farmers then use for the type and quantity of inputs they want. More generally, a larger share of support should be allocated to general services, such as training and extension services; this share is relatively low in Indonesia (5.2% of total support in 2013-15) and mostly benefits infrastructure development (84%) rather than agricultural innovation (7%)

and knowledge transfer (4%) (OECD, 2018f). In addition, public financial support to industrial plantations (notably oil palm) and forest plantations should be redirected towards income support or environmental sustainability objectives, including ecosystem restoration (Chapter 3).

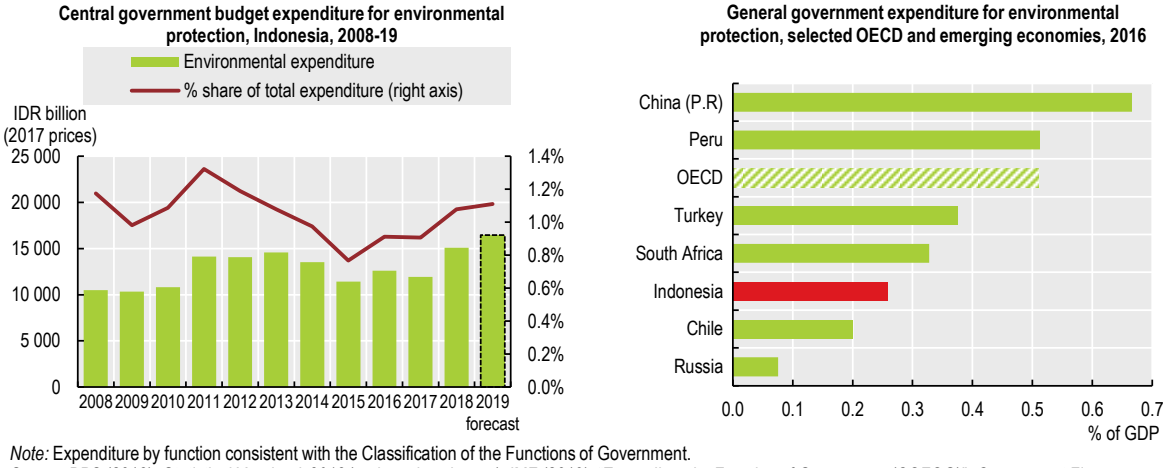
2.5. Investing in the environment to promote green growth

2.5.1. Public environmental expenditure

Budget allocation to the environment

Until 2015, central government budget expenditure for the environment was on a declining trend. However, the 2018 budget raised the share to 1.1% – an absolute increase of 30% from 2017 (Figure 2.10). A breakdown of environmental expenditure in Indonesia is not available, but it includes waste and wastewater management, pollution control and natural resource conservation. The budget allocation to the MoEF has continued on a declining trend, from 1% of the total budget in 2013 to 0.8% in 2017 (GoI, 2018).[14] Subnational environmental spending varies widely, from less than 0.1% of the provincial 2017 budget in West Java to more than 2% in Jakarta and South Kalimantan (MoF, 2017).

Figure 2.10. Environmental expenditure is set to rise



Note: Expenditure by function consistent with the Classification of the Functions of Government.
Source: BPS (2018), *Statistical Yearbook 2018* (and previous issues); IMF (2019), "Expenditure by Function of Government (COFOG)", *Government Finance Statistics* (GFS) (database); MoF (2019), *Nota Keuangan beserta RAPBN 2019*.

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Green planning and budgeting

Indonesia has made major steps in tracking public finance related to climate change and is working to establish broader mechanisms to track investment promoting green growth. The 2012 Mitigation Fiscal Framework, developed by the Ministry of Finance, provided a first assessment of public finance used for climate change mitigation action. It found that 0.9% of the central government budget was invested in such action in 2012. While this represents an increase from 2008, when 0.3% was spent, maintaining that level of financing in real terms would mean Indonesia reaching just 15% of its 2020 mitigation target (MoF, 2014). Domestic climate finance is allocated almost entirely through the central government and through budget expenditure rather than grants, loans or revolving funds (CPI, 2014). A 2018 presidential decree established the Environmental Management Fund Agency to

channel funds for environmental purposes, including international grants and revenue from carbon trading mechanisms.

In 2014, the Ministry of Finance launched the Green Planning and Budgeting Strategy to identify the "green economy gap" and develop scenarios on how to fill it, using both public and private resources. The strategy identified 21 priorities for green economic growth, including forest, peatland and coral protection. If fully met, the priorities could prevent most loss and damage from natural resource depletion and climate change. Analysis conducted under the strategy found that public green economy investment remained relatively stable at around 1% of central government expenditure in 2011-14 (MoF, 2015a). This compares to 29% for fossil-fuel consumption subsidies in the same period (although that share dropped to below 10% in 2016; see Figure 2.6). To maintain strong GDP growth of around 7% a year in a green economy scenario (one in which losses and damage from natural resource degradation would be avoided), public expenditure on green economy investment would need to rise to 3.8% by 2025 (MoF, 2015a).

In 2015, the government introduced a climate mitigation tagging system. Activities with climate mitigation purposes were tracked in six key ministries for the 2016 and 2017 state budgets; activities for climate change adaptation were tagged in 2017. The resulting data showed that state budget support to climate change increased from IDR 72 trillion (USD 5.4 billion), or 3.5% of the state budget, in 2016 to IDR 121 trillion (USD 8.5 billion), or 5.4% of the state budget, in 2018 (MoF, 2019). Of the 2018 budget share, 60% targeted mitigation and 40% adaptation. Allocations were highest for the Ministry of Public Works and Housing and the Ministry of Transport; the ministries that are expected to achieve the largest GHG emission reductions (the MoEF and the Ministry of Energy and Mineral Resources) received relatively small allocations. The experience gained from climate tagging should be assessed to inform extension to other areas of the green economy, including "traditional" environmental protection programmes. The planned expansion of budget tagging to subnational levels will yield useful information about local climate investment and could help identify and address potential bottlenecks in access to finance at the local level.

2.5.2. Greening the financial sector

Private investors will have to play a key role in meeting Indonesia's green economy investment needs, in terms of both increased finance for green infrastructure and better integration of climate and other sustainability factors into finance and investment in general. To date, there has very little private green financing in Indonesia. Only 1.2% of total bank lending was considered green, according to a Bank Indonesia survey of 29 banks in 2012; the share was still considered negligible in 2015 (MoF, 2015a; Volz et al., 2015). This has been related to lack of demand for green credit (which is linked to low energy prices and weak enforcement of environmental standards) as well as lack of supply and capacity constraints in the financial sector (e.g. lack of experience with green lending and limited capacity to assess associated risk).

The Financial Services Authority (OJK)[15] has taken steps to enhance the financial sector's engagement in sustainable growth. It developed a Roadmap for Sustainable Finance, set up a national network of climate finance experts (an inter-ministerial working group), joined the Sustainable Banking Network and published guidebooks on sustainable finance for the industry. In 2017, as part of the roadmap, OJK issued a regulation on Application of Sustainable Finance for Financial Services Institutions, Issuer Companies and Public Companies, making Indonesia one of the first countries to have a regulation on sustainable

finance. It outlines sustainable finance principles and obliges financial institutions to develop a sustainable finance programme and formally report on it to OJK through annual business plans, in addition to publishing public sustainability reports. The aim is to encourage lenders to assess potential borrowers based not only on financial but also social and environmental sustainability standards. The requirement will be rolled out gradually, starting with larger banks in 2019. Sanctions for non-compliance are administrative in nature (written warnings and compliance orders). Continued capacity building will be needed to enhance the understanding and practical application of sustainable finance principles among regulated institutions. As a next step, Indonesia could consider restricting access to finance for businesses that operate without, or do not comply with, an environmental permit. This would be a powerful tool to enhance environmental law enforcement.

In February 2018, Indonesia launched its first green bonds. The five-year "green *sukuk*" bonds (i.e. they comply with Islamic finance norms) are worth IDR 16.7 trillion (USD 1.25 billion). Cicero, a leading global provider of green bond assessments, rated the issue medium green – the second highest on a four-point scale. A 2017 OJK regulation stipulates that at least 70% of the proceeds from any green bond issue must be used to finance environment-friendly projects. The government intends to use all the proceeds of the 2018 issue to finance climate change mitigation and adaption activities, but stated that future issues could consider broader environmental projects, including on biodiversity and forest conservation. Indonesia has pledged to publish independently audited annual reports on the spending and impact of its bonds (Allen, 2018).

Public support measures such as specific credit lines and soft loans with technical support can help shift the risk-return relationship for commercial investors, making investment more attractive to them. Blended finance[16] is gaining attention as a mechanism to attract private sector resources, both internationally and in Indonesia. In 2016, Indonesia launched the Tropical Landscapes Finance Facility to leverage private and long-term finance to projects and companies that stimulate green growth and improve rural livelihoods (Box 2.4). Blended finance has also been used to finance the mass rapid transit system in Jakarta. Both initiatives will provide lessons on using development finance and other public resources to attract private finance, thus informing the eventual establishment of similar mechanisms for other green sectors where investment risk is considered high (e.g. renewables, water and sanitation).

Box 2.4. The Tropical Landscapes Finance Facility

The Tropical Landscapes Finance Facility (TLFF), launched in 2016, uses public funding to unlock private finance for sustainable land use, including in agriculture and ecosystem restoration, and for investment in renewables. The TLFF co-ordinates between government, the private sector and communities to foster positive change on a broad scale. Investment opportunities are impact focused and seek to involve marginalised communities as active partners. The TLFF consists of a loan fund and a grant fund. BNP Paribas and ADM Capital act as fund managers while the United Nations Environment Programme manages the secretariat. The inaugural deal, closed in early 2018, is a USD 95 million bond supporting socially inclusive, climate-friendly production of natural rubber. It is Asia's first corporate sustainability bond.

Source: TLFF, 2018.

2.5.3. Investment in environment-related infrastructure

Indonesia has wide infrastructure gaps that hamper economic and social development. The World Economic Forum's Global Competitiveness Report (WEF, 2017) cited inadequate infrastructure as a key problem in doing business (along with corruption, inefficient bureaucracy and restricted access to financing). At the same time, Indonesia's ranking with regard to infrastructure improved from 90 in 2010 to 52 in 2018, out of 138 countries. Years of underinvestment have led to an estimated infrastructure deficit of USD 1.5 trillion (World Bank, 2017b), constraining growth, limiting the pace of poverty reduction and contributing to environmental pressures.

Recognising the challenge, the government targeted additional investment (private and public) to the transport, water, energy and other key sectors, amounting to USD 415 billion over 2015-19 (equivalent to 7% of GDP per year). The increase was in part made possible by the dramatic reduction in public spending on fossil-fuel subsidies (Section 2.4.1). Due to the long lifespan of infrastructure, failure to invest in the right type of infrastructure in the next 10 to 15 years would lock Indonesia into a GHG-intensive development pathway and risk stranding many assets (OECD, 2017a).

The private sector needs to play a bigger role in filling the infrastructure gap. Infrastructure investment largely relies on public finance, with the government accounting for 55% of total infrastructure investment in 2015 and state-owned enterprises (SOEs) most of the rest. The private sector contribution is relatively small, having declined to 9% over 2011-15. The government has strongly emphasised improving the business climate and some progress has been made. A pipeline of projects was developed, on the public-private partnership model, though the complex legal landscape for the model resulted in delays and cancellation of some projects. Steps are being taken to simplify burdensome land acquisition processes, a major deterrent for private investors. Improving the transparency and efficiency of SOEs, which crowd out private capital in some sectors, would further help in mobilising private investment, as would reducing foreign investment restrictions and deepening local banking and capital markets (OECD, 2018a; World Bank, 2017b).

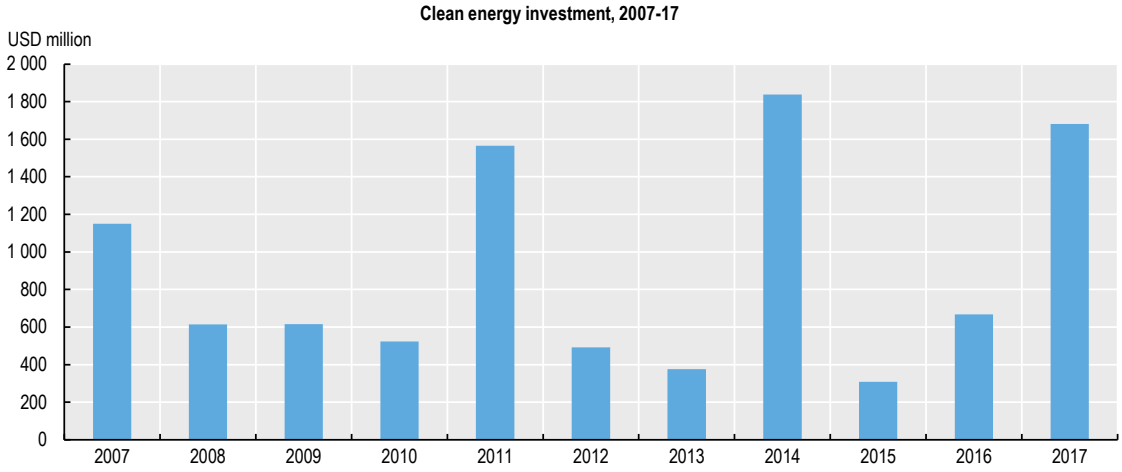
Investment in clean energy

Investment in renewables reached USD 1.6 billion in 2017 (Figure 2.11). This falls short of the estimated USD 15 billion a year needed to meet the target of sourcing at least 23% of energy supply from renewables by 2025 (IESR, 2017). Most renewables investment is channelled to geothermal energy and, to a lesser extent, biofuels – areas in which Indonesia is positioning itself as a global leader. Investment in wind and solar energy has been sluggish (REN21, 2018). Overall, investment in the energy sector remains heavily tilted towards fossil fuels. The government expected just 5% of total energy sector investment in 2018 to target renewables, with the majority going to the electricity sector (33%) as well as oil, gas and coal (62%) (*The Jakarta Post*, 2018c).

Various government incentives to attract clean energy investment have not led to new investment as hoped. The measures include feed-in tariffs (FiTs) for renewable electricity, ambitious biofuel blending mandates, fixed tax incentives such as income tax rebates, accelerated depreciation, exclusions from VAT and import duties, and the establishment of the 2009 Clean Technology Fund and 2017 Geothermal Fund. Weak political commitment, frequent policy changes and patchy implementation of government policy by PLN (which has a monopoly on electricity distribution) make renewables investment a risky undertaking, raising financing costs and thus reducing the economic viability of individual projects. Regulatory barriers such as slow land acquisition and permitting processes have

further undermined investor confidence. Foreign equity restrictions and local content requirements raise projects costs, especially as local manufacturing industries (e.g. for solar PV) are relatively small (IISD, 2018; IRENA, 2017).

Figure 2.11. Investment in clean energy needs to accelerate to meet the 23% target



Source: BNEF (2018), *Climate Scope 2018*.

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Power sector

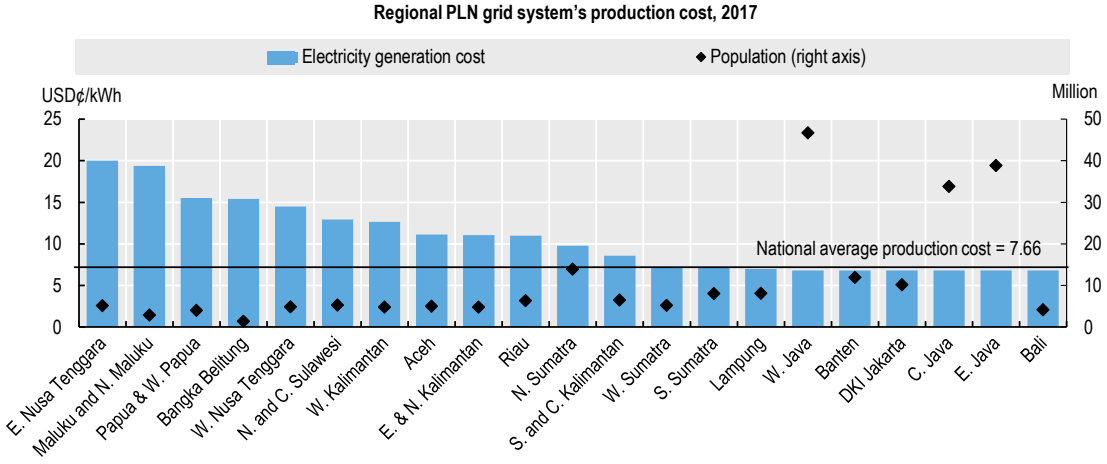
In the power sector, it has been challenging to find the right balance between offering attractive prices for independent power producers (IPPs) to generate renewable power to PLN, on the one hand, and achieving cost recovery for PLN, on the other. In 2013, Indonesia began providing FiTs to IPPs generating power with renewables. However, the underlying regulations did not establish a clear mechanism enabling PLN to recover the additional cost resulting from the higher prices IPPs charged. PLN, which is heavily indebted and considered at risk of default, was thus reluctant to buy renewable electricity from IPPs under FiTs. In 2017, PLN requested a subsidy to offer higher FiTs, but the parliament did not approve it (IISD, 2018).

A new regulation, No. 12/2017, replaced FiTs with a system linking tariffs to local electricity generation costs, which vary widely across the country (Figure 2.12). The objective was to lower PLN's financial burden by making payments reflect costs better while avoiding subsidies. The regulation provides for prices paid to IPPs to be capped at 85% of the regional average production cost if that cost is higher than the national average production cost. Where it is equal to or lower than the national average, the price is determined by agreement between the project owner and PLN. In the first scenario, renewables development would reduce the average production cost, giving PLN an incentive to issue tenders for renewables projects and sign renewables purchasing power agreements. It was hoped that this would encourage renewables development, especially in Eastern Indonesia, where production costs are highest. However, in most cases, especially in areas where most of the population and economic activity concentrate (e.g. Java and Bali), the regulation establishes ceiling prices that are too low to allow renewables projects to compete with (subsidised) fossil-fuel sources. Overall, it limits the profitability of renewables projects and incentives to invest in them.

If Indonesia is to reach its goal of 23% renewables by 2025, a step change in investment is required. Relying on PLN's ability to deliver new renewables capacity is risky, given its fiscal constraints. Profitability under the new tariff regime is questionable. Stronger policy action is needed to make renewables competitive with fossil fuels. Bringing down capital costs for renewables projects (which often are capital intense) should be a priority. Specific support programmes, such as guarantees from the government or multilateral development banks, could help reduce risk premiums resulting from regulatory uncertainty (following a dozen changes in 2017) and offtake risks.

Strong political commitment and a transparent, achievable plan for renewables development could help reduce regulatory uncertainty. Reverse auctions, a mechanism used in several emerging markets, can be an effective way to develop large renewables projects at low cost. Local content requirements and foreign equity restrictions should be revised. To level the playing field, subsidies to fossil-fuel production need to be phased out. Continuing to increase consumer tariffs to cost-recovery levels would bring PLN capital to upgrade infrastructure while improving energy efficiency incentives. Off-grid renewables should be promoted in rural areas, as these are likely to be cheaper for consumers than other options (notably diesel).

Figure 2.12. Renewables are not competitive in the most populated areas



Note: Exchange rate assumption: IDR 13 307/USD. Many provinces have several electricity grids with different average generation costs. For reasons of simplification this figure presents average costs in the province or region as a whole.
Source: MoEMR (2018), Ministerial Decree Nr. 1772 K/20/MEM/2018; BPS (2018), "Population Projection by Province, 2010-2035", *Statistics Indonesia* (database).

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Biofuels

Indonesia places a strong focus on development of biofuels. These are expected to account for a quarter of renewables by 2025 under the 23% target. The country introduced ambitious blending requirements in 2008 (revised in 2013 and 2015) not only in transport but also in the industrial/commercial and power sectors. It is among the first countries to have a mandatory blending mandate for aviation fuel. The biodiesel targets are particularly ambitious, with a 30% blending mandate in 2025 (Table 2.3). In September 2018, the government began requiring all vehicles to use fuel with 20% biodiesel content (previously the blending mandate applied to subsidised transport fuels only). The intent was to reduce petroleum imports, which were increasing the current account deficit, and to cut GHG emissions.

Concerns about supply sustainability are a challenge to the biofuel blending targets. About 90% of the biodiesel used comes from palm oil, whose production is associated with deforestation, peatland drainage and forest fires (Chapter 3). Yield improvement and use of degraded lands alone might not be enough to meet the targets. As biofuel prices are higher than the base fuel price, the government created the Oil Palm Estate Fund to redistribute revenue from a palm oil export levy[17] to a biofuel subsidy (IRENA, 2017).

Table 2.3. Indonesia has ambitious biofuel mandates

	2015	2016	2020	2025
Biodiesel				
Transport, industry/commerce, small business, fisheries, agriculture, public services	15%	20%	30%	30%
Power sector	25%	30%	30%	30%
Bioethanol				
Transport, industry/commerce	2%	5%	10%	20%
Small business, fisheries, agriculture, public transport, public services	1%	5%	10%	20%

Source: BNEF, 2017.

Geothermal

Indonesia has the world's largest geothermal resource, much of it untapped. To promote development of geothermal energy, the government established the Geothermal Fund with USD 145 million to support early-stage resource exploration. Approvals from the fund for exploration or projects have been limited to date (IRENA, 2017). Indonesia has also used financial instruments from multilateral actors, such as the World Bank and Asian Development Bank, and from bilateral institutions to enhance geothermal project implementation. A geothermal law enacted in 2014 removed the "mining activity" label from geothermal exploration drilling, enabling it in protected forest areas (where most geothermal resources are located), and provided for expedited permitting. Stringent EIA should be ensured to minimise the ecosystem and other environmental impact. Enhancing data on geothermal resources and transparency about drilling attempts and successes could help attract investors to participate in auctions.

Investment in energy efficiency

Only 16% of Indonesian energy use was covered by mandatory energy efficiency policies, such as performance standards or labelling, in 2016 (compared to 31.5% of global energy use) (IEA, 2017). There is scope to extend energy efficiency policy and make existing policies more stringent and effective. One of the most important policies requires industrial companies to implement energy management programmes and report their energy consumption. However, compliance is not yet comprehensive. Minimum energy performance standards have been introduced for lighting, appliances and buildings, but the lack of penalties for non-compliance with these standards (or labelling regulations) reduces their effectiveness. Some of the standards, such as for air conditioners, are too low to have a substantial effect on the market.

The economic and environmental benefits of energy efficiency are substantial. The IEA (2017) estimates that meeting the government target of reducing energy intensity by 1% per year to 2025 would avoid the equivalent of 20 coal-fired power stations (or investment worth USD 10 billion) as well as GHG emissions of 341 Mt CO_2 eq between 2017 and

2025, and there remains scope for greater savings. Opportunities exist in cooling (given the rapid demand growth for space cooling), lighting and transport (via electric motorcycles and vehicle fuel efficiency standards). If fuel efficiency standards for trucks, which account for 40% of road transport energy use, were introduced at a level that improved efficiency at the same rate as in China, USD 630 million in oil imports could be avoided in 2030 alone (IEA, 2017). Efforts also need to continue to enhance improving compliance with existing industry policies. Finally, cost-reflective electricity pricing would encourage energy savings. Burke and Kurniawati (2018) estimated, for instance, that the electricity subsidy reform in 2013-15 induced electricity savings of around 7% per year.

Investment in sustainable transport

Limited connectivity among islands, the absence of major transport corridors on the main islands (including Java) and poor road quality constrain the movement of goods and people across the archipelago. Traffic congestion in major cities is notorious, deterring investment. Nationwide, it has been estimated that logistical costs account for 24% of GDP (PwC, 2016). Addressing these challenges is a government priority. Investment in the transport sector increased by USD 20 billion in 2014, to about one-third of total infrastructure spending, and is projected to increase by USD 40 billion by 2025 (PwC, 2016). Roads and ports will continue to be the largest subsector by investment value, although growth is also planned for public transport, air and rail (Table 2.4).

Table 2.4. Transport infrastructure investment focuses on roads and ports

Planned transport infrastructure investment, 2015-19

Sector		USD billion over 2015-19
Road	3 650 km of new roads (including 1 000 km of toll roads)	67.9
Road – public transport	Bus rapid transit and mass rapid transit in 29 cities	19.4
Rail	3 258 km of new railway (2 159 km intercity and 1 099 km urban)	23.9
Marine	Expansion or construction of 24 container ports	81.0
Air	Maintenance of existing airports and construction of new airports and air traffic control facilities	13.9

Source: PwC, 2016.

Several major public transport projects are under development, such as the Transjakarta Busway and a train connecting the airport to the city. Countrywide, the government aims to establish bus rapid transit systems in 29 cities and mass rapid transit systems in 6 metropolitan areas and 17 cities (OBG, 2018). The development of better urban public transport will help reduce congestion, improve air quality and provide inclusive access to opportunities.

Electrification of motorcycles, the leading form of passenger transport in Indonesia, bears significant potential to improve efficiency (and reduce GHG and air pollutant emissions). If the penetration of electric two-wheelers were boosted to match the current level in China, Indonesia would avoid USD 800 million worth of oil imports in 2030, compared with current projections (IEA, 2017). However, investment in electrification has been modest to date. The government envisions 2.1 million electric motorcycles on the streets by 2025, as well as 2 200 electric or hybrid cars (as mandated in Presidential Regulation No. 22/2017), but there is no direct support to electric vehicles. The tax burden on these vehicles (which are imported) is high, meaning their retail price in Indonesia can be a multiple of the price

in the US or European market (Section 2.3.3). The lack of a regulatory framework and supporting infrastructure (e.g. public charging stations) is holding back the potential for both two- and four-wheeled electric vehicles (IRENA, 2017). A presidential decree on electric vehicles is under development to address this.

Investment in urban water supply

After decades of underinvestment, the water and sanitation sector is characterised by low access rates and poor service quality (Chapter 1). The resulting costs for human health and the environment (notably in the form of freshwater pollution) were estimated at more than 2% of GDP in 2005 (World Bank, 2009). The government has set an ambitious target of 100% access to safe drinking water and sanitation facilities by 2019. Meeting it requires investment of the order of USD 42 billion (PwC, 2016). This would necessitate step change in investment at all levels. The target was revised to achieving 90% access to improved sanitation (including 20% safely managed sanitation) by 2024 (Chapter 1).

Investment capacity of local government-owned water utilities (*perusahaan daerah air minum*, or PDAMs), which are responsible for water supply in urban areas, is very limited, as many are not financially viable (ADB, 2016). While government initiatives and development co-operation helped improve performance of PDAMs over the past decade, many still lack capacity in operation and financial management. Water tariffs, set by local governments, are generally too low to recover the cost of service provision, let alone to finance new investment. The Ministry of Home Affairs has issued guidelines on setting tariffs aimed at achieving full cost recovery,[18] but many local governments do not follow them. As a consequence, PDAMs have been reluctant to expand their services, particularly to the poor (who pay subsidised rates), leaving them dependent on alternative sources such as bottled water and small providers, often at higher unit prices (Hadipuro, 2010). This contributes to significant plastic waste generation and depletion of groundwater sources (Chapter 1). District governments tend to spend relatively small amounts (about 1% to 2% of their budget) on water and sanitation, leaving the central government as the main fallback to keep services running (ADB, 2016).

A possible way forward could be strengthening cost-recovery mechanisms for water provision. Increasing user fees for those who can afford to pay would help make PDAMs commercial and financially robust, while encouraging consumers to use water more efficiently. Targeted cross-subsidies could ensure service provision for users who would otherwise be unable to afford it (ADB, 2016). A prerequisite would be to enhance PDAMs' operational efficiency, which is now low. Connected households experience frequent interruptions and unstable water pressure. Water losses reach as much as 50% in some cities (e.g. Bandung) due to leaks from outdated pipe networks, inadequate metering devices and water larceny (OECD, 2016b). Under such circumstances, users are unlikely to be willing to pay for water supply. Expansion of piped water supply should be prioritised in areas where alternatives (e.g. small wells) put pressure on groundwater resources (Chapter 1). Enhancing upstream ecosystems could also be a cost-effective way to improve urban water supplies, as it often requires less upfront finance. In rural areas, development of decentralised community-based solutions could be more efficient than centralised water supply networks.

Investment in waste management

Municipal solid waste (MSW) management is severely underfunded. The main finance sources are the waste collection fee and budget allocations. The fee is low and often little

enforced. On average, it covers 28% of total waste management costs (Munawar and Fellner, 2013). Local government budget allocations for MSW management are small at USD 5-6 per capita per year, while the international benchmark is USD 15-20 (World Bank, 2018b).

The waste collection fee does not take into account the quantity of waste produced and hence does not encourage waste reduction. The Ministry of Finance is considering moving towards a volume- or weight-based charge. However, without better law enforcement and social norms, the introduction of "pay-as-you-throw" charges for households could lead to more illegal dumping. Landfill fees for commercial institutions apply in some areas, such as Jakarta, but the prevalence of illegal dump sites undercuts the landfills' capacity to charge adequate fees. An alternative to pricing disposal would be to impose fees upfront on production or consumption.

China's 2018 import ban on certain waste products is expected to increase waste flows to Indonesia, creating an urgent need to push domestic recycling capacity. There has been no major initiative on developing an institutional framework or financial mechanisms for a recycling industry (UNEP, 2017). Setting up extended producer responsibility programmes could encourage separate waste collection and recycling while also being a good source of funding and trigger for investment in the sector (Chapter 1). Private-sector involvement in recycling and final disposal facilities is limited. Weak local government capacity translates to a lack of confidence and unreasonably high risk for the private sector, while local content requirements make it difficult for foreign investors to engage (World Bank, 2018b). Government procurement policy could help create demand for recycled content.

2.6. Eco-innovation and green markets

2.6.1. Eco-innovation

Indonesia's general innovation performance appears weak compared with other Southeast Asian countries and with India and China. Gross expenditure on research and development (R&D) was 0.08% of GDP in 2012, the lowest value among G20 economies. Numbers of patent applications and scientific and technical publications are relatively small, albeit increasing. Most R&D is performed by public research organisations, and links with businesses are limited.

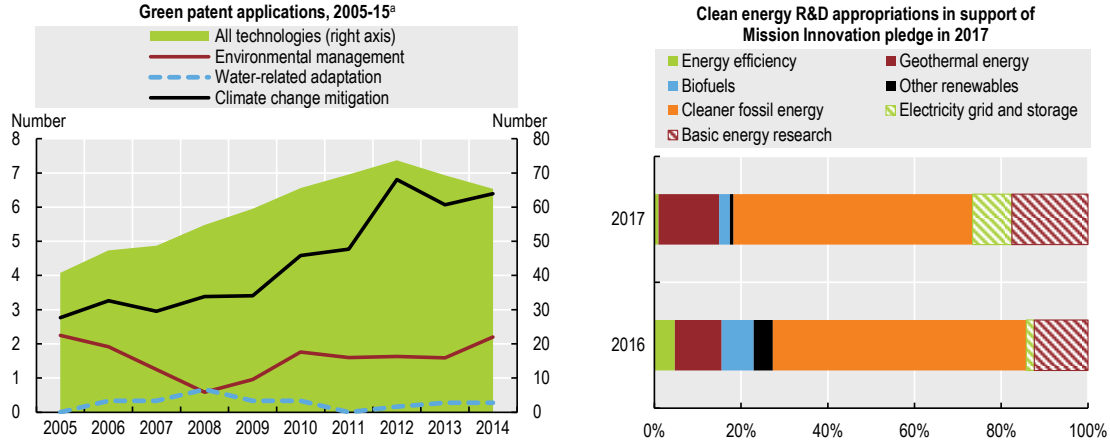
Environment-related technology accounted for 11% of all patents filed in Indonesia in 2012-14. This is similar to the OECD average, but comparison is difficult due to the small overall number of patent applications in Indonesia. On a per capita basis, 0.02 environment-related patents were filed in Indonesia, compared to 0.3 in Brazil and India, 0.9 in China, or 19 in the OECD (OECD, 2018g). The number of patent applications for climate change mitigation technology had increased slightly since 2005 while patenting activity in other environment-related fields remained low (Figure 2.13).

The government has begun putting more emphasis on policies designed to stimulate innovation-led growth. In 2016, it launched the Indonesian Science Fund, the country's first research funding institution. R&D increasingly includes funding from regional and local governments, as well as the private sector. While Indonesia has no formal strategy or goals for eco-innovation, major innovation initiatives target areas of direct relevance for green growth. For example, four of the eight focus areas of the new science fund are archipelago, marine, and bio-resources; water, food and energy; earth, climate and the universe; and natural disasters and community resilience.

Energy-related R&D has focused largely on oil, gas and coal, with a view to increasing energy supply and security (IEA, 2015). Only 1% of clean energy research is devoted to energy efficiency or non-geothermal renewables (Mission Innovation, 2016). The government plans to keep its focus on developing cleaner fossil-fuel use in the short term and to increase funding on geothermal energy, the electricity grid and basic energy research. As a member of the global Mission Innovation initiative,[19] Indonesia pledged to increase the state R&D budget on clean energy from USD 16.7 million in 2016 to USD 150 million in 2021. Given the key role energy efficiency can play for Indonesia's goals of enhancing security and reducing GHG emissions, greater focus on demand-side R&D would be a good complement to the current focus on the supply side. More technology neutrality in energy R&D funding would help ensure that the most cost-effective technology is pulled into the market (IEA, 2015).

Under Mission Innovation, Indonesia announced the establishment of a Centre of Excellence for Clean Energy to create a hub for data collection and analysis, investment facilitation, and decision-making support. Centres of excellence can be a cost-effective way to train specialists and build capacity for integration of renewables into the grid, as well as operation and maintenance of renewables sites. The government also plans to establish a Centre of Excellence for Carbon Capture and Storage and to increase funding for clean energy R&D through the Energy Resilience Fund (Mission Innovation, 2016).

Figure 2.13. Patenting in green technology is increasing slowly



a) Higher value inventions that have sought protection in at least two jurisdictions (family size: 2 or more). Data are based on patent applications and refer to fractional counts of patents by inventor's country of residence and priority date. Three-year moving average data.
Source: Mission Innovation (2016), *Country Report: Indonesia*; OECD (2018), "Patents in environment-related technologies: Technology development by inventor country", *OECD Environment Statistics* (database).

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2.6.2. Green markets and sustainable businesses

Indonesia's environmental technology market is estimated to be among the world's ten largest (ITA, 2017). The market value increased by 64% over the past decade to reach USD 6.9 billion in 2017 (Figure 2.14). Other estimates suggest that average annual imports of environmental goods reached USD 5 billion and exports USD 2 billion over 2008-13 (ITC, 2014). Indonesia does not collect official statistics on the size of the sector or employment in it.

At the same time, market barriers for environment-related goods and services (EGS) are reported to be "substantial and often insurmountable in the public sector" (ITA, 2017). Environmental regulations have become more stringent, but slow implementation and lack of enforcement limit their effect on demand for EGS. EGS companies attempting to export to Indonesia or work there cite barriers including weak technical capacity to implement advanced environmental systems, poor asset management in public projects, perpetual delays in announced projects, local content requirements, and issues with public tenders including corruption and lack of regulatory implementation and transparency. Use of environmental technology in Indonesia is driven primarily by the private sector and donor organisations (ITA, 2017).

Figure 2.14. The environmental goods and services market is growing

Source: Environmental Business International with OEEI Analysis, 2017, cited in ITA (2017), *2017 Top Markets Report Environmental Technologies.*

StatLink http://dx.doi.org/10.1787/888933931620

Corporate social responsibility and promotion of compliance and green practices

Indonesia is among the few countries to have made corporate social responsibility (CSR) mandatory by law. For example, Law No. 19/2003 obliges SOEs to allocate 2% of net profit to CSR, and Law No. 40/2007 obliges companies carrying out activities in natural resource-based sectors to engage in environmental social responsibility. Voluntary adoption of CSR is largely limited to international and large Indonesian enterprises whose practices have come under increased scrutiny from foreign investors and buyers, pushing many of them to adopt CSR practices and sustainability standards for local operations.

Certifications for the ISO 14001 environmental management system (EMS) standard are rapidly increasing, albeit from a low base. About 2 000 companies had their EMS certified in 2016, twice as many as in 2010. By comparison, Korea had 5 000 certifications in 2016 and Singapore over 1 300 (ISO, 2017). EMS certifications are driven exclusively by export market demand and CSR policies, as companies have little incentive to be certified.

There have been attempts to create sector-specific certification regimes. A 2010 environment ministry regulation on certification criteria for eco-friendly buildings, a 2012 green building regulation of the governor of Jakarta, and a similar 2015 regulation of the Ministry of Public Works (with guidelines on the certification process) aim at promoting green practices in construction. However, the complexity of the green building certification requirements and low environmental awareness of building owners have led to very few Indonesian commercial or residential projects being certified (Dawborn et al., 2017). The Ministry of Industry is developing Green Industry Standards (initially voluntary), a Green Industry Certification Body and a Green Industry Authorization Committee.

The government strives to offer guidance to businesses on good environmental management practices. The MoEF maintains a website providing information on environmental laws and regulations, EIA procedures, cleaner production practices, etc. It established the Indonesian Cleaner Production Centre in 2004 and has produced waste management guidance for several small industries. These efforts are supplemented by the non-government Centre for Resource Efficient and Cleaner Production Indonesia and Centre for Assessment and Development of Green Industry and Environment, which function mostly with international donor support. However, these initiatives have not been sufficient to effectively promote compliance. More efforts are especially needed to reach small and medium-sized enterprises. Compliance promotion among small businesses does not get the attention it deserves from Indonesian environmental authorities.

The Program for Pollution Control, Evaluation and Rating (PROPER) has been the government's attempt to encourage better business practices by ranking companies by performance (Box 2.5). PROPER has been effective in mobilising public opinion to influence environmental behaviour of large industries. PROPER has considerable potential as a compliance promotion programme if it becomes truly complementary to regulatory and enforcement tools. To amplify the public pressure effect of PROPER ratings, the government needs to invest more in consumer environmental awareness, continue to introduce strict green public procurement policies and work with investors and banks to limit access to finance for poorly performing companies.

In 2013, the MoEF and BAPPENAS adopted a ten-year framework programme on sustainable consumption and production (SCP), with three targets: i) the inclusion of SCP in national development planning; ii) asset management and service to stakeholders for SCP implementation; and iii) "quick wins" through thematic programmes such as green public procurement, green industry, green building, green tourism and waste management.

Green public procurement has considerable potential to stimulate demand for and supply of EGS in Indonesia, where public procurement accounts for about 30% of the government budget (WWWF, 2016). The Government Procurement Agency uses environment-related labels (on energy efficiency, logging and chemical use) in purchasing decisions. The MoEF is co-ordinating an inter-ministerial team on preparation of sustainability criteria (including social and workplace health aspects) for public procurement of products and services. Their implementation is expected in 2021-22.

Box 2.5. PROPER mobilises public opinion to change large firms' behaviour

The government established the Program for Pollution Control, Evaluation and Rating in 1995 with support from the World Bank and the US, Canadian and Australian development agencies. It initially covered water pollution only. It collapsed in 1998 with the Asian financial crisis, but was revived in 2002 to cover air pollution and hazardous waste generation as well. As of 2017, it had over 1 800 participating industrial facilities. Participants in PROPER are selected on criteria such as high potential to damage the environment, being listed on the stock market, and producing goods that are either for export or widely used domestically.

PROPER aims to encourage environmental compliance by publishing the results of environmental monitoring. It takes a voluntary approach: companies self-monitor their environmental performance and submit their report to the MoEF. The MoEF evaluates reports and publishes the compliance rating for each company. The rating system grades

factories' environmental performance as gold and green (beyond compliance), blue (compliant), red (not appropriate compliance for some aspects of operation) or black (in breach of standards). Compliance is assessed against regulations on marine pollution, hazardous waste, air pollution, water pollution and EIA. Self-reporting is done through an online platform called SIMPEL. In addition, the MoEF and provincial governments conduct on-site assessment (at 68% of participating facilities in 2017).

The simple colour-coded rating facilitates civil society monitoring of companies' environmental performance. Factories rated gold and green get public recognition, which can help them gain a competitive edge in the market, while public pressure on factories rated blue, red and black should act as a deterrent. Non-compliant (black and red-rated) companies are referred for enforcement action.

PROPER has been effective in mobilising public opinion to influence environmental behaviour of large industries. For example, hazardous waste generation at participating facilities fell by 111% between 2016 and 2017 (though GHG emissions rose by 56%). In 2017, nearly 10% of participating companies were rated gold (1.1%) or green (8.4%). The programme has allowed factories to evaluate abatement costs against the benefits accrued through compliant behaviour. PROPER has also been instrumental in raising awareness of owners, managers and employees about the performance of their factories.

The credibility of the rating process has been questioned since it is largely based on self-assessment. Self-monitoring data supporting the ratings are not publicly disclosed.

Source: MoEF, 2017; WRI, 2017; Andri Gunawan Wibisana, 2017.

2.7. Environment, trade and development

2.7.1. Development co-operation

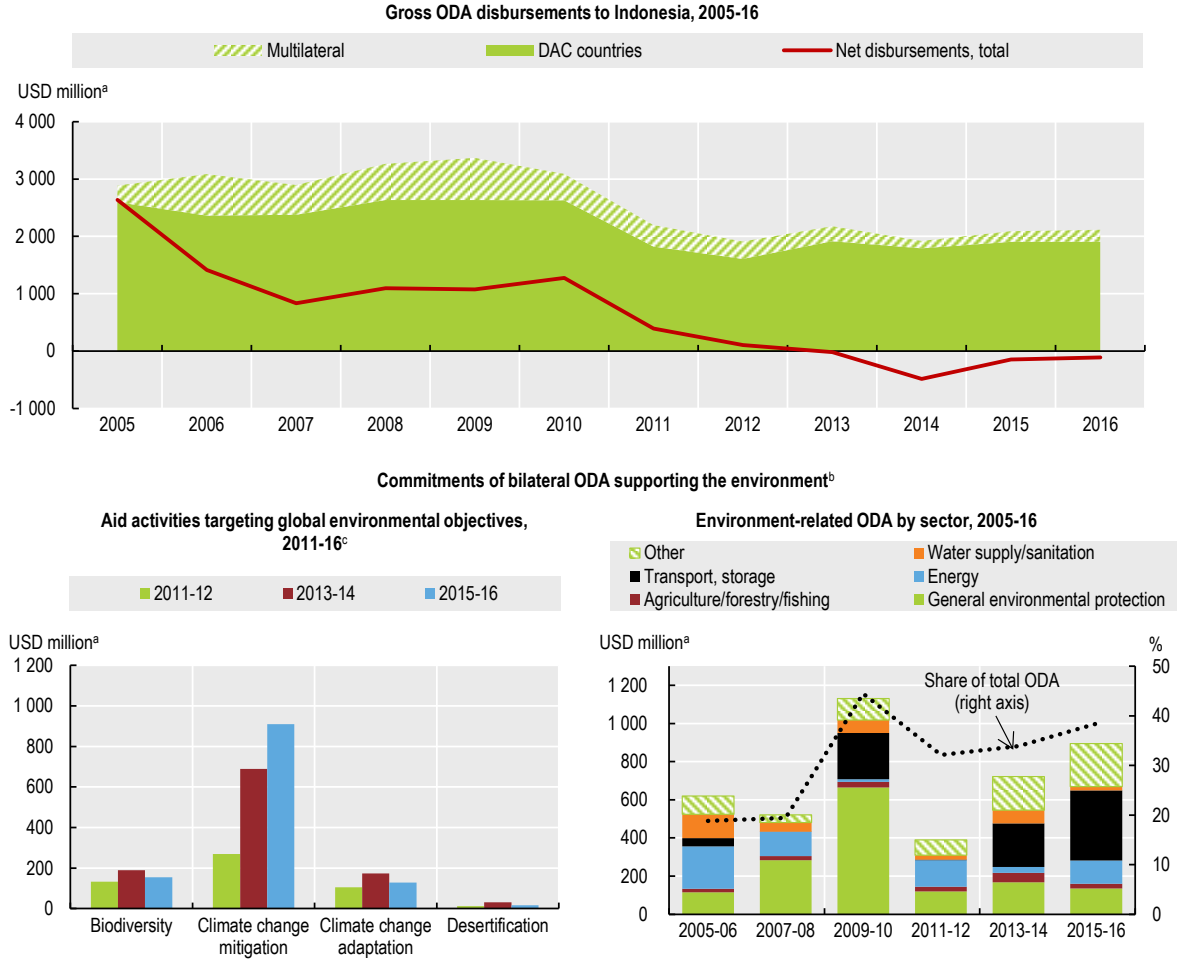
Indonesia remains among the ten largest official development assistance (ODA) recipients worldwide, though ODA has decreased since the mid-2000s. ODA disbursements averaged USD 2.2 billion per year between 2010 and 2016, representing about 0.2% of GDP. Roughly half of ODA takes the form of concessional loans. Loan repayment has started to exceed new aid commitments, bringing net disbursements to negative levels in 2014-16 (Figure 2.15). Indonesia also receives significant amounts from countries that are not members of the OECD Development Assistance Committee, for which data are not available. Development finance disbursed by Indonesia reached USD 56 million in 2014, which is of the order of Chile's and Colombia's development co-operation (OECD, 2017c).

Commitments of bilateral ODA to Indonesia targeting climate change mitigation have significantly increased since 2011 (Figure 2.15). The increase was largely driven by infrastructure projects, including the Jakarta mass rapid transit system. ODA to general environmental protection, agriculture, and water and sanitation has declined, however. Overall, close to half of total ODA commitments to Indonesia were tagged as contributing to environmental objectives in recent years, most of which were from Japan, Germany and Australia (OECD, 2018h). Indonesia increasingly uses ODA to mobilise private resources for green growth. One important Indonesian blended finance collective investment vehicle is the TLFF, with a target size of USD 1 billion (Box 2.4).

In 2010, Indonesia launched its first climate finance institution, the Indonesia Climate Change Trust Fund (ICCTF). The fund was an important instrument to pool resources and

promote coherence in climate finance planning, as Indonesia lacks an overarching donor co-ordination mechanism. It attracted funding from international donors in the first few years of operation, but further fund-raising success was limited. Nevertheless, 76 mitigation projects have been financed through the ICCTF since 2010. These projects reduced GHG emissions by 9 Mt CO_2 eq at the relatively low cost of USD 1.5/t CO_2. The ICCTF was merged with the REDD+ Fund in 2015. In 2010, Norway pledged to support Indonesia with USD 1 billion if it reduced emissions from deforestation and forest degradation. So far, 13% of this amount has been disbursed for policy milestones and support to preparatory work. Indonesia is preparing a funding mechanism that can receive climate finance from Norway and other international partners when results are forthcoming (Chapter 3). These efforts should be given priority.

Figure 2.15. Climate-related ODA has increased in the energy and transport sectors



a) At 2016 prices.
b) Data refer to activities that have been marked with at least one of the environment and/or Rio policy markers. They include activities where the environment, climate change mitigation, climate change adaptation, biodiversity and/or desertification is an explicit objective of the activity and fundamental in its design, and activities where one or more of these is an important, but secondary, objective of the activity.The marker data do not allow exact quantification of amounts allocated or spent in support of the environment. They give an indication of such aid flows and describe the extent to which donors address these objectives in their aid programmes. Two-year average data.
c) An activity can target the objective of more than one of the conventions, thus respective ODA flows should not be added.
Source: OECD (2018), *OECD International Development Statistics* (database); OECD calculations.

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2.7.2. Trade and environment

With nearly half of Indonesia's exports coming from natural resource-based activities, trade flows have an important impact on the environment. Most production of palm oil and its derivatives are intended for the export market, making Indonesia the world's largest palm oil exporter. It is also among the world's largest coal producers and exports more than 80% of domestic production (IEA, 2018).

Indonesia has signed and implemented regional trade agreements and is a member of the Association of Southeast Asian Nations (ASEAN). All the trade agreements include an environmental exception modelled on GATT Article XX, specifying that actions "necessary to protect human, animal or plant life or health" are not inconsistent with the trade-related obligations. None includes an environment chapter or provisions on co-operation and participation in environmental matters, unlike more recent North American and European trade agreements (Berger et al., 2017). Indonesia should consider including environmental provisions in future trade agreements, as is proposed in the free trade agreement being negotiated with the European Union. Chile's experience shows that such provisions can help establish long-lasting co-operative projects, strengthen institutional and environmental management capacity and drive reform (OECD, 2016c).

Indonesia has implemented trade and investment restrictions aimed at developing local industry and moving its firms up the value chain. Some of these measures have raised concerns among trading partners. Examples include export restrictions on raw materials and divestment requirements for foreign mining companies, as well as high import duties on certain products (e.g. motor vehicles), local content requirements for energy products (e.g., most recently, solar technology) and restrictions on foreign workers. Such measures impose a heavy burden on imported products and could impede diffusion of environmental services and technology. Moreover, Indonesia places a 55% limit on the share of equity detained by foreigners in companies providing consulting, engineering and construction services (Sauvage and Timiliotis, 2017). As such services are important inputs to environmental projects, the limit could hamper project development in renewables, waste processing, and water and sanitation. The measures should be revised to avoid disturbing diffusion of low-emission technology not supplied domestically.

As a member of the Asia-Pacific Economic Cooperation alliance, Indonesia pledged to cut most-favoured nation applied tariffs to 5% or less by 2015 on environment-friendly goods in 54 product categories. It did not completely make the deadline, with a dozen tariff lines or specific products not yet in compliance, but did lower some tariffs in 2017 and announced it would reduce remaining tariffs gradually to 2021 (ICTSD, 2016).

Wildlife trade

Indonesia is a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As major exporter of species listed in CITES, it has put in place several measures to control wildlife trade. All non-protected species native to Indonesia, whether listed on CITES or not, are regulated by harvest and export quotas, although monitoring and enforcement are challenging (Kimbrough, 2012). National statistics indicate the value of wild animal and plant exports reached IDR 8.3 trillion (USD 620 million) in 2017, up 26% from 2016.

Indonesia is one of the transit centres of illegal wildlife trafficking. This problem has reached such magnitude that trafficking is arguably among the biggest pressures on biodiversity in the country, along with deforestation and peatland loss (Chapter 3). The

Wildlife Conservation Society estimates that the volume of illegal wildlife trade quadrupled between 2010 and 2017 to IDR 13 trillion (USD 1.2 billion) per year (Gokkon, 2018). The government is committed to strengthening law enforcement to combat wildlife crime.

Indonesia is a source country for the growing international market, but also home to a huge domestic market, in particular for songbirds. Bird trading contributes an estimated USD 80 million to the economy annually (Berton Harris et al., 2015).[20] A significant part of this market involves illegal and unsustainable trade in species that have been illegally harvested and/or are protected by law. In Jakarta, a known hotspot for illegal bird trade, a 2015 survey found that 98% of birds traded in the three largest bird markets were native to Indonesia and harvested outside the national harvest quota system or in direct violation of the 1990 Conservation Law (Chng et al., 2015). It is illegal to hunt birds in the wild and sell them as pets, but monitoring and law enforcement in markets remain a challenge.

Indonesia is also a major exporter of coral and shark fin. Shark finning – the practice of slicing live sharks' fins off and dumping the fish back in the ocean – is illegal but nonetheless widespread. A quota system has been introduced to ensure sustainable use of coral, but several practices (e.g. purposefully misidentifying coral, marking wild-collected coral as aquacultured) undermine sustainable collection. Indonesia plans to end exports of wild coral and switch to 100% export of verifiable cultured coral by 2020.

The government should re-examine its threatened species list to ensure that species in decline because of trade are legally protected. Given the immense size of the market, law enforcement should gradually be strengthened by focusing on priority species first. Partnering with civil society organisations and using social media could facilitate monitoring of the largest markets. Better surveillance and enforcement, but also continued efforts to raise awareness among citizens, will be important in combatting illegal trading of threatened wildlife species. Efforts are also needed to develop a traceability system for legal wildlife trade from wild species and species from captive breeding and ranching (OECD, 2019). A positive development is that 248 wildlife enforcement operations were carried out in 2015-18, leading to 191 criminal cases being brought to court. The MoEF has established a science and technology-based national intelligence centre and three regional centres to support the fight against wildlife trafficking.

Box 2.6. Recommendations on green growth

Framework

- Fully follow through with SEA of the 2020-24 RPJMN. Implement the System of Environmental-Economic Accounting Central Framework to properly value the country's natural capital in economic planning at the national and subnational levels.

Getting prices right

- Make better use of environmentally related taxes and charges with a view to better applying the polluter-pays principle. Consider establishing a dedicated commission to develop options and pathways for comprehensive green fiscal reform. Items for reform include:
  - Moving towards cost-reflective energy pricing (bringing the implicit price of carbon to positive levels) by continuing to phase out fossil-fuel subsidies, while gradually raising the regional fuel tax and expanding energy/carbon taxation to non-road sectors such as industry. Regularly adjust fuel prices to global oil prices and continue to better target electricity and LPG subsidies. In the medium term, replace energy subsidies with cash transfers for poor households. Introduce an explicit carbon price, even if initially very low.
  - Align vehicle taxation to environmental performance, for example by linking tax rates to fuel efficiency and the emission of CO_2 and local air pollutants to encourage the purchase of more fuel-efficient and low-emission vehicles.
  - Continue to enhance transparency and law enforcement related to forest concessions as well as mining and fishery permits. Review the structure and rates of royalties, especially in the forestry sector, in order to collect full economic rent on natural resource use. Continue efforts to better enforce water abstraction fees.
  - Introduce the planned plastic bag excise tax. Consider introducing taxes on air pollutants and wastewater discharge.
- Reorient agricultural production support away from market price and direct input support towards productivity and income-enhancing investment (e.g. R&D, education, infrastructure, creation of value added, restoring ecosystem services). Replace fertiliser subsidies with more productive and sustainable support programmes for farmers.

Investment

- Enhance incentives for investment in waste, water and sanitation by gradually increasing user fees to make service providers more independent, commercially and financially robust and capable of funding capital investment. Poor households should be compensated through existing conditional cash transfer programmes or other social protection programmes. Support local institutions in improving service quality (a prerequisite for ensuring citizens' willingness to pay) and enhance enforcement capacity.

- Continue to build capacity among financial institutions to comply with the sustainable finance regulation and to improve their contribution to financing of climate and green economy-related projects. Explore options on how the regulation could be used to promote compliance with environmental law.
- Develop a comprehensive, transparent and achievable plan to scale up renewables, backed by high-level commitment and buy-in from all stakeholders. Remove regulatory barriers and streamline processes for granting permits. Develop mechanisms to reduce the risk premium on finance for renewables (e.g. using guarantees). Work towards a level playing field by phasing out subsidies benefiting coal, oil and natural gas production.
- Increase the stringency of energy performance standards (particularly for air conditioning) and enhance enforcement and compliance with energy efficiency regulations.
- Develop support measures for adoption of electric vehicles, particularly electric motorcycles.

Environment-related goods and services and innovation

- Balance the focus of energy-related R&D budgets under Indonesia's Mission Innovation commitment to adequately support research on renewables and energy efficiency, in addition to cleaner fossil fuels.
- Scale up the Sustainable Consumption and Production programme across ministries; continue to build product certification programmes; consider extending sustainable procurement to smallholders (e.g. those involved in social forestry and agricultural products).
- Reform trade barriers such as local content requirements and foreign equity restrictions, which prohibit Indonesia from adopting modern clean energy technology.
- Continue to fight illegal wildlife trade, prioritising protection of the most endangered species and partnering with civil society to enhance law enforcement.

Notes

[1] Indonesia adopted the SDGs through Presidential Decree No. 59/2017 on Sustainable Development Goals and ratified the Paris Agreement through Law No. 16/2016.

[2] Indonesia has a well-established development planning framework. The long- and medium-term development plans provide the basis for formulating ministries' and government agencies' five year strategic development plans. In Indonesia's highly decentralised governance system, the national development plans are translated into regional and local strategic development plans. The

government prepares annual work plans and budgets, and each ministry and agency at all levels prepares its own work plan and budget.

[3] A feature specific to Indonesia is the existence of four co-ordinating ministries: for economic affairs; maritime affairs; human development and culture; and political, legal and security affairs. The Co-ordinating Ministry for Economic Affairs is responsible for policy planning, co-ordination and harmonisation for industry, trade, finance, agriculture, labour, small and medium-sized enterprises, state-owned enterprises, public works and housing, land use and spatial planning, and environment and forestry. The Co-ordinating Ministry for Maritime Affairs is responsible for co-ordination of energy, mineral resources, transport, tourism and fisheries.

[4] Environmentally related taxes are defined as any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance. This definition implies that a tax is considered environmentally related if it particularly affects the environment, whether this is the policy intention or not. See OECD (2017b) for a detailed discussion of the definition of environmentally related taxes.

[5] The vehicle registration tax is charged at 20% for the first car and 10% for any additional car. The transfer of title tax is 10% for the first ownership change and 1% for any further ownership changes.

[6] In an odd-even licence plate system, cars whose licence plates end in an odd number are only allowed through certain roads and tollgates on odd-numbered dates, etc.

[7] The OECD considers environmentally related taxes levied on tax bases (e.g. products, resources) of environmental relevance. Resource taxes typically include taxes on water abstraction, forest and some raw materials, such as gravel, but exclude taxes on oil and gas extraction. Part of PNBP from natural resources is collected via taxes that would fall under this definition, such as certain forestry levies, but also it also includes revenue collected through mechanisms which do not. As the share of revenue collected through mechanisms that would qualify as environmentally related taxes is unknown, PNBP from natural resources is not considered in the list of environmentally related taxes in Table 2.1.

[8] Mining royalties from non-metallic and rock minerals are levied by local governments directly. They reached about IDR 1.7 trillion in 2016.

[9] The law stipulates that mining companies shall pay a land rent (based on the mining area), royalties (based on the gross sales value) and compensation for access to public services. Royalty rates vary between 2% and 7%, depending on the mineral produced. Coal and mineral contract of works have been renegotiated to align them with the law and associated regulations.

[10] Other non-tax revenue comes from the Forest Estate User Fee, an area-based fee collected from mining and plantation companies holding Forest Estate Temporary Use Licenses; the Commercial Forest Utilization License Fee, an area-based fee collected from holders of most types of commercial forest utilisation licences; and Stumpage Value Replacement, a volume-based fee collected on timber harvested from natural forests through land clearing. Concession holders must also pay a one-time area-based fee at the time the timber concession contract is initially issued.

[11] The DR, introduced in 1989 to collect revenue for reforestation and forest rehabilitation, is a volume-based tax on timber harvested from natural forest. The rates vary from USD 2 to USD 20 per tonne, depending on species, grade of timber and the region where it was harvested. DR revenue can be used only for forest and land rehabilitation (Budi et al., 2012). The PSDH is a volume-based tax on both timber and non-timber products from natural and plantation forests. Rates for timber from natural forests vary between USD 4 to USD 20 per tonne. They are calculated as a percentage (about 10%) of a benchmark price set by the government and differentiated by region of production, commercial grade and tree diameter. Forests under customary management or from privately owned forests, which account for a small share of total forest, are exempt from the DR and the PSDH (KPK, 2015).

[12] Petrol outside the Jamali region (Java, Madura and Bali) continued to receive subsidies to compensate for higher distribution costs.

[13] Indonesian agricultural policy centres on four main objectives: self-sufficiency; affordable prices; diversified production and consumption; and raising both the level of agricultural production competitiveness and value-added processing, and farmers' incomes. Self-sufficiency targets (100% of domestic production) exist for rice, maize and soybeans by 2017 and beef and sugar by 2019.

[14] This includes allocations to both the Ministry of Forestry and the Ministry of Environment before they were merged in 2014.

[15] OJK was established in 2012 to supervise banks, stock brokerages, and financing and insurance companies. Up to 2012, Bank Indonesia supervised the banking sector while the Ministry of Finance oversaw capital markets and insurance firms.

[16] The OECD defines blended finance as "the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries" (OECD, 2018).

[17] Since July 2015, Indonesia has imposed export levies of USD 50 per tonne on crude palm oil (USD 30/tonne on processed palm oil products) when crude palm oil prices fall below USD 750.

[18] The guidelines prescribe increasing block tariffs, with a first subsidised tariff (for consumption of up to 10 m^3 per households and month) and a break-even tariff for higher consumption. Commercial and industrial users can be charged higher tariffs with higher blocks at the full-cost tariff.

[19] Mission Innovation is an initiative of 22 countries and the European Union to accelerate global clean energy innovation. Participating countries have committed to double their governments' clean energy R&D investment over five years while encouraging greater levels of private sector investment in transformative clean energy technology. See http://mission-innovation.net.

[20] Bird keeping is deeply rooted in Indonesian culture; nearly one in four Indonesian households own a pet bird.

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Chapter 3. The land-use, ecosystems and climate nexus

This chapter examines how Indonesia is managing its land to achieve the objectives of ecosystem protection and tackling climate change. It provides an overview of drivers and trends relating to land conversion, ecosystem services and climate change. It analyses the performance of institutional arrangements and policy tools in achieving a coherent approach to the nexus of land use, ecosystems and climate change, and explores the challenges of financing management of this nexus, supporting innovation and ensuring social inclusion.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

3.1. Introduction

The use of land is critical for economic growth, inclusive development and environmental sustainability. Exploitation of Indonesia's rich natural resources has enabled continued economic growth, particularly in land-based sectors (agriculture, forestry, mining). However, it has also brought severe problems, including rapid deforestation and conflicts over land rights. Deforestation has led to forest fires and haze, biodiversity loss and substantial greenhouse gas (GHG) emissions. These all have a serious economic cost: the World Bank estimates that in 2015, forest fires alone led to USD 16 billion in damage.

Achieving a sustainable land-use sector will be pivotal to meeting the Paris Agreement targets and Sustainable Development Goals (SDGs) and, ultimately, to unleashing Indonesia's full potential for green growth. Its climate change mitigation goals rest on a substantial contribution by the forestry sector. Efforts to tackle peat fires and decomposition will be crucial for meeting these goals. Improving policy coherence in the land-use sector will reinforce the sector's competitiveness and capacity to enhance local communities' prosperity. Ultimately, the aim is to decouple production from environmental degradation by improving the management of natural capital.

The government is striving to achieve better balance between social, economic and environmental objectives. Its efforts to improve the mapping of land and clarify its legal status are removing one of the main barriers to greening the land-use sector. Indonesia is developing a unified map for land use and stepping up efforts to rationalise the system of land allocation through the social forestry and agricultural reform programmes. These provide a foundation for increasing policy consistency. Institutional strengthening and capacity development will be needed to achieve better land management, particularly of forest and peatland. Improved management would in turn facilitate increased productivity, legal recognition of local communities' land rights and protection of ecosystems.

3.2. Trends in land-use change

3.2.1. Changes in land use

Agriculture, forestry and mining caused large, rapid changes in land use during the review period. Growing demand for land by these activities has led to conversion of forest and peatland.

Forest and peatland resources

Forest and peatland are essential for provision of ecosystem services, including carbon sequestration. In 2016, half of Indonesia's land area was covered by forest, which totalled 90.3 million ha.[1] Of this, 46 million ha is megadiverse, carbon-rich primary forest. The rest consists of other naturally regenerated forest[2] and planted forest. These figures refer to the physical status of land, which is not necessarily the same as whether the land is legally defined as forest (Box 3.1).

Box 3.1. Forest classification in Indonesia

Indonesia legally classifies its land into two broad categories: state forest (*kawasan hutan*), an area to be maintained as permanent forest; and non-state forest (*area pengunaan lain*), an area for other uses. This legal classification determines how the land is managed.

In 2017, two-thirds of Indonesia's land, or 120.6 million ha, was classified as state forest. This land is almost exclusively state owned; it is not legally possible for businesses or individuals to own land in the state forest. The exception is the 0.1% of state forest that is community owned and referred to as customary forest (*hutan adat*). The Ministry of Environment and Forestry (MoEF) is responsible for state forest land and issues usage rights.

Further classification is used to define allowable uses of state forest land under norms and standards set by the MoEF:

- Conservation forest (22.1 million ha) (*hutan konservasi*) is land designated for biodiversity protection and ecosystem integrity. Conservation forest corresponds to the IUCN definition of protected area. In 2017, 21% of land legally classified as conservation forest was not forested.
- Protection forest (29.7 million ha) (*hutan lindung*) is land identified as important for provision of ecosystem services, such as controlling erosion, preventing flooding, maintaining soil fertility and preventing seawater intrusion. In 2017, 20% of land legally classified as protection forest was not forested.
- Production forest (68.8 million ha) (*hutan produksi*) is land designated for production through logging, timber plantation and ecosystem restoration. It may be designated as convertible production forest, which is eligible for use for non-forestry purposes, such as mining, agriculture and infrastructure development. Once converted, such land is no longer managed as forest or classified as state forest. In 2017, 42% of land legally classified as production forest was not forested.

The legal classification does not always match the land's current physical characteristics, even though legal mechanisms exist to change the classification. Overall, 29% of state forest land is not forested, and 8% of forested land is not legally defined as state forest. The latter, classified as non-state forest, is subject to a different management regime, overseen by the Ministry of Agrarian Affairs and Spatial Planning.

Source: MoEF, 2018a; MoEF, 2018b.

Indonesia has the world's largest area of tropical peatland, a type of wetland established on peat soil and important for carbon sequestration and biodiversity (Box 3.2). Indonesia's peatland and primary forest resources are concentrated on four islands: Kalimantan (the Indonesian part of Borneo), Papua, Sumatra and, to a lesser extent, Sulawesi and Moluccas (MoEF, 2018a).

Box 3.2. Defining peatland and peat ecosystem areas

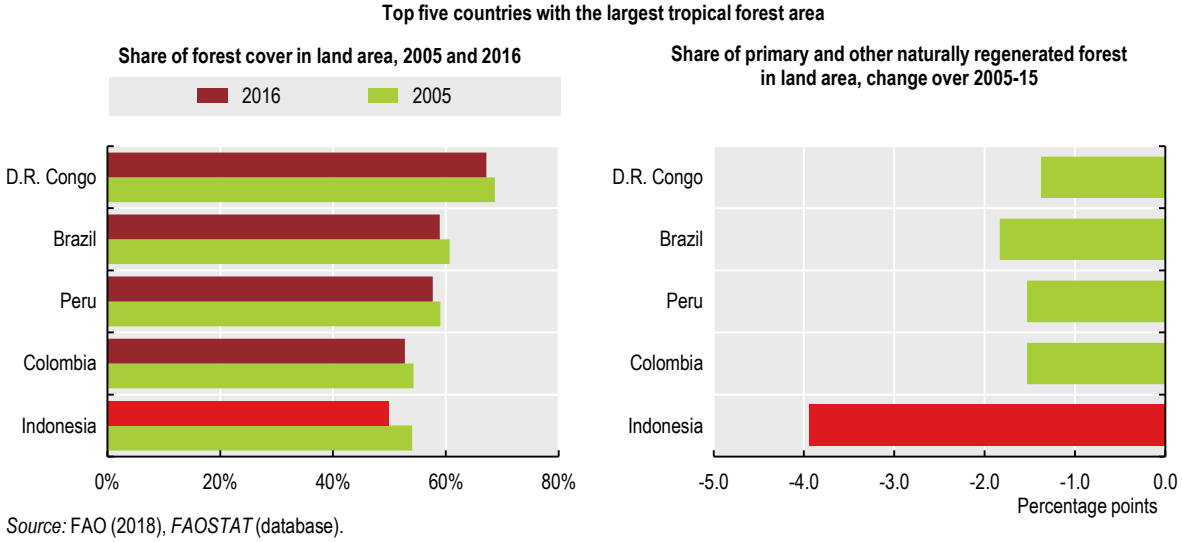
Peatland refers to peat soil (decaying organic matter thousands of years old) and the wetland habitat growing on its surface. The presence of water significantly slows the decaying of peat, enabling the sequestration and accumulation of large amounts of carbon over time.

Peatland has both a legal and a biophysical classification in Indonesia. The legal classification refers to the area covered with peat soil, estimated at 15 million ha. The biophysical classification concerns peat ecosystem areas, the share of landscape that forms an integrated system with peatland. Their combined area is estimated at 24 million ha. Peat ecosystems are broken down into peat hydrological units for peatland management and protection.

In 2017, the MoEF issued a National Peat Ecosystem Function map indicating that half the combined peat ecosystem area was to be protected. Cultivation is allowed in the other half, provided it does not interfere with preservation of the overall peat ecosystem.

Indonesia has calculated deforestation levels since the early 1990s. The highest deforestation rates were recorded in the late 1990s: 3.5 million ha per year over 1996-2000 (MoEF, 2018a). Deforestation rates declined thereafter, reflecting strengthened policies to combat deforestation, but they remain considerable. The share of forest cover in land area decreased by four percentage points between 2005 and 2016 – the largest decline among the five countries with the largest tropical forest area (Figure 3.1). Although more than half the loss occurred in naturally regenerated forest (also of ecological importance), primary forest cover loss was also high by international standards. The United Nations Environment Programme projected that, under a business-as-usual scenario, Indonesia's forest cover could further decline by 15% over 2015-30, equivalent to a cumulative economic loss of USD 10 billion to USD 25 billion (UNEP, 2015).

Figure 3.1. Forest cover has declined fast since 2005



Source: FAO (2018), *FAOSTAT* (database).

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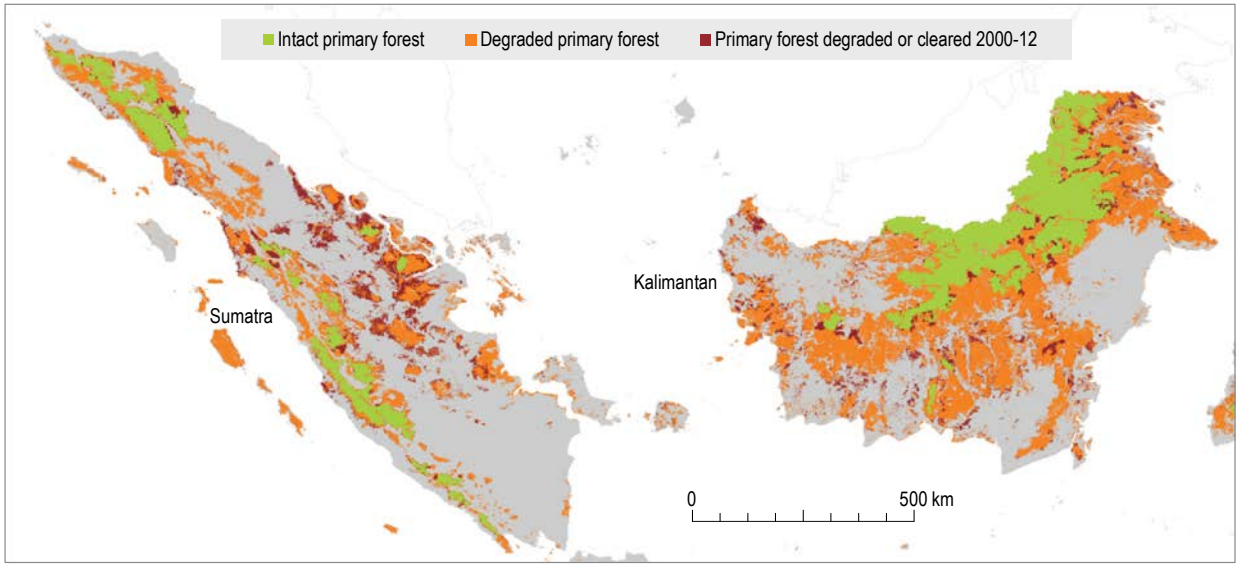
The annual average deforestation rate over 2005-16 ranked among the world's highest. After peaking at 1.2 million ha in 2015, the rate decreased to 0.6 million ha in 2016 and 0.5 million ha in 2017. Most forest loss occurred in Sumatra and Kalimantan, where oil palm and timber plantation development has been highest (Figure 3.2). The other major forested island, Papua, has registered lower deforestation rates (including in absolute terms) because it is under less economic development pressure (Figure 3.3). Data for 2013-16 show that reforestation was low compared to forest loss and was essentially driven by plantation expansion rather than forest rehabilitation (MoEF, 2013; MoEF, 2014; MoEF, 2015a; MoEF, 2016).

Figure 3.2. Forest clearance and degradation were highest in Sumatra and Kalimantan



Source: Based on Margono et al., 2014; FAO, 2015.

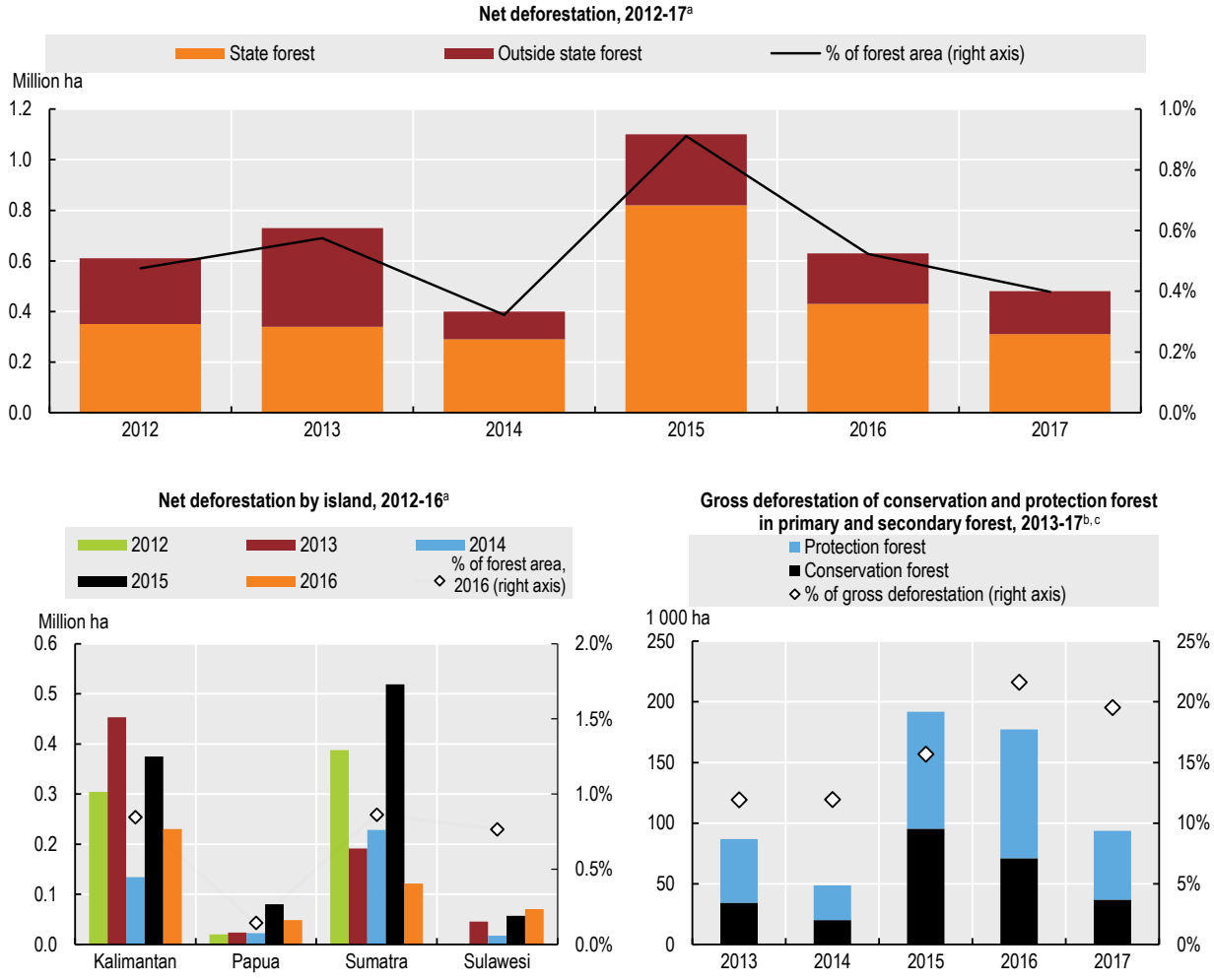
Quantitative government data on deforestation drivers are limited. Illegal activities are likely a major contributor to tree loss. Abood et al. (2014) indicate that between 2000 and 2010, only 45% of total forest loss occurred on land where industrial concessions (e.g. for timber or agriculture) were permitted. Outside concession areas, deforestation partly reflects illegal land conversion and logging, a major share of which occurs in legally protected state forest (Figure 3.3). Recurring human-caused fires are a significant factor in forest loss and degradation.

The main fire cause has been so-called slash-and-burn clearing for agriculture or timber, the cheapest and fastest way to clear land and often a means of illegally claiming land. Peatlands are drained (using canals to evacuate water) and set aflame for clearing. Dried peat areas are highly flammable and can burn for days or weeks.

Following large fires in 2015, the government put in place an extensive set of measures to reduce the incidence of fire, underpinned by Presidential Instruction No. 11/2015 regarding the Acceleration of Forest and Land Fire Control. The instruction aims to encourage co-ordinated responses at the national and subnational levels. The Ministry of National Development Planning (BAPPENAS) later issued the Grand Design of Forest, Garden, and Land Fire Management 2017-19, and Ministry of Agriculture Regulation No. 5/2018 on zero burning for land clearance and land management requires plantations to anticipate and

reduce fires from plantation activities. The incidence of fire hotspots has declined significantly since 2015 in parallel with the introduction of these measures, facilitated by wetter weather.

Figure 3.3. Deforestation has been rapid



Note: National legislation (Decree No. 30/2009) defines deforestation as a permanent alteration from a forested area to a non-forested area as a result of human activities. The data here are based on interpretation of optical satellite remote sensing images.

a) Net deforestation is the balance between gross deforestation and forest gain (including plantation expansion and reforestation). State forest is permanent forest, almost exclusively state owned, extending over 120.1 million ha and divided into three categories: production forest, protection forest and conservation forest.

b) Gross deforestation refers to the area of forest that has been cleared, excluding forest regeneration (natural or due to human intervention).

c) The main function of conservation forest is conserving the diversity of plants and animals and their ecosystems. Protection forest serves as a life buffer system and helps regulate water drainage, in addition to contributing to flood prevention, erosion control and soil fertility preservation.

Source: MoEF (2018), *The State of Indonesia's Forest 2018*; MoEF (2017), *Deforestasi Indonesia Tahun 2014-2015* (several issues); MoEF (2016) *National Forest Reference Emission Level for Deforestation and Forest Degradation*; MoEF (2016), *Statistik Kementerian Lingkungan Hidup Dan Kehutanan Tahun 2016*, (several issues).

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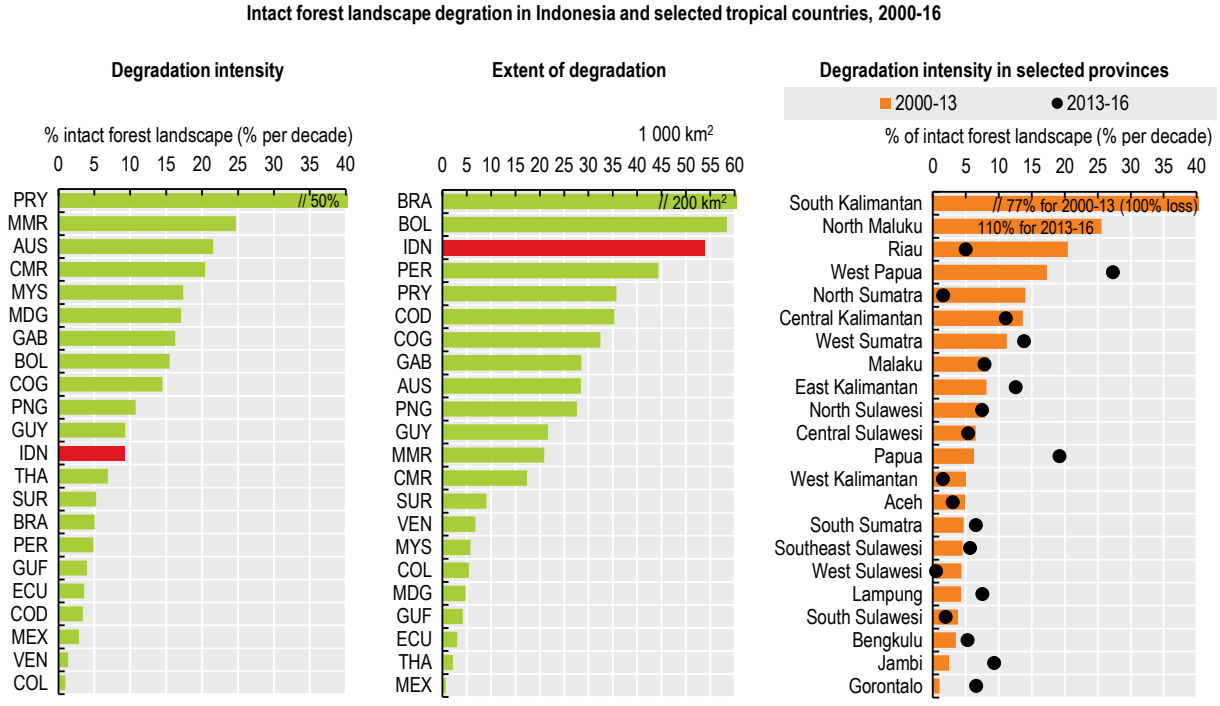
A further challenge, in addition to deforestation, is loss of intact forest landscapes. These landscapes, which are defined as having no remotely detectable signs of human activity, play a crucial role as biodiversity habitats and for ecosystem service provision. Indonesia's annual rate of degradation is typical for forest countries, but in terms of total area it has

witnessed the third highest loss globally (Figure 3.4). Logging, agricultural activity and infrastructure development all contribute to the loss of intact ecosystems.

Figure 3.4. Forest degradation remains a challenge



Note: Degradation intensity shows the degradation of intact forest landscapes as a percentage of the total intact forest landscape area at the start of the time period. It is expressed as the percentage of intact forest landscape degraded each decade. Degradation intensity above 100% in 2013-16 (i.e. in North Maluku) implies that, if degradation continued at the 2013-16 rate, all remaining intact forest landscapes would be degraded before 2023.
Source: OECD calculations based on data from FAO (2018), *FAOSTAT* (database); Potapov et al. (2017),*The last frontiers of wilderness: Tracking loss of intact forest landscapes from 2000 to 2013.*

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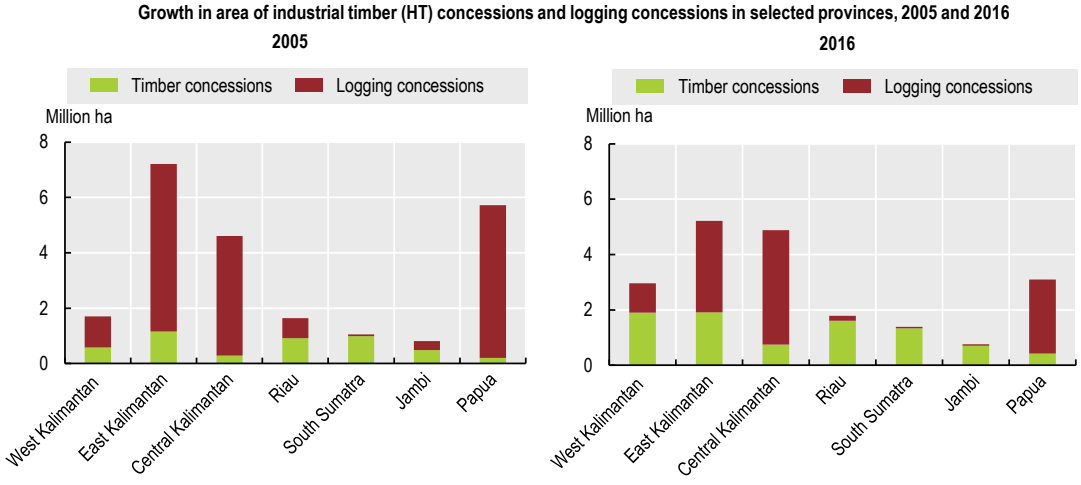
Timber production and forestry concessions

Indonesia's forests have mostly been used for timber extraction, making the country one of the world's largest producers and exporters of tropical logs (ITTO, 2016). Concessions for selective logging of natural forest (called HPH concessions) had been the main type of timber production, but output has progressively shifted towards industrial plantations in the past two decades, as they tend to be more productive per hectare. Since 2008, the MoEF has directed industrial timber concessions (known as HT concessions) towards non-productive production forest. The policy is intended to prevent conversion of productive natural forest to industrial timber plantations. High-quality wood from natural forest is diminishing fast, particularly in the more accessible lowland areas. Log supply from industrial timber concessions more than doubled over 2005-17 and now represents 87.5% of total log supply at 37.8 million m^3. The rapid expansion of HT concessions has come at the expense of peatland and forest (Abood et al., 2014; Gaveau et al., 2016). In 2017, the government instructed holders of HT concessions in peatland to halt production until they had taken protection and rehabilitation measures to protect the peatland's water storage function.

Overcapacity in wood processing has encouraged the shift from selective logging to industrial plantations, as plantations have been better able to scale up production. The overcapacity is due to policies encouraging downstream investment in plywood, pulp and paper mills. The policies' effect has been compounded by slow development of industrial concessions; in 2014, only 68.5% of concession areas were planted (MoEF, 2015b). Forest Trends, a non-government organisation (NGO), estimated that 30% of the resulting gap between log supply and demand was filled by illegal logging, often carried out as a prelude to establishing oil palm and timber plantations (Forest Trends, 2015; ITTO, 2016). The share may have declined in recent years, however, following government efforts to improve law enforcement.

Figure 3.5. Industrial timber concessions play a growing role in log production



Note: HT concessions data for East Kalimantan include North Kalimantan.
Source: BPS (2018), *Forestry* (database); MoEF (2016), *Statistik lingkungan hidup dan kehutanan 2016* [Environment and Forestry Statistics 2016].

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Agricultural production

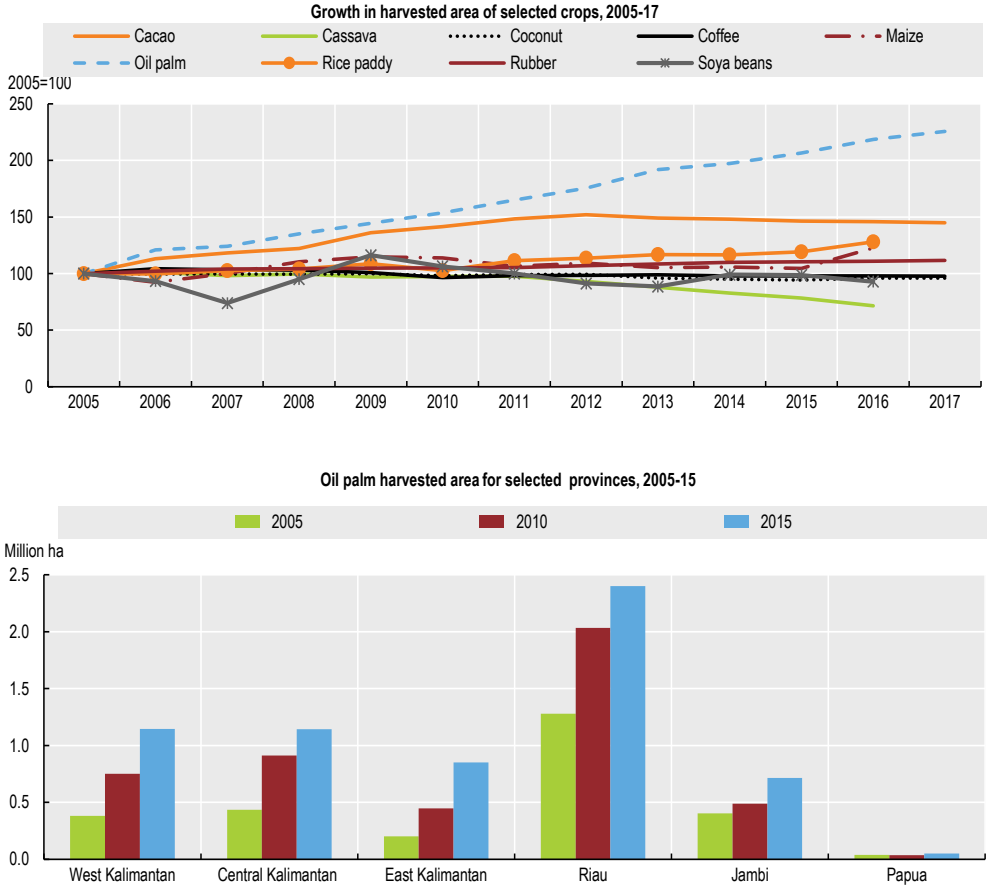
The landscape has long been shaped by mosaics of agricultural plantation. Indonesia is a major producer and exporter of agricultural commodities, including rice, cocoa, coffee, tobacco, tea, rubber and palm oil. Agricultural cropland occupies 35% of the total land area (OECD, 2019), including rice on 15 million ha, coconut and rubber on 3.6 million ha and cocoa on 1.7 million ha. Agricultural land use has increased substantially over the last decade (more than in Brazil or India, for instance), driven by growing domestic and global demand (Figure 3.6). Coffee and cacao plantations, often small to medium-sized, are reported to have contributed to forest loss in parts of Sumatra and Sulawesi, but it is oil palm that has had the largest impact on deforestation and peatland loss (Abood et al., 2014; Gaveau et al., 2016).

The harvested area expanded more rapidly for oil palm than other major crops, albeit with regional variation (Figure 3.6). Oil palm is attractive to growers because of its high yields and potential for continual harvesting. These qualities, combined with rising demand, have led to rapid increases in harvested area. Planted area doubled nationwide (and tripled in West Kalimantan) over 2005-15, driven by fast-growing demand for palm oil-derived products. Plantations now cover around 12.3 million ha, mostly on Borneo and Sumatra (Figure 3.6) (MoA, 2018). By 2017, around 5.5 million ha previously in the state forest

(classified as convertible production forest), or 4.5% of state forest land, had been converted to oil palm plantations (MoEF, 2018c).

Global demand for palm oil is projected to continue increasing over the next decade (OECD/FAO, 2017). Indonesia's strengthened domestic biofuel mandate, which has stimulated demand for biofuel based on palm oil, is also likely to drive palm oil production growth (Chapter 2) (USDA, 2017). On current trends, rising demand for palm oil will need to be met by expansion of harvested area, if productivity per hectare does not improve. Yields, in terms of oil palm fruit, have decreased by 14.4 % since 2005 and have been lower than maximum theoretical yields. The government plans to increase palm oil productivity.

Figure 3.6. Oil palm plantation has grown rapidly since 2005



Source: MoA (2018), *Agricultural Statistics* (database) and several commodities outlooks.

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Mining concessions

Indonesia has significant energy resources (coal, geothermal, natural gas, oil) and minerals (copper, bauxite, gold, nickel ore, tin). Mining concessions occupy a negligible proportion of state forest at 0.4 million ha, much of it devoted to exploration (MoEF, 2018a). Mining has been a minor contributor to deforestation due to its small share of total land area, but has disturbed surrounding natural ecosystems. Widespread illegal small-scale mining is a

significant contributor to this problem due to lack of compliance with environmental safeguards (Abood et al., 2014).

Investment in developing new mining concessions slowed recently as global prices fell, the business environment became more challenging and reserves of some minerals, such as tin, oil and gas, neared depletion (Tang, 2017; PwC, 2017). However, an improving business environment (OECD, 2018) and increased global demand for mineral and energy resources could reverse this trend, stimulating investment.

Current and projected impact of climate change on the land-use sector

The impact of climate change could increase demand for land, as it can result in lower agricultural productivity. Yields of oilseed crops (including oil palm) could decrease by 20% and rice production by 12% by 2050 (OECD, 2015a). Oilseed crops could have a higher dieback level at younger ages as dry seasons (compounded by El Niño) become more severe and diseases develop in parallel with rising temperatures and changing rainfall patterns. The need for expansion would grow accordingly. Higher temperatures and more severe dry spells could also increase vulnerability to forest fires, such as those that occurred in 2015 (Box 3.3). More frequent floods and droughts could also affect productivity in other land-based sectors, including mining and forestry.

Box 3.3. Consequences of the 2015 forest fires in Indonesia

Forest fires have severe environmental and social consequences, particularly in El Niño years, when the Indonesian dry season (around March-October) is particularly arid.

The 2015 forest fires were notably severe. Around 136 100 hotspots were declared (compared to 4 448 in 2016) and an estimated 2.6 million ha was burnt, generating toxic smog and haze that also affected Malaysia and Singapore. This contributed to some 500 000 cases of respiratory disease and potentially more than 100 000 premature deaths across the region. The haze caused economic activity to slow, schools to close and flights to be cancelled or delayed. The total cost of the fires was estimated at USD 16 billion.

In response, a range of policy measures have been implemented (MoEF, 2018a):

- Establishment of fire task forces at the provincial and district levels to provide a co-ordinated response to forest fires. The MoEF also established fire brigades called Manggala Agni in 38 areas at particularly high fire risk.
- Commitment to restore 2 million ha of peatlands and an extended moratorium on peatland development.
- Improved monitoring. The MoEF developed a forest fire monitoring system (http://sipongi.menlhk.go.id/home/main), and satellite monitoring from the National Institute of Aeronautics and Space is used to identify potential hotspots.
- Establishment of the Peatland Restoration Agency in 2016 to restore degraded peatland, with a focus on fire-prone areas.
- Establishment of community-level firefighting programmes.

Source: Carrington, 2015; MoEF, 2015c; MoEF, 2018b; World Bank, 2016.

3.2.2. Impact of land-use change on the environment

Sustainable management of Indonesia's forest and peatland is of global importance. The country contains two of the 25 world's biodiversity hotspots and many endemic species, most of which are supported by its extensive forests and peatlands. The land can have cultural and religious importance to local communities. Pressures on forest and peatland threaten biodiversity and provision of essential ecosystem services. These services include freshwater provision (provisioning services), water cycling (supporting services), climate and water regulation, and carbon sequestration (regulating services). Carbon sequestration is essential to help Indonesia achieve climate goals. The country is among the world's largest GHG emitters, with a large share of emissions stemming from burning and conversion of carbon-rich forest and peatland (Chapter 1).

Forest ecosystem services

The rapid degradation, fragmentation and loss of forest ecosystems contributes to habitat loss and threatens biodiversity (BAPPENAS, 2016). About 60% of rainforest species in Indonesia are endemic, including iconic mammal species such as the Bornean orangutan and Sumatra elephant. The elephant population declined by 84% over 1984-2007 in Riau province due to high forest loss (Petrenko, Paltseva and Searle, 2016). The Bornean orangutan population declined at a rate above 25% over the last decade, with acute pressures in Central and West Kalimantan (MoEF, 2017a).

Monoculture plantations support less diversity of species than natural forest (Petrenko, Paltseva and Searle, 2016). They also support rodents, snakes, beetles and other pests that affect surrounding habitats and plantations (Meijaard et al., 2018). By contrast, selective logging is less damaging to biodiversity and forest, though the damage varies by amount of timber felled (Burivalova, Sekercioğlu and Koh, 2014). Maintaining intact natural forest is essential for carbon sequestration. The estimated average economic value of the carbon stored in Central Kalimantan's forest as of 2010 was USD 19.5 billion (UNEP, 2015).

Forest loss around watersheds is adversely affecting water quality and increasing flood frequency. Around 14% of Indonesia's watersheds are in a critical state,[3] in large part due to land-based sector activities (particularly on Borneo and Sumatra). The resulting increase in flood frequency has affected many vulnerable downstream communities (BPS, 2014). A study in Sumatra found that oil palm plantations in certain areas had increased sedimentation levels in nearby waterways due to vegetation loss (Carlson et al., 2014). Forest plays a key role in preventing soil erosion and thus avoiding water and soil quality degradation; in Central Sulawesi, the value of soil conservation services of primary forest are estimated at USD 81 million (UNEP, 2015).

Forest loss is furthermore affecting local microclimates by decreasing daily precipitation and increasing average and extreme temperatures. In Borneo, dry-season temperatures were found to be 1.7°C higher in deforested than forested areas; in Jambi, areas around young oil palm plantations were up to 6°C warmer than forested areas.[4] Deforestation thus puts a double burden on local microclimates, both directly and, through climate change, indirectly (Jasechko et al., 2013; Sabajo et al., 2017; McAlpine et al., 2018).

Peatland ecosystem services

Peat ecosystem degradation (Figure 3.7) is damaging biodiversity. Peatland (especially peat swamp forest) is an important habitat for species, of which many are endemic. Around

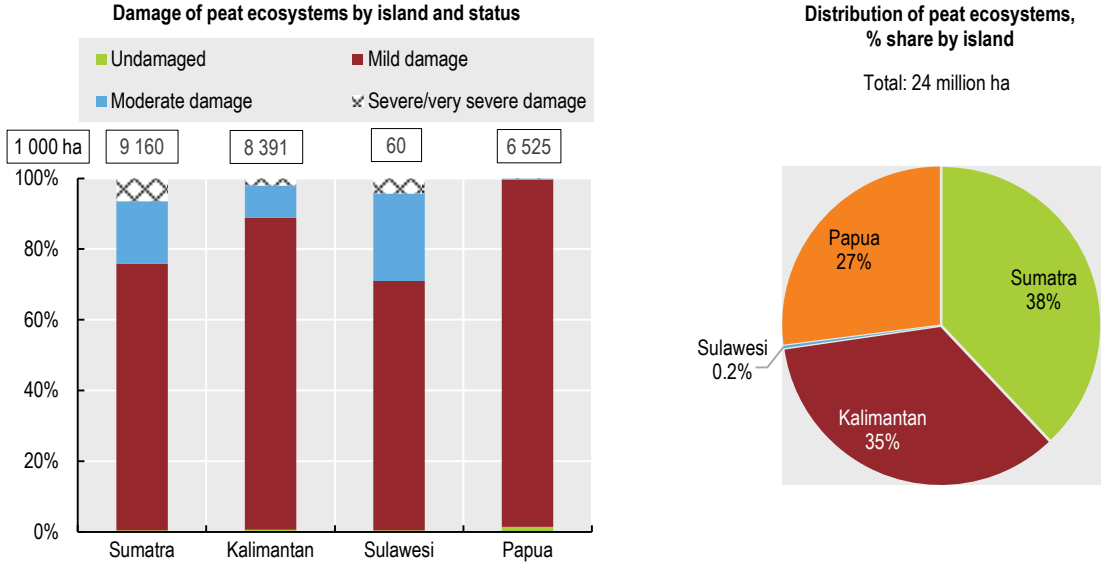
33% of birds and 45% of mammals in peat swamp forest are threatened, vulnerable or endangered, by IUCN classification (Posa, Wijedasa and Corlett, 2011).

Peatland is the predominant source of GHG emissions from the land-use sector, through releases from decomposition and peat fires. The emissions are driven by land conversion for agriculture. Peatland's low economic value has made it particularly vulnerable to conversion, especially as pre-2016 legislation provided little protection to areas where peat soil was less than 300 cm deep (i.e. 64% of Indonesia's peatland) (MoEF, 2018b) (Section 3.5, Moratoriums). As a result, much peatland has been drained, burned or left to decompose.

In 2014, peat decomposition led to emissions of 342 Mt CO_2 eq, or 18.5% of total GHG emissions that year. Carbon emissions from peat decomposition continues even after plantation establishment, outweighing the amount of carbon stored by oil palms or other species. Emissions from peat fires vary by year, but amounted to 499 Mt CO_2 eq (27% of total emissions) in 2014.

Peatland conversion also increases flood risk and thus threatens the long-term viability of newly planted crops. Peat soil acts as a sponge, absorbing tremendous amounts of water. Draining it can lead to subsidence and increase flood exposure. A study in Central Kalimantan found that oil palm plantations established on drained peatland could become unmaintainable due to projected increases in flood frequency (Sumarga et al., 2016).

Figure 3.7. Most peat ecosystems are already degraded



Note: According to a peat ecosystem inventory carried out by the Indonesian Center for Agricultural Land Resources Research and Development in 2011 and recently revised and updated with MoEF data, Indonesian peatlands cover more than 15 million ha or 12% of total forest land. Peatlands and the associated landscape area are designated as peat hydrological units (*kesatuan hidrologis gambut*) and cover 24 million ha. A peat hydrological unit is defined as an ecosystem located between two rivers, between a river and the sea, and/or in a swamp area.
Source: MoEF (2018), *The State of Indonesia's Forests 2018.*

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Air, soil and water pollution

Air quality has been degraded by repeated forest and peat fires, combined with other pressures such as emissions from transport (Chapter 1). Fires increase air pollutant

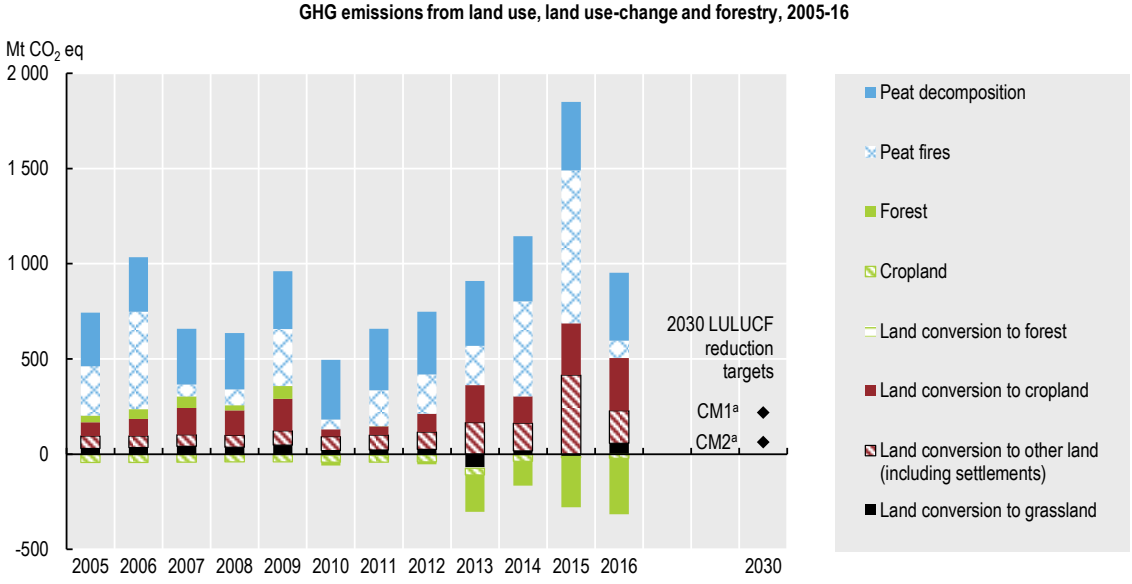
concentrations to dangerous levels and expose nearby communities to noxious amounts of pollution, putting their health at risk. In addition, oil palm plantations emit up to seven times more volatile organic compounds (VOCs, primarily isoprene) per unit area than forest (Meijaard et al., 2018). Some VOCs are associated with increased risk of cancer and respiratory illness.

Water and soil quality has been damaged by chemical inputs used in mining and on large plantations. Direct discharge of mining effluent, including from illegal mining, into surface waterways has led to numerous cases of local communities being poisoned by mercury and other metals (*National Geographic*, 2016; Hardjanto, 2017). Land areas and waterways have been contaminated by chemical discharges, mainly from agribusiness and mining. In East Kalimantan, for example, fish from the Mahakam River were found to contain dangerous amount of metals (Adri, 2015).

Emissions from land use, land-use change and forestry

In 2014, the land use, land-use change and forestry (LULUCF) sector emitted 979 Mt CO_2 eq, more than half of Indonesia's total emissions that year and up 40% from the 2005 level of 700 Mt CO_2 eq (though year-to-year variation is high due to forest fires. Peat decomposition and fires were the main drivers, accounting for 86% of the sector's total net emissions in 2014. Forest conversion for crops, construction, mining and other activities accounted for much of the rest (Figure 3.8). Recent government estimates indicate emissions from peat fires peaked at 713 Mt CO_2 eq in 2015 and declined in 2016, helped by wetter weather and fire reduction measures (MoEF, 2018a).

Figure 3.8. LULUCF emission variations follow forest fire occurrences



Note: Land conversion to other land refers mainly to the conversion of forest to other non-agricultural sectors such as mining or infrastructure development; land conversion to settlement mostly refers to the conversion of forest to settlement often mixed with vegetation; land conversion to cropland mostly refers to the conversion of forest to estate crops, primarily oil palm.
a) CM1 - Unconditional mitigation scenario; CM2 - Conditional mitigation scenario (international support available).
Source: MoEF (2018), *Second Biennial Updated Report under the United Nations Framework Convention on Climate Change*.

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Forests are reported as having become a net sink by 2010 as a result of a change in methodology used to estimate past emissions. The revised methodology, used since 2014, assumes lower rates of forest degradation resulting from illegal logging following introduction of timber verification in 2010. For 2014, around 165 Mt CO_2 eq was reported as being removed, mostly by forest and cropland.

3.2.3. Economic and social role of land-based sectors

Land-based sectors are a mainstay of the Indonesian economy, particularly in East Kalimantan, Riau and Papua, where they account for more than 50% of GDP (Chapter 1). The sectors have been a key source of income for rural Indonesians, particularly the 32.5 million people (8.6 million households) living in or near state forest. Agriculture accounts for 30% of employment nationally and is the main activity (excluding forestry) of 57% of households living around state forest (BPS, 2014b). The capital-intensive formal mining sector has played a lesser role in rural households' livelihoods, but illegal small-scale mining has been a considerable source of income for some of the rural poor (Edwards, 2016; Purwanto, 2017).

The growth of palm oil production over the last two decades has significantly improved local communities' livelihoods, providing jobs to 16-20 million people on and off farms (MoEF, 2018b; Euler et al., 2015). Oil palm's profitability has led many smallholders to shift to it either as a complement to or substitute for more traditional crops such as rubber (Rist, Feintrenie and Levang, 2010). Smallholders now account for around 41% of the area of Indonesia's oil palm plantations.

Strengthening the capacity of smallholders will be crucial to improving the productivity of the palm oil sector. Smallholdings have lower average productivity than larger estates, partly because they rely on cheaper but less productive seedlings and fertilisers. The technical potential for improvement is considerable: a pilot study found that application of best management approaches to suitable land could achieve yields 50% higher than the national average (Fairhurst et al., 2010). Faced with a similar challenge, Malaysia is using a combination of subsidies for replanting, technical support and the creation of co-operatives to secure access to cheaper inputs (Varkkey, Tyson and Choiruzzad, 2018). Indonesia, using a "nucleus-plasma" approach, has struggled to raise productivity. The approach relies on partnerships between larger plantations and smallholders, but the quality of support provided is variable (OECD, 2015b; Varkkey, Tyson and Choiruzzad, 2018).

Only a small share of people living in or near state forest rely on forestry activities as their main source of income, but forests contribute to the livelihoods of many local communities (BPS, 2014a). Global estimates have found that the benefits of ecosystem services accrue mainly to nearby communities, including the poor (Mullan, 2014). Forests support the spiritual values, knowledge and traditions of the country's forest-dependent communities and play a determining role in the quality of their diet (Ickowitz et al., 2016). Around 37.5% of the 1.7 million households exerting de facto control over state forest land collect forest products or hunt to meet their needs; the share is 90.7% in Papua and 70% in West Kalimantan (BPS, 2014a). Beyond this, forests support livelihoods by contributing to other ecosystem services, including cultural and religious services (essential to many forest-dependent groups), clean water, flood protection and climate regulation (Rist, Feintrenie and Levang, 2010).

The economic potential of forest-based tourism has yet to be fully exploited, despite increased tourist flows (OECD, 2018). The recent designation of four tourism priority areas could accelerate regional growth and open new opportunities. Mahadevan, Amir and

Nugroho (2017) estimate that tourism-led growth in Indonesia could significantly improve rural and urban poverty outcomes. Sound land management will be key to reconciling growth and sustainability of tourism.

3.3. The institutional and policy frameworks for the nexus: Improving coherence

Indonesia has made international commitments that have implications for land use. These include the Indonesia National Biodiversity Strategy and Action Plan (NBSAP) under the Convention on Biological Diversity (CBD) and the Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC). The NBSAP (2015-20) includes commitments to strengthen capacity, sustainably develop resources and support biodiversity conservation and rehabilitation. This requires protecting and linking habitats to offset forest landscape fragmentation and provide corridors allowing species to roam between protected areas. The land use sector is expected to deliver the majority of reductions to the NDC by 2030.

Indonesia has also made national-level commitments with implications for land use, in addition to the objective of achieving 7% annual GDP growth. It intends to achieve self-sufficiency in staple crop production, which will require significant production increases given the current gap between consumption and production. The biofuel mandate (Chapter 2) will entail using an increasing volume of palm oil in fuels. The target of a 60% share for coal in electricity generation capacity by 2025 has implications for mining.

Government Regulation No. 13/2017 on National Spatial Planning set specific targets, ranging from 30% to 70%, for the extent of protected land (*kawasan lindung*) on the eight largest islands and archipelagos. The Peatland Restoration Agency (Badan Restorasi Gambut) has a target of restoring 2 million ha of peatland forest by 2020 and the MoEF has a target of restoring 100 000 ha of degraded land in conservation areas by 2019. The following sections explain the trade-offs and synergies between these goals and the mechanisms in place to manage them.

3.3.1. Identifying trade-offs and synergies between sectoral policy goals for the nexus

The importance of environmental issues, including ecosystems and climate change, are recognised in the developing planning process. The 2015-19 National Medium-Term Development Plan (RPJMN) explicitly recognises the importance of sustainable development and the role of spatial planning, and adopts the targets from the NDC and the National Action Plan for Climate Change Adaptation (RAN-API). The secretariat for the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) helped mainstream the NDC targets into the RPJMN and ministerial work plans.

The development of the RPJMN is being informed by Statistics Indonesia's System of Environmental-Economic Accounts (SEEA). The core accounts include the value of land, energy, mineral and timber resources. Satellite accounts recognise the value of ecosystem services, such watershed protection, carbon sequestration and biodiversity, and provide a useful basis for making well-informed decisions about alternative land uses. Indonesia is continuing to develop SEEA to better capture changes in the value of natural capital. Pilot studies have been undertaken in several provinces and the government aims to link the land accounts with ecosystem accounts. Continuing efforts to improve data coverage and quality will facilitate the use of these accounts to inform policy development, including development planning.

The elaboration of sector targets in the RPJMN, however, does not appear to have fully considered interactions between objectives. As the stock of land is finite, implicit demand for land from each objective needs to be consistent. For example, increased production will require a combination of increased productivity and increased land area. However, the production targets for food and fuel crops imply claims on the stock of degraded land that are likely to exceed the volume of suitable land available (Bellfield et al., 2017).

The experience of Malaysia demonstrates how setting clear, realistic overall land use targets can help shape behaviour. In 1992, Malaysia committed to keeping at least 50% of forest cover intact. This signalled to the industry that output increases would have to be met through productivity gains rather than expansion of planted area (Varkkey, Tyson and Choiruzzad, 2018). Robust enforcement helped establish credibility. Setting realistic, overarching targets for how land is to be used can improve coherence and predictability.

As in many countries, mainstreaming of government targets has not been co-ordinated across sectors, and the alignment of targets is sometimes limited, posing a risk of inter- and intra-ministerial conflict. For example, reducing GHG emissions from land use is a central pillar of the NDC but there are no specific targets for reducing emissions from LULUCF in the MoEF 2015-20 work plan. The Master Plan for Acceleration and Expansion of Indonesian Economic Development (2011-25) promotes transport infrastructure development, but only highlights potential environmental impact from agriculture and mining. Indonesia has the conflicting goals of expanding oil palm and timber plantations while reducing GHG emissions from forestry and land use change, and of reducing emissions by 29% by 2020 but also expanding electricity generation using coal.

Barriers hampering the adoption of a coherent approach to managing these interactions include (GGGI, 2015a; Bellfield et al., 2017):

- Insufficient data and tools, which are needed to understand the consequences of various policy choices and identify potential trade-offs. The work is resource intensive, particularly when modelling policy choices' impact on ecosystems and climate.
- The vast number of strategies and documents that have to be aligned to achieve greater coherence. They include national strategies and commitments (such as the NDCs), ministerial work plans, budgets and the formal development planning process.

The next phase of the medium-term development plan, the 2020-24 RPJMN, provides an opportunity to reconcile developmental policy goals with climate change, land use and ecosystem targets. As part of the preparation for the 2020-24 RPJMN, BAPPENAS has undertaken economic modelling to facilitate discussion between stakeholders and ensure that relevant sector targets are compatible. This modelling aims to integrate the role of natural capital to reveal interactions between economic development and environmental outcomes. The improved modelling could also achieve greater clarity and specificity in land use and biodiversity targets, which would aid in mainstreaming them at the national and subnational levels.

3.3.2. Central government and horizontal co-ordination

As in other countries, the management of the nexus cuts across several key ministries. For example, policies relevant to oil palm are produced by the Ministry of Energy and Mineral Resources (national biofuel blending mandate), Ministry of Agriculture (plantations on non-state forest land) and the MoEF (land required for plantation expansion in state forest

areas). The Coordinating Ministry for Economic Affairs has the remit of ensuring co-ordination among most ministries relevant to management of the nexus. The exception is the Ministry of Energy and Mineral Resources, under the Coordinating Ministry for Maritime Affairs and Natural Resources. BAPPENAS also has a co-ordinating function, particularly in relation to the national development planning process. Thus there is a need for co-ordination between co-ordinating ministries.

Various approaches have been tried over time for enhancing policy coherence. Under the previous administration, independent bodies reporting directly to the president were created, e.g. a co-ordinating body for climate change in 2008 and the Reduced Emissions from Deforestation and Forest Degradation (REDD+) agency in 2013. While they facilitated horizontal links, they struggled to gain legitimacy among the relevant ministries (Di Gregorio et al., 2017).

Following the 2014 election, the functions of the REDD+ agency were moved to the MoEF, and the MoEF and BAPPENAS have since shared responsibility for climate policy more generally. An autonomous Peatland Restoration Agency was established in 2016 to help achieve the target of restoring 2 million ha of peatland by 2020. The current policy development structure has aligned responsibilities within MoEF and BAPPENAS, but faces challenges in facilitating co-ordination more generally (Di Gregorio et al., 2017).

3.3.3. Subnational institutions and vertical co-ordination

The subnational administrative landscape in Indonesia is complex, with 34 provinces, 416 districts (or regencies) and 98 cities, each with its own separate administrative bodies. In the nexus, local governments play several key roles in setting and co-ordinating the policy agenda. Both provincial and district governments are responsible for further defining the spatial development plan, following guidelines laid out in the sometimes conflicting sector spatial plans produced at the national level.

Vertical integration of policy goals is facilitated by MoEF, and also by BAPPENAS, which has offices in each province. For example, the RAN-GRK secretariat, based in BAPPENAS, provides technical assistance to district governments in the production of their climate change mitigation action plans, which include provisions for ecosystem resilience. These mechanisms are intended to align regional policy targets with broader national policy objectives. There has been some success in mainstreaming and vertical co-ordination of policy goals for climate change. All provinces have submitted local mitigation plans and integrated them in their latest medium-term development plans.

Progress on climate change adaptation has lagged behind mitigation, with only 8 of the 34 provinces having produced an adaptation plan. Uptake has also been lower at the district level but several cities, including Semarang, Bandung and Lampung, have incorporated adaptation plans in their development plans. These cities were included in a pilot programme funded by the Asian Development Bank, however; broader adoption of adaptation work has yet to be achieved.

A major challenge involves limited local capacity for spatial and development planning, which hampers vertical co-ordination and coherence of policy at the provincial and district levels. As a result, policies protecting ecosystems and tackling climate change are often secondary to policies promoting development, and district policies can be poorly aligned (WRI, 2014).

Efforts to improve capacity in provincial and district governments are under way (MoEF, 2018a). For example, Forest Management Units (FMUs, Box 3.4) are expected to

play a central role in supporting management of forest areas. They will not only aid in local government capacity building but will also be essential for improving land allocation and both vertical and horizontal policy integration at the land-use, ecosystem and climate change nexus across layers of government. There is a particular need to strengthen capacity for integrating climate change and biodiversity into regional spatial and development plans.

Box 3.4. Enhancing state forest management with Forest Management Units

Indonesia is introducing Forest Management Units (Kesatuan Pengelolaan Hutan) to enhance management of state forest. FMUs are on-site organisations undertaking day-to-day, ground-level management activities to ensure that the functions and services of given forest units are maintained. FMUs act as intermediaries between local stakeholders and local and national governments, which retain responsibilities for forest administration.

An FMU's activities include establishing its forest unit's boundaries, conducting a forest inventory, assisting local communities in the management of social forestry activities (particularly as regards community forests), carrying out monitoring and fire prevention, creating short- and long-term management and business plans in line with national and local plans, and contributing to the resolution of land conflicts.

The direct relationship between FMUs and local communities can help resolve land conflicts and create economic opportunities. Kim et al. (2015) highlight the role of the West Rinjani FMU in supporting the development of community partnership agreements between communities and other stakeholders to ensure rights to non-timber products from production forests. It implemented a successful programme of community monitoring to reduce the incidence of illegal activity. It also acted as a mediator in a land conflict between the provincial government and local communities.

The 430 FMUs to date across Indonesia face considerable constraints. For instance, Ota (2018) found that one FMU managed 80 000 ha with a staff of 15. In addition, unclear responsibilities can hamper FMUs' effectiveness. Donors are supporting the development of FMUs through multilateral development banks and agencies, as well as bilateral co-operation.

Source: FORCLIME, n.d.; Ota, 2018.

3.4. Enabling environment for sustainable land management

As in many emerging market economies, lack of clarity about land classification and rights poses a continuing challenge to effective land management in Indonesia. The main issues, which are interrelated, include conflicting claims to land, the status of land belonging to indigenous communities, the lack of a single map of land rights and weaknesses in enforcement.

3.4.1. Land classification and rights

Indonesia's Constitution declares that the state controls the land, natural resources and water and must use this ownership to support the common good.

The MoEF is responsible for the administration and management of state forest areas and access to them (Box 3.1). Other forested land is generally controlled by the Ministry of Agrarian Affairs and Spatial Planning, while each sector ministry can define its own

national spatial plan. The status of customary lands (*adat*) has changed: under the 1999 Forestry Law they could be treated as state forest, but the Constitutional Court invalidated this provision in 2013. The implication is that the state should not allocate such land without local communities' agreement (Butt, 2014). This requirement of more inclusive decision making should help reduce the incidence of land-related conflicts.

Spatial planning at the local level affects which objectives at the nexus are ultimately prioritised. At the national level, spatial planning is regulated by Law No. 26/2008, which requires spatial plans to take into account the carrying capacity of the land in terms of water, ecosystems and agriculture. Provinces and districts are to define their spatial plans in reference to national ones. However, effective integration of the goal on carrying capacity into local spatial plans is challenging due to a lack of clear guidance and targets to operationalise the concept. Improving local land allocation with respect to national climate change and ecosystem targets would require more provincial and national guidance and targets for district spatial plans.

Mainstreaming systematic use of strategic environmental assessment at the local level would help in addressing these issues (Chapter 2). However, that would require developing new and better metrics for the ecological and economic value of land and resources, particularly outside state forest land, where ecosystem protection is weaker overall. In 2014, the government issued guidelines on high conservation value (HCV) assessment, in line with international standards, and is now developing HCV identification and management guidelines to be adopted at the highest level. A province-level HCV assessment of Central Kalimantan was conducted in 2016 (CPI, 2016). The functional classification of peat ecosystems (cultivation/protection) by the MoEF provides further guidance for spatial plans (Box 3.2).

For Indonesia to make significant progress towards its NDC and CBD targets, it is essential for new plantations to be directed towards degraded lands, but the current system of land allocation does not actively encourage this. While the legal mechanisms exist to change land classification to and from forested areas, in practice they are mainly used to allow oil palm development – nearly 90% of all state forest reclassification registered until 2017 was for oil palm (MoEF, 2018c). The most widely used legal reclassification is to change convertible production forest into non-state forest to allow the development of oil palm plantations, which cannot be legally established on state forest land. Swaps between degraded state forest land and forest outside the state forest are hindered by administrative complexity (Rosenbarger et al., 2013).

Decisions on the issuance of permits and conversion of land type do not fully reflect the conservation value of land, particularly outside state forest areas. Current legislation requires holders of agricultural permits outside the state forest, including oil palm for plantations, to clear the area for which they have a use permit of the type known as HGU[5] (Daemeter Consulting, 2015). This is true even if the areas concerned includes ecologically sensitive or primary forest except where land is land designated as conservation or protection forest. For example, if a plantation operator fails to convert its entire concession to production, it could result in the concession permit being revoked, even though Law No. 40/1996 on the Right of Exploitation, Right of Building and Right of Use of Land obliges HGU permit holders to prevent damage to natural resources and maintain environmental capabilities.

Setting aside HCV area is legally feasible but complex, and eventually depends on willingness by the local government and permit-issuing authority[6] (TFT, 2017). In 2015, the Ministry of Agrarian Affairs and Spatial Planning issued two circulars calling for the

preservation and recognition of HCV forest within concessions. The instruments' low legal value cast doubts over their effectiveness, however. As efforts to mainstream HCV considerations into land permitting are undertaken, the designation of essential ecosystem areas (EEAs) potentially offers a way around these issues (Box 3.5). In addition, plantations over 25 ha must hold, and report on, an environmental permit but various cases indicate that many companies do not comply with one or both requirements (Obidzinski et al., 2012; Maradona, 2015; IDM, 2016).

Box 3.5. Protecting ecosystems within concessions

The essential ecosystem area (*kawasan ekosisstem esensial*) designation means an HCV area within a concession that is ecologically integrated with the surrounding landscape. Typically, a permit holder for a concession where an HCV area is connected or serves as a bridge to tracts of forest or peatland either inside or outside a state forest area (e.g. an ecological corridor) may be eligible for an EEA programme and thereby benefit from legal protection, upon application to the local government. The land remains under the overall supervision of the MoEF, but is managed collaboratively by local stakeholders through the establishment of EEA collaborative management forums.

The EEA in the Wehea-Kelay landscape in East Kalimantan illustrates how the designation can be used. The Wehea-Kelay landscape spans more than 500 000 ha, including a luxuriant lowland and plateau forest, hills and various ecosystems; it also supports the livelihoods of many local communities. It is an essential carbon sink and home to rich biodiversity, including around 25 000 orangutans. In 2016, the governor of East Kalimantan and the MoEF established a multi-stakeholder forum, including oil palm and timber plantations and logging concessions, to conserve and manage an EEA in the Wehea-Kelay landscape.

The development of EEAs is promising but has been slow thus far. It really took off when authority was transferred from the MoEF to local government, which facilitated administration and co-ordination. But there is as yet little incentive to develop the approach, as it limits potential revenue from plantations and other economic activity.

Source: TFT, 2017.

The complex system of land permitting has undermined the coherence of the land classification process. Responsibilities for issuing permits are divided among several ministries and government levels, depending on the type of resource to be extracted (Ardiansyah, Marthen and Amalia, 2015). The introduction of an online permitting system in 2018 represented progress, but the underlying issue is that land parcels are subject to various legal regimes that are not necessarily consistent with the interconnected nature of the ecosystems. The number of permits required can make the legality of extraction operations unclear. Moreover, agreement is lacking on which maps to base land-use decisions on, with inconsistencies among national sector plans, leading to further confusion and conflicts at the subnational level (Brockhaus et al., 2012).

Local land allocation is intended to be a participatory process involving affected communities. But the multiple conflicting maps, poor recognition of customary (*adat*) land tenure and the influence of powerful commercial and political interests have left local communities mostly excluded from the final allocation process (Brockhaus et al., 2012).

3.4.2. Improving mapping of land resources

The One Map initiative is a significant effort to address a major underlying weakness in land management, which is the lack of a single map. The goal is to reflect and present development objectives in spatial maps. Integration of regulatory aspects and inter-ministerial coherence are important elements of the process. The project is not only a cartographic challenge but also a policy endeavour. The aim is to facilitate coherent land use reflecting sector and development objectives.

The need for a single map arose because ministries and agencies have used different maps, leading to lack of clarity about land status and overlapping permits. The aim of Law No. 4/2011, the One Map initiative, is to create a unified map of Indonesia at a scale of 1:50 000. It will have 85 thematic layers, including concession boundaries, to inform land use management decisions. Public access to the base map was provided in 2018, with the thematic maps added over the course of 2019. The project is in line with the government's One Data Policy for providing public access to information. Discussions are still under way about how much public access to the thematic layers will be granted.

All but two of the 85 layers are ready, despite the complexity of the undertaking. On the technical side, previous thematic maps used different scales and base maps, making it difficult to reconcile the thematic levels. Capacity building was required to ensure that maps of customary forest lands met the technical standards set by the geospatial agency. Institutionally, the existence of overlapping boundaries has necessitated a politically sensitive process of reconciling land classification. Continued high-level support, combined with sufficient resources, will be required to maintain progress in this vital area.

3.4.3. Social forestry and agrarian reform

Indonesia is working to provide predictable, legal access to land to communities through its social forestry and agricultural programmes. One target is to have 12.7 million ha (6.8% of total land area) under social forestry, providing legal usage rights to communities for the first time. A further 9 million ha (4.8% of total land area) will be redistributed for agrarian reform. These programmes are part of a broader effort to reduce inequality and support the livelihoods of poor rural communities. Social forestry programmes aim to provide usage rights to forest communities for 35 years for uses specified in social forestry permits: agroforestry, agro-silvopasture, silvofishery, ecosystem service provision and ecotourism. Ownership of the land remains with the state. The agricultural reform programme goes further by providing legal ownership as well as usage.

By clarifying land rights, these programmes could address a major source of tension between local communities and fast-expanding land-based sectors (OECD, 2015b). It is estimated that local communities use 9.3 million ha, two-thirds of it as customary forest, but few have already been granted legal status (Arumingtyas, 2018). Only 60% of households exerting control over state forest land have permits to do so (BPS, 2014a). Consequently, land claimed or owned by local communities often overlaps with industrial concessions, leading to conflicts.

Secure access to land is intended to encourage adoption of sustainable natural resource management and discourage land clearing as a de facto means of securing property rights. Social forestry may reduce GHG emissions from deforestation: RAN-GRK estimated that designating 2.5 million ha for social forestry would reduce emissions by 92 Mt CO_2 relative to the baseline. In Brazil, a land registration programme known as SICAR is estimated to have reduced deforestation rates by 10% relative to business as usual

(Alix-Garcia et al., 2018). In Indonesia, the social forestry designation of village forest (*hutan desa*) has reduced deforestation, but it remains to be seen whether other types of designation have similar influence (Santika et al., 2017). Box 3.6 provides an example of social forestry.

Box 3.6. Environmental and economic benefits of community forestry in Yogyakarta

Kulon Progo Community Forest is located within the Yogyakarta production FMU in Yogyakarta province. It was designated in 2007, with 197 ha of forest to be managed by community. Ecotourism is a major income source for this area, with visitors attracted by the landscape. Social media exposure helped visitor numbers increase from 7 161 in 2010 to 443 070 by 2016. It is estimated that tourism has created jobs for 236 people. There have also been environmental benefits, with watershed protection safeguarding drinking water supplies.

Source: MoEF, 2018a.

These land reform programmes should also support investment, as legal land rights serve as collateral for loans. To help realise these benefits, the government is working with banks to facilitate access to microcredit and with state-owned enterprises to support marketing of non-timber forest products from social forestry (MoEF, 2018a). By increasing the economic value communities reap from standing forest, such agroforestry can provide an incentive for longer-term sustainable management.

Concerted effort is needed to meet the social forestry goals. The government has allocated 12.7 million ha to be used social forestry and aims to distribute 4.3 million ha of it by the end of 2019. Over 2007-18, 2.5 million ha was put into social forestry (MoEF, 2018a). The rate of uptake increased over time, but strengthened effort is required to meet the target for distributing land. Efforts to streamline the application process have been successful: reforms in 2016 reduced it from 2-3 years to about 1 year. Significant capacity building is required to improve access to social forestry programmes, notably the training of facilitators to assist communities in registering social forestry rights. This is especially true of less developed regions, where uptake of social forestry programmes has been low.

3.5. Aligning goals and policy instruments

A wide range of policy instruments influence the nexus in Indonesia. Regulatory instruments are the primary tool used to support land management, particularly through the development of spatial plans and requirements to undertake environmental impact assessment (EIA). As in many emerging economies, weaknesses in the enabling environment, such as capacity constraints and inconsistent enforcement, hinder the tools' effectiveness.

There is scope to increase the use of economic instruments to enhance the efficiency and effectiveness of nexus policies. The use of positive incentives for conservation, such as payment for ecosystem services (PES), remains at an early stage. There are also economic instruments that indirectly encourage unsustainable behaviour, including provision of subsidised inputs. Charges for the use of natural capital remain generally low and do not internalise environmental costs to change relevant behaviours.

3.5.1. Regulatory instruments

Protected areas

The designation of terrestrial conservation areas (protected areas) is intended to prevent conversion of forest that is important for wildlife and plant biodiversity. Some 22 million ha (18%) of state forest land is classed as conservation forest and is afforded legal protection from conversion and logging. Conservation forest is subdivided into classes with varying degrees of protection. Around 30% of Indonesia's remaining primary forest is conservation forest. The definition is similar to that of the internationally recognised concept of protected areas. Under Law No. 23/2014, all forest designations are gazetted at the national level by the MoEF, which also manages them at the national level. Grand forest parks, a type of protected area, are managed at the district level.

The designation of protected areas has not prevented deforestation. Studies have found that the legal protection does not significantly reduce deforestation rates when compared to logging concessions (Gaveau et al., 2012). Land under strict protection (equivalent to IUCN category 1a) saw increased deforestation rates over 2000-10 (Brun et al., 2015). Around 10% (2.2 million ha) of the area designated as conservation forest is devoid of tree cover as a result of encroachment by activities such as agriculture, plantations and illegal mining.

Particularly in the context of constrained government funding, it is essential for communities to have a stake in the continued preservation of protected areas (Waldron et al., 2017). Government enforcement of protected areas is hampered by insufficient funding, capacity gaps and development pressures. Allowing limited resource use, such as harvesting of non-timber forest products, would permit local communities to support their livelihoods while protecting the land. There is also increasing recognition of tourism's revenue stream potential, e.g. at Gunung Leuser National Park on Sumatra (Hang, 2018). Visitors are drawn to the area for nature activities, and villagers earn revenue by providing guiding, transport, homestays and food.

Comparison with Brazil illustrates opportunities for effective policy implementation. Between 2002 and 2012, Indonesia lost 4.4% of the total carbon contained within protected areas, while Brazil lost 2.6%. Brazil had established a dedicated agency, ICMBio, to co-ordinate the management of these areas. The majority of protected areas in Brazil have management committees, which provide a formal mechanism for involving local communities and businesses in the management of the areas. In addition, the environmental compensation regime in Brazil provides an additional revenue stream for forest management. The system requires landowners to retain a certain proportion of native vegetation on their land. If they do not do so, they have to purchase credits from landowners who have retained more native vegetation than the legal requirement.

Moratoriums

Two-year moratoriums have been adopted to prevent the issuance of permits for new concessions on forest and peatland of more than 3 metres' depth, the aim being to stop clearance of primary forest and peatland. A two-year presidential moratorium on new permits for primary state forest land was first issued in 2011 (Presidential Instruction No. 10/2011) and renewed three times. Without the moratorium, 59% of primary forest, designated as suitable for production, could be exploited. The MoEF has developed maps indicating the forest and peatland covered by the moratorium. It now totals 66.4 million ha, or more than half the total area of state forest.

Three issues hinder the moratorium's effectiveness in preventing forest loss, however: first, there are few legal consequences for disobeying a presidential instruction, weakening its power with local institutions. Second, as a moratorium is by definition temporary, it does not provide a long-term signal to guide investment decisions. Third, the moratorium only concerns new permits, so existing but unused permits are still valid. Still, the moratorium provides a crucial window of opportunity to reduce land clearance pending other reforms to clarify the land tenure system. Firm legislation, informed by evaluation of lessons learned from these temporary measures, would provide greater predictability for the private sector and communities.

Following the 2015 fires, a moratorium on conversion of all peatland was adopted. Government Regulation No. 71/2016 forbids conversion of any peatland (including that covered by the moratorium) countrywide for current and new concessions. The intent was to allow time to verify peat ecosystem maps and design a consistent peat ecosystem zoning system identifying areas suitable for protection and cultivation. Peatlands zoned for protection are to be conserved and restored by permit holders. In 2017, the government issued a further policy to maintain peatland by defining protection and cultivation zones within the peatland area and revising the spatial plans for the affected companies (Government Regulation No. 57/2016). The moratorium represents a step forward as all peatlands and existing concessions are covered. However, there are concerns that if the peat ecosystem zoning system does not take account of the ecological integrity of peat ecosystems, it will not grant sufficient protection (Mongabay, 2016).

In 2018, a three-year presidential moratorium was issued on new palm oil development, combined with a review of existing licences. The aims are to pause new development while land ownership is clarified, reduce GHG emissions from land conversion and provide an incentive to increase productivity on existing plantations.

Mandatory palm oil certification

Indonesia has a national standard for palm oil sustainability. The Indonesian Standard for Sustainable Palm Oil (ISPO) intends to ensure that palm oil is produced legally and meets certain environmental performance standards. It is mandatory for large producers and expected to become mandatory for smallholders by 2022. ISPO bans the use of fire but allows expansion of plantations onto peat soils (though this is currently prevented by presidential moratorium).[7] ISPO certification incorporates environment-related requirements covering the entire palm oil production process, including standard procedures for land clearing, plantation, soil and water conservation, and waste management. The ISPO certification process encourages the use of best available practices to increase production efficiency and reduce GHG emissions. Around 17% of Indonesian palm oil output is ISPO certified, which is less than under the voluntary Roundtable on Sustainable Palm Oil (RSPO) (Section 3.5.3) (Barthel et al., 2018).

Although it has broad coverage, the ISPO's targets are insufficiently stringent to make a significant contribution to meeting climate change targets and reducing ecosystem degradation. A recent comparative study on the world's main certification regimes ranked the ISPO as the weakest (Forest Peoples Programme, 2017). Under the ISPO, only protection and conservation forests, as designated by the MoEF, are considered land of high conservation value and thus protected from clearance. Moreover, as was noted earlier, concessionaires may be obliged to clear the land or risk having their permits revoked.

ISPO enforcement capacity is limited. Local governments are responsible for penalising non-compliance, and are subject to local pressures for continued development. In addition,

many smallholders may not be able to meet ISPO criteria by 2022. Complying with basic ISPO criteria such as a land ownership certificate or ISPO-compliant fertilisers and seedlings is already proving challenging for many (Jong, 2018).

The ISPO can help improve the baseline environmental performance standard by ensuring minimum legal and regulatory compliance. It could be used to complement the more stringent RSPO, which might help reduce sustainability concerns. Such concerns led to revision of the EU Renewable Energy Directive, which by 2030 will phase out import of biofuels that pose a high risk of indirect land-use change. This could have a major impact, as 40% of European palm oil imports are currently used for biofuels (*Deutsche Welle*, 2018). The criteria for which feedstocks will continue to be eligible have yet to be determined, but are expected to include at least some palm oil production.

Timber legality system

Indonesia has made strides towards reducing illegal logging through the timber assurance legality system (SVLK). It has won EU acceptance, with SVLK registration now automatically qualifying exporters for Forest Law Enforcement Governance and Trade licences. The SVLK was designed to ensure that all Indonesian timber and wood products come from sustainably managed forests. Enrolment, which is based on an annual audit, is mandatory for all companies in the timber supply chain (logging and processing). The SVLK is intended to be collaborative, bringing together stakeholders including business associations, NGOs, academic experts and government officials. The stakeholders can file reports if they suspect that licences have been improperly issued. The licences of assessment bodies can be revoked if they are found to be improperly issuing licences.

The SVLK has made progress in ensuring legality and sustainability of timber production, but some major challenges remain. The 26 registered SVLK assessment bodies in Indonesia are accredited by the National Accreditation Committee and endorsed by the MoEF. The assessment process has focused on whether companies have the correct paperwork, rather than whether permits were correctly issued. In addition, there have been cases of suspected laundering of illegal timber through legal companies and inconsistent sanctions against offenders (EIA, 2014). While there have been no sanctions to date, companies that do not implement the SVLK cannot export their timber.

Compliance, monitoring and enforcement

Most compliance assurance activities are conducted by provincial and district authorities. The MoEF's role has increased in recent years, with enforcement becoming one of its priorities. The 2015 merger of the environment and forestry ministries helped strengthen central government enforcement efforts. However, important gaps remain at the subnational level, where institutional capacity is limited by lack of technical skills and high staff turnover.

Weaknesses in enforcement hinder effectiveness of land management, leading to a gap between the land uses envisaged by policy and the situation on the ground. Examples include activities undertaken without the correct permits, activities that are not reported to avoid taxes, and activities in which permits have been improperly issued. Irregularities include issuance of permits without completion of the necessary EIA and district government issuance of permits that are inconsistent with national legislation. Strict penalties against forest crime exist: for example, illegal clearance of state forest is punishable by ten years in prison. However, the penalties' deterrent effect is lessened by prosecution bottlenecks.

The nature of illegal and unreported activity makes it hard to closely estimate its scale, but studies suggest it is extensive. The Corruption Eradication Commission (KPK) found that 77-81% of timber production was unreported between 2003 and 2014, leading to annual state revenue losses between USD 539 million and USD 739 million from uncollected charges and taxes. The value of the state-owned timber taken rose to between USD 7.7 million and USD 9.9 billion in 2014 (KPK, 2015). Forest Trends (2014) estimated that 70-80% of forest conversion was probably illegal, due either to illegal methods (such as using fire for clearance) or to a lack of valid permits. After the KPK issued its report, the MoEF integrated the Timber Administration Information System with the non-tax revenue database to keep timber industries from using illegal products.

In 2008, there were fewer than 500 environmental inspection officers and only about 400 environmental civil servant investigators across the entire country. In 2018, the MoEF alone employed over 2 800 forest police, 247 environmental inspectors and 468 investigators. The national police and MoEF investigators have equal authority to enforce environmental and forestry law. While the MoEF usually focuses its compliance assurance efforts on illegal logging and wildlife trade, the police concentrate on crimes related to pollution and forest fires. Local police officers, who are often the only agents in a position to respond to offences, do not always act. Environmental investigators often support police cases with technical expertise, data and laboratory analysis.

Formally, inspectors must have the title "regional environmental inspection officer" (PPLHD) to carry out their duties. The number of PPLHDs is very limited, partly because there are few opportunities to follow the required training, and partly because the position is perceived as unattractive in terms of career opportunities and benefits. For example, only one of the Gresik district's environmental agency's 77 officials is a PPLHD (Fatimah et al., 2017). This shortage of certified inspectors severely hampers local compliance monitoring and enforcement. Inspections are often conducted by non-certified officials carrying a letter from the head of the agency. This compromises their ability to impose sanctions if they detect a violation (Sembiring et al., 2017).

The central, provincial and district governments are authorised to monitor and enforce compliance with permits they issue. Since co-ordination among the various authorities' inspectors is insufficient, they often send non-binding recommendations to each other following detection of a violation and avoid taking enforcement action themselves. The MoEF, as part of so-called second-line enforcement, can inspect and penalise facilities permitted by subnational governments if it suspects serious unaddressed violations.

In 2013, the national police, attorney general and ministries of environment and forestry signed a memorandum of understanding to adopt a "multi-door approach" when handling natural resource and environment-related crimes in forest areas and peatlands. However, guidelines for interagency co-ordination and standard inspection and enforcement procedures are still being developed.

Over half of inspections carried out by the MoEF are planned. However, inspections at the provincial and district levels are mostly reactive, responding to accidents, complaints and third-party reports of non-compliance. In handling complaints, provinces are often more active than local governments, even where the latter are authorised to undertake inspections. Provinces may receive referrals from the central government and take up complaints to which the district has not responded within ten days. Complaints are often received via text message or at a desk at the agency; many agencies do not make it possible to file complaints via email or a website. Usually no information is provided to citizens on how to file a complaint (Sembiring et al., 2017).

The fragmentation of authority to impose administrative sanctions across sectoral agencies and government levels has resulted in inconsistent application. Enforcement approaches often vary within the same authority, as officials have considerable discretion in carrying out their tasks. For example, the East Java Environmental Agency's standard procedure describes complaint handling but stops where the complainant is informed about the result of complaint verification and does not address how to respond to a detected violation (Fatimah et al., 2017). Moreover, inspectors involved in complaint verification are often not involved in enforcement decisions (Sembiring et al., 2017). To try to address this issue, the MoEF produced guidelines on inspections (last revised in 2015) and complaint handling (in 2017). It also conducts capacity-building activities at the provincial and district levels.

In response to non-compliance, provincial governors and the MoEF can issue warning letters and compliance orders, suspend or revoke permits or impose environmental audits. The environment minister may ask the governor to impose such sanctions on the violator and, if this does not happen, apply the sanction directly. The number of administrative actions by the MoEF has increased in recent years. There are no fines, but a ministerial decree introducing fines for failing to implement a compliance order is under preparation.

Criminal enforcement depends heavily on the time-consuming trial process in courts of general jurisdiction. Although the public prosecutor's office usually pursues cases it receives from the police or environmental investigators (568 cases were brought to court over 2015-18), the majority of these prosecutions are unsuccessful. The Supreme Court issued guidelines to courts on handling environmental cases in 2013. Nevertheless, Indonesian courts have been criticised for their lack of judges with expertise on environmental issues (Dawborn et al., 2017). As the law does not provide for specialist courts handling environmental cases, a major effort has been made to train and certify judges on environmental issues: 780 judges had been certified as of 2018.

Despite these challenges, the government is taking action to strengthen enforcement. There were 970 operations to secure land against encroachment, illegal logging and wildlife crime over 2015-18, resulting in the protection of 12.7 million ha. Seizures of illegal timber increased from 1 042 m^3 in 2015 to 11 122 m^3 in 2018, which is a positive trend but represents only a small fraction of the estimated 40-52 million m^3 per year of illegal logging (MoEF, 2018a; KPK, 2015). On average, 80 criminal cases a year went to trial between 2015 and 2017 for illegal logging and forest encroachment. In a landmark case, one company was fined USD 1.2 billion for activities linked to illegal deforestation (MoEF, 2018b).

Detection of forest crime is being enhanced by the creation of the One Map system, which will provide greater clarity and transparency on land status. The government has also established a database to integrate data sources to support forest management: the Sustainable Production Forest Management Information System. It will help in cross-checking databases, including the non-tax state revenue system and the SVLK, and thereby identify potential irregularities.

3.5.2. Economic instruments

Payment for ecosystem services

PES is increasingly used to support sustainable land management in Indonesia. The government estimated that REDD+ could reduce emissions from land-use change by up to 70% (MoEF, 2017b). REDD+ provides financial incentives in exchange for reductions in

deforestation. In addition, smaller programmes demonstrate the potential for using voluntary payments to encourage provision of ecosystem services.

In 2010, Norway pledged up to USD 1 billion to support Indonesia's REDD+ efforts. However, Indonesia has yet to meet the requirements for receiving this contribution. The main requirements are establishing a reference GHG emission level, a financing mechanism and a monitoring, reporting and verification (MRV) system. An interim evaluation of the Norwegian initiative found that the timetable outlined in 2010 was overly ambitious given governance challenges and capacity gaps (Caldecott et al., 2013).

Nonetheless, there are clear signs of progress on access to this REDD+ funding. The reference emission level, used as a baseline for payments, was submitted to the UNFCCC in 2015 and passed technical review in 2016. The government also established a reporting system, SIS-REDD+, to assess whether social and environmental safeguards are being respected. There has been progress on putting the MRV and financing systems into place. The scale of disbursements is increasing, with NOK 365 million (USD 44 million) disbursed in 2016, compared to NOK 416 million (USD 50 million) over 2010-15. The government is establishing a financing agency, the Environmental Fund Management Agency, to host the funding mechanism required for access to the Norwegian funding.

The government has proposed complementing the Norwegian funding by creating a mechanism to aggregate the carbon credits generated by smaller-scale conservation programmes. Global finance flows for REDD+ are significant, with over USD 500 million of carbon credits purchased in 2017 (Forest Trends, 2018). The revenue could increase significantly if REDD+ were linked to the forthcoming emission trading scheme for aviation, known as CORSIA.

Several projects related to watershed services have succeeded in improving the sustainability of forest management, such as an inverse auction in Sumberjaya[8] (OECD, 2010) and the Cidanau River programme (Box 3.7). The continued success of the Cidanau programme shows the potential for PES to provide benefits to upstream and downstream users of environmental services. An analysis of 90 PES projects in Indonesia found that the vast majority were either not operational or did not meet the criteria for PES. Only four water and four carbon projects were making conditional payments by 2016 (Suich et al., 2017).

Box 3.7. Payments for water quality improvements in Banten

The Cidanau River catchment in Banten, West Java, is one of the longest-running PES programmes in Indonesia. Clearing of upland vegetation and encroachment into the protected swamp forest had led to increased siltation and reduced flow in the Cidanau River, particularly in the dry season. Downstream users of the river, most notably PT KTI, the company holding the contract for water distribution in Jakarta, was concerned about future water supplies. PT KTI identified measures to ensure the integrity of upstream ecosystems as the cheapest option to ensure supply and entered into a voluntary contract to pay for reforestation and management of the upstream catchment. The payment is made to a management team, which disburses it to the landowners, who are organised into farmer groups (Munawir et al., 2007). The first payments were made in 2005.

Source: OECD, 2010.

High transaction costs pose a significant barrier to widespread PES in Indonesia. All currently operational PES programmes have involved significant inputs from intermediary bodies, typically international and/or local NGOs, which bear much of the costs of the initial set-up and administration of payments. In many cases the operational PES projects are pilot projects intended to be a proof of concept and test methodologies, and the same resource is unlikely to be available to other projects in the future (Pirard and Billé, 2010; Suich et al., 2017). Strengthening the enabling environment to provide greater clarity about land rights and improved enforcement will lower transaction costs for individual projects and increase overall investor confidence.

Agricultural subsidies

The OECD estimated that Indonesian agricultural support rose to USD 36 billion in 2015, the world's highest as a percentage of GDP (OECD, 2017).[9] Fertiliser subsidies constitute a large and growing amount of budget expenditure on agricultural subsidies, budgeted at IDR 31 trillion (USD 2.3 billion) in 2017 (Chapter 2). There are 14 financial subsidies linked to palm oil production and six to timber products, providing a perverse incentive to increase deforestation and environmental degradation (Mcfarland, Whitley and Kissinger, 2015). The subsidies include tax exemptions for investment in the biofuel and palm oil sectors, concessional loans for biofuel production and subsidies for domestically produced cooking oil. These subsidies reduce the cost of expanding plantations, often in forested areas, and drive land use change and ecosystem degradation. There are also tax exemptions for investment in timber plantations, below-market levies on timber harvests and a national subsidy on transport fuel, all of which encourage further expansion of industrial plantations and conversion of natural forest (Mcfarland, Whitley and Kissinger, 2015).

The Reforestation Fund has the potential to support sustainable forest management by funding restoration activities. However, it has been hampered by fraud, corruption and lack of capacity. Improved governance could help it increase land use efficiency by financing plantation development on already cleared land (Barr et al., 2010).

There are plans to reform the fertiliser subsidy system. This would be a welcome development, as subsidising fertiliser can encourage inefficient use of chemicals and contribute to ecosystem degradation through leaching of excess nitrogen into ecosystems (which particularly affects freshwater ecosystems).

3.5.3. Voluntary instruments

Voluntary certification

The Roundtable on Sustainable Palm Oil is a voluntary certification programme intended to assure purchasers that palm oil has been sustainably produced. The RSPO is more stringent than the national ISPO, which is mandatory for large businesses (Section 3.5.1). In 2018, the RSPO certified 1.7 million ha (14% of total planted area) of oil palm plantations (RSPO, 2018). The RSPO was started as a collaborative initiative of the World Wildlife Fund, European demand-side actors and, on the supply side, industry bodies, including the Indonesian Palm Oil Association (GAPKI). It certified its first palm oil in 2008. GAPKI withdrew from the RSPO to concentrate on the ISPO in 2011.

The RSPO requires companies to conduct HCV assessment based on specific guidelines. RSPO-certified plantations are prohibited from converting HCV land, must not have converted any primary forest since 2005 and must obey all national environmental laws and regulations. But Indonesian Law No. 39/2014 requires plantation companies to develop

at least 30% of their concession within three years and the whole concession within six years. Land set aside under HCV by an RSPO-certified plantation can be, and has been, excised from the concession and reallocated for development as non-RSPO plantation (Colchester et al., 2009). This is not an issue for the ISPO, as it has a narrower definition of HCV than the RSPO.

There is evidence that RSPO certification leads to decreased rates of deforestation and fire in plantations. However, almost all RSPO-certified plantations contained very limited forest at the time of certification, and RSPO certification seemed to have limited impact on clearing in peat areas, which reduces its contribution to biodiversity and climate change targets (Carlson et al., 2017).

While the RSPO now certifies about 17% of the global market (RSPO, 2018), it is likely reaching the limits of its influence, as it has yet to make a significant impact on the biggest individual importers of palm oil outside the EU. Most significantly, large markets have yet to adopt this standard: very little of the 10.6 Mt of palm oil imported by India and only 50 000 of the 4.8 Mt imported by China is RSPO certified (Schleifer and Sun, 2018). Wider uptake would be needed to reach the goal of raising standards across the industry.

"Zero deforestation" commitments by companies

Corporate zero deforestation commitments could be an important tool for the nexus (Chain Reaction Research, 2014). They could reduce conversion of forest to oil palm and timber plantations and encourage development on degraded land. They also have the potential to deter the shifting of cultivation to areas with high forest cover and low deforestation rates (Austin et al., 2017). Zero deforestation commitments currently apply to around 60% of the global palm oil trade and a smaller proportion of the pulp and paper product industry.

However, for these commitments to have a significant impact in Indonesia, greater clarity on definitions of forest and deforestation from the individual actors is required. It is also essential for Indonesian plantation law to be amended to allow such pledges to be met. Under Indonesian law, the clearing of forest that has been designated for plantation development is not considered deforestation. A commitment to zero illegal deforestation still allows companies extensive leeway to clear forested areas. As with RSPO compliance, land that is set aside may be handed to concessionaires who have not made such a commitment. There also needs to be a comprehensive approach involving local communities, businesses and governments to improve environmental outcomes (Daemeter Consulting, 2015).

Ecosystem restoration concessions

Ecosystem restoration concessions (ERCs) could help reduce deforestation and ecosystem degradation and contribute to the biodiversity and climate change targets. ERCs were introduced by the Ministry of Forestry in 2004 as an attempt to counter degradation of production forests. Companies can apply for ERCs in state forest and use the land to generate ecosystem services. This includes using it for activities such as growing medicinal plants and beekeeping, as well as producing other non-timber forest products (Buergin, 2016). Licence holders must develop partnerships with local communities as part of their social responsibilities. Concession holders may be granted licences to harvest timber provided that the ecological balance of the area is maintained.

ERCs are underutilised. The first ERC was awarded in 2007. By 2016, 16 ERCs had been awarded, covering 623 075 ha of forest. High start-up costs remain a challenge. They are

due to the need to address existing degradation and landscape characteristics that can make restoration difficult. The high costs also reflect the more general challenges of complex permitting processes, the need to prevent illegal logging and the frequency of land claims. All have impeded more widespread use of ERCs (Rahmawati, 2013).

PES could help generate demand for ERCs. Establishing ERCs has relied on international NGO funding and development assistance. Developing other revenue streams could help expand ERCs' use. Alternative revenue streams include ecotourism, non-timber forest products and access to PES (including REDD+). The Katingan-Mentaya project shows how ERCs can be used to conserve forest by generating carbon credits (Box 3.8).

Box 3.8. Revenue from REDD+: The Katingan-Mentaya project

The Katingan-Mentaya project is one of the world's largest REDD+ forest conservation and restoration projects. Located in Central Kalimantan, it is already generating revenue from carbon trading. Since 2016, the project has been received triple gold accreditation under the Verified Carbon Standards, Climate Community and Biodiversity standards. It has generated revenue of USD 7.5 million annually.

The project is located in Katingan and Kotawaringi Timur districts of East Kalimantan, which contain a 300 000 ha peat swamp forest supporting rich endemic biodiversity. A Global Green Growth Institute assessment of the area in 2015 found that total net benefits of conservation could reach USD 9.9 billion in the long term, accounting for ecosystem, social, climate change mitigation and economic growth benefits. This compares to revenue of USD 482 million if the land were used for oil palm or timber plantations.

An ERC application was submitted in 2007 to protect and restore more than 200 000 ha of the peat swamp forest. Ultimately, the forestry ministry granted an ERC of 108 225 ha in 2013, followed by an additional 49 497 ha by the MoEF in 2016. Due to the lengthy carbon credit accreditation process, the sale of carbon credits only started in 2017, ten years after the first ERC request.

The project has embarked on a wide range of activities to restore and protect the peat swamp forest and support local communities (e.g. development of community co-operatives and 300 artisanal coco sugar businesses). It has been a significant source of local employment. Acceptance by local communities was built through a decade-long community engagement process, initially facilitated by a local NGO, and through community involvement in the project's activities.

Source: Katingan Mentaya Project, n.d.; Indriatmoko et al., 2014; GGGI, 2015b; Revitalization, 2017.

3.6. Financing for the nexus

Indonesia has estimated that significant financial resources, far in excess of currently recorded finance flows, will be required to improve land and ecosystem management and reduce GHG emissions. There are no estimates for the nexus per se, but indicative results on the scale of finance flows required are available. The RAN-GRK estimated that USD 17 billion of external funding was required for mitigation across all sectors from 2011 to 2020 (MoEF, 2017b). For biodiversity conservation, it has been estimated that

USD 725 million per year would be required just for conservation area management (BAPPENAS, 2016).

Domestic resource mobilisation is the primary source of funding on issues relevant to the nexus. However, spending is limited by the government's ability to raise revenue. Indonesia's tax/GDP ratio is low compared to other countries at a similar income level (OECD, 2018). BAPPENAS (2014) estimated that, for 2011-14, the domestic budget allocation relevant to GHG emission mitigation totalled IDR 96 trillion (USD 6.3 billion). For biodiversity, an average of USD 119 million was allocated per year for 2010-14 (BAPPENAS, 2016).

Plans call for the volume of domestic investment related to REDD+ to increase, but it will remain a small proportion of overall climate-related finance. Between 2011 and 2014, IDR 8.7 billion (USD 573 000) was spent on activities linked to reducing GHG emissions from forestry. Planned expenditure for 2018-19 through the MoEF is IDR 5.9 billion (USD 389 000) on activities related to REDD+. At the local level, expenditure related to climate has been increasing since 2011, with the bulk of resources dedicated to forestry activities.

3.6.1. Intergovernmental fiscal transfers

District governments could use the system of intergovernmental fiscal transfers (IFT) to encourage more sustainable land management. IFT is made up of three mechanisms: the general allocation fund (*dana alokasi umum*), the specific allocation fund (*dana alokasi kusus*) and shared revenue (*dana bagi hasil*). The general and specific allocation funds finance administration and specific national priorities. Shared revenue is allocated to local governments from national revenue based on the percentage of tax and non-tax revenue generated in the local area. Shared revenue is important to the land use, climate change and biodiversity nexus, since a primary source of revenue in some provinces is economic exploitation of forest land.

The current IFT arrangements encourage conversion of forest to economically productive uses. Income to districts from shared revenue is directly proportional to the value of forestry revenue earned, and there is no penalty for overexploiting forest. About 40% of forestry activity revenue is currently returned to the producing district. District governments thus have an incentive to maximise revenue though logging and conversion of forest to timber plantations (Nurfatriani et al., 2015). Palm oil plantations also generate revenue that is returned to the producing district, and while the proportion is much lower, the higher profitability of oil palm results in more money to the producing district in real terms (Irawan, Tacconi and Ring, 2013). District governments thus similarly have an incentive to maximise revenue by facilitating palm oil plantation development.

Linking allocation of shared revenue to compliance with previously agreed environmental standards, such as protection of sensitive ecosystems, and measures of environmental quality would help achieve sustainability (Nurfatriani et al., 2015). In Brazil, for example, fiscal transfers serve as an incentive for biodiversity conservation because a share of the revenue from the state-level value added tax (ICMS) is allocated on the basis of environmental criteria (OECD, 2015). Integrating the shared revenue allocation with existing sustainability initiatives, such as the SVLK and ISPO, would be mutually beneficial. It would provide an incentive to develop local capacity and enforce the standards, which in turn could help in monitoring sustainability in the forestry and agricultural sectors.

3.6.2. International support

Development co-operation is being channelled to support management of the nexus, with a primary focus on climate change mitigation rather than adaptation or biodiversity. Bilateral commitments vary considerably by year, so the figures are expressed as multiyear averages. In 2014-15, more than one-third (38%) of the USD 5 billion Indonesia received as official development assistance (ODA) was marked as contributing to climate mitigation,[10] 8% as contributing to biodiversity and 7% for climate adaptation.

The volume of resources and degree of mainstreaming vary by sector. The majority of bilateral climate ODA went to infrastructure, which accounted for USD 1.7 billion of the USD 2 billion marked for mitigation. Climate mitigation was mainstreamed into 71% of infrastructure ODA in 2014-15, including USD 622 million to support public transport in Jakarta. More than 71% of support to general environmental protection (USD 284 million) also supported climate objectives. Most support for biodiversity was also counted as general environmental protection. The majority of the projects concerned support enhanced forest management.

There was limited direct support for biodiversity or climate in productive sectors. Support to productive sectors, including forestry, was smaller in absolute terms, accounting for USD 71 million in 2014-15. Only 25% of ODA for productive sectors was marked for climate, while the proportion has been variable for biodiversity.

Further progress is needed to obtain financial resources from dedicated climate funds. In addition to finance from bilateral donors, Indonesia has received USD 746 million from the Global Environment Facility and USD 5 million from the Special Climate Change Fund. It has yet to receive funding from the Green Climate Fund (GCF). PT Sarana Multi Infrastruktur, the only accredited entity for the GCF in Indonesia, focuses on infrastructure provision. Expediting approval of entities with a forestry remit would broaden potential access to these funds for addressing nexus issues.

Efforts to co-ordinate finance flows through the Indonesia Climate Change Trust Fund have not yet come to fruition. Originally managed by UNDP, the fund became an independent unit under BAPPENAS in 2015. The scale of funding remains limited: between 2010 and 2014, it received USD 11 million. Progress was delayed by capacity constraints and high staff turnover (ICCTF, 2015), along with ministries' desire to retain autonomy in resource use. The scale of planned expenditure for 2015-18 remains modest.

Box 3.9. Recommendations on the land-use, ecosystems and climate change nexus

Knowledge base

- Maintain and strengthen work to value ecosystem services consistent with the SEEA, including ecosystem accounts. Ensure that the potential to identify priority areas for policy action is exploited to contribute to a coherent policy framework informed by natural capital.
- Finalise the remaining elements of the One Map, including the development of thematic layers and larger-scale (e.g. 1:50 000) maps. Use the One Map to develop and refine a long-term land-use strategy. Provide public access to the mapping information to facilitate transparency and detection of illegal activities. Provide technical support and capacity building to facilitate participatory mapping of customary (*adat)* lands.
- Continue to improve the measurement and mapping of peatlands and forests to more accurately identify areas that are particularly valuable for providing ecosystem services. Enhance public access to information by providing open data where possible.
- Continue efforts to monitor, evaluate and disclose data on deforestation and drivers of land-use change.

Policy and institutional framework

- Set specific, realistic targets for overall land use in the 2020-24 RPJMN, including targets for reducing deforestation. Ensure that the targets are agreed by all relevant ministries (especially those for environment and forestry, agriculture, and energy and mineral resources), included in sector work plans and monitored by BAPPENAS.

Clarifying land rights

- Ensure that the system for land allocation and permitting redirects development towards land of lower ecological value. Allow concession holders to leave standing land of high conservation value within their concession area. Simplify the administrative processes governing land swaps between degraded state forest land and standing forest that is permitted for clearance.

Social forestry and agrarian reform

- Provide additional resources to accelerate registration of social forestry and recognition of customary forests. Encourage peer learning between communities to improve access to the social forestry programme. Disseminate guidance and encourage use of the mobile application for submitting monitoring information for social forestry.
- Accelerate agrarian reform by using the land redistribution programme to recognise community tenure claims, transparently delineate and register state lands and assets, and provide legal access for communities to co-manage state lands and forest resources.

Enforcement

- Accelerate efforts to deter, identify and penalise illegal land use by providing additional resources for enforcement agencies and increased investment in satellite monitoring systems. Provide additional training for law enforcement officials to increase their capacity for investigation of environmental crimes.
- Further develop online systems for managing land-use permits. Cross-reference databases governing permits, tax receipts and regulatory compliance to target illegal logging and agricultural activities.
- Consolidate and streamline the set of permits required for land-use activities. Develop clear guidance for ministries and subnational governments on the legal requirements for various land-based activities. Audit existing permits for land-based activities to ensure that they were issued following the required processes.
- Strengthen capacity of FMUs through recruitment, training and peer learning. Identify potential sources of private-sector funding to complement resources from public budgets.
- Undertake voluntary agreements with supply chain nodes (traders, consumers, banks) to reinforce the effectiveness of the SVLK.

Policy instruments

- Evaluate the effectiveness and ancillary impact of forest moratoriums. Replace the use of time-limited moratoriums with legislation that provides a predictable legal framework governing sustainable development of primary forests and peatland.
- Expand the terrestrial protected area network and establish mechanisms to encourage effective conservation and sustainable use inside these areas, working with the FMUs and local communities.
- Continue progress towards the target of restoring 2 million ha of degraded peatland. Put in place arrangements to continue restoration activities after the Peatland Restoration Agency deadline of 2020.
- Raise yields per hectare of agricultural commodities through increased investment in agricultural extension programmes, including increased training for agricultural extension works.
- Review support measures to the forest sector with a view to phasing out subsidies that encourage deforestation and propose alternative options for social considerations. Use the system of support measures to incentivise the provision of ecosystem services, such as those provided through sustainable forest management.
- Ensure that the Environmental Fund Management Agency starts operating on time and follows international good practice regarding governance, fiduciary responsibilities and environmental and social safeguards. Explore opportunities for this REDD+ financing mechanism to mobilise additional public and private resources.

Notes

[1] These data are from the 2015 FAO Global Forest Resources Assessment. Indonesia uses a different definition of forested areas (in MoEF Regulation No. 14/2004): in 2018, official data had a total extent of forested area of 93.9 million ha (of which 46.1 million ha was primary forest).

[2] Naturally regenerated forest is forest where there are clearly visible indications of human activities. It includes i) selectively logged-over areas, areas regenerating following agricultural use, areas recovering from human-induced fires, etc.; ii) forest where it is not possible to distinguish whether vegetation was planted or naturally regenerated; and iii) forest with a mix of naturally regenerated trees and planted/seeded trees, where the naturally regenerated trees will constitute more than 50% of the growing stock at stand maturity.

[3] Indonesia defines two states for watershed areas: i) "to be restored" (*dipulihkan*), designating watersheds in critical condition; and ii) "to be maintained" (*dipertahankan*), designating watersheds in relatively good condition.

[4] Young oil palm plantations tend to have less transpiration and canopy cover than mature oil palm plantations and old-growth forest.

[5] HGU permits are provided for cultivation activities (e.g. farming, fisheries, livestock raising) on non-state forest land, including as part of a swap of state forest for non-state forest land.

[6] Establishment of a set-aside area for conservation exceeding 10% can be allowed if the permit holder can show that i) the conservation area is integral to the functioning of the plantation; ii) the conservation area shall be protected as proved by an HCV report. Demonstrating the former requires ground truthing, analysing the reason for not developing the land, preparing a report, conducting a committee hearing and providing recommendations to the competent authority.

[7] Hidayat et al. (2017) emphasise that the ISPO both prohibits and allows conversion of peatland to plantation.

[8] In an inverse auction, bidders offer to supply a good or service, and the bidder(s) offering the lowest price win the contract.

[9] Agricultural support is defined as the annual monetary value of gross transfers to agriculture from consumers and taxpayers arising from government policies that support agriculture, regardless of their objectives and economic impact.

[10] The Indonesian government uses a different method for recording financial support than that adopted by donors. It records finance received by ministries, while the figures here represent commitments from donors to the country.

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